

# How Do Industry Evolution and Industry Conditions Prompt Product Firms to Offer Services?

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*This is a Working Paper*

## **Why this paper might be of interest to Alliance Partners:**

Product companies are increasingly offering different types of services. Companies choose this strategy, often called servitization, when they face several challenges in their 'native' product industry. We study under which industry conditions product companies offer services and why. Moreover, we distinguish between services that are performed on products (product-oriented services) and services that go beyond the products to provide more broadly based support for customer needs (customer-oriented services). Statistical tests performed on the sample of 410 public companies from 1990 to 2011 demonstrate that companies are more likely to offer product-oriented services in the early stage of the industry life cycle and/or when their industries are highly R&D intense and competitive. Conversely, product companies tend to offer customer-oriented services in the mature stage of the industry life cycle and/or in highly cyclical industries. We argue that companies are more likely to opt for product-oriented, as opposed to customer-oriented services in young, R&D intense and competitive industries because they focus on deepening the product knowledge through offering those services. For example, offering maintenance and monitoring helps learn about the product functioning and use, enabling companies to improve their product and become more competitive in an attractive product industry. On the other hand, we believe that product companies are more likely to offer customer-oriented services, as opposed to product-oriented services, in mature and turbulent industries because they intend to broaden their knowledge base beyond products and discover other market opportunities that are unrelated to their increasingly unattractive product industry. For example, offering consulting services helps understand better customers' business model and other unsatisfied needs they may have.

**October 2015**

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# How Do Industry Evolution and Industry Conditions Prompt Product Firms to Offer Services?

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We study the industry conditions that prompt product firms to offer services, distinguishing between services performed on products (product-oriented) and services that go beyond product to support broader customer needs (customer-oriented). We theorize and provide empirical evidence that product firms are likely to offer product-oriented services when industry conditions favour the deepening of product knowledge and to offer customer-oriented services when industry conditions reward the broadening of firms' knowledge base. Analysis of 410 public firms from 1990 to 2011 demonstrates that firms are more likely to offer product-oriented services in the early stage of the industry lifecycle and/or under conditions of high R&D intensity and competition, while they tend to offer customer-oriented services in the mature stage of the industry lifecycle and/or highly cyclical industries.

## Introduction

Product firms are increasingly including services in their market offerings (Bowen, Siehl, and Schneider, 1989; Suarez, Cusumano, and Kahl, 2013; Visnjic, Kastalli and Van Looy, 2013). By 2007, two out of three product firms in developed countries had already adopted this so-called servitization strategy (Neely, 2008). Product firms that offer services already generate an average of 30% of their revenues from different services (Fang, Palmatier, and Steenkamp, 2008). For example, Rolls Royce, a manufacturer of aero engines, offers maintenance services and performance guarantees for their engines, while IBM, a hardware and software manufacturer, offers management consulting services. Evidence from manufacturing industries suggests that, with the right business model, this strategy can generate higher profit margins (Visnjic, Kastalli and Van Looy, 2013). Yet, in spite of the increasing prevalence of servitization, management scholars have only recently begun to explore the determinants of the decision of product firms to offer services (Cusumano, Kahl, and Suarez, 2014).

Existing research suggests that, aside from internal factors (e.g. slack resources), servitization most often represents a response to challenging industry conditions, namely industry life cycle changes, competition, R&D intensity, or cyclicity (Oliva and Kallenberg, 2003; Neu and Brown, 2005; Teece, 1986; Wise and Baumgartner, 1999). For instance, most theory and evidence suggest that product firms invest in services in order to expand their revenue and profit streams when entering the mature phase of industry evolution (Wise and Baumgartner, 1999; Eggert *et al.*, 2014; Visnjic, Kastalli, Van Looy, and Neely, 2013). However, some authors have argued that firms might actually offer services early in the industry life cycle to tackle technological uncertainty or entice customers to adopt new products (Cusumano, Kahl, and Suarez, 2014; Teece, 1986; Chesbrough, 2011).

While different industry conditions have been identified as antecedents of product firms' decision to offer services, it remains unclear how these conditions influence firms' decisions to offer *specific types* of services (Eggert, Thiesbrummel, and Deutscher, 2015; Gebauer *et al.*, 2012). Indeed, recent contributions have begun to unpack the black box of servitization by examining how industry conditions influence product firms' decisions to offer *specific types* of services as opposed to services in general (Cusumano *et*

*al.*, 2014; Eggert *et al.*, 2015; Mathieu, 2001). For instance, Cusumano *et al.* (2014) examine the relationship between industry conditions and product firms' decisions to offer different types of services. The taxonomy they adopt stems from the customer's perspective on the relationship that services have with a firm's existing product offering.

While this taxonomy is clearly pertinent in understanding service offering, extant literature has been silent on resource – and particularly, learning and knowledge – considerations that a firm may have when deciding to offer services, i.e. how technical and customer knowledge interdependencies between products and services shape product firms' decisions to offer certain types of services in specific industry environments. This is surprising, considering that a link can be expected between the choice of type of service and the knowledge base, learning needs, and corresponding investment and resource commitments that product firms make (e.g. leveraging and developing product technology skills versus communication and relationship management skills) (Baveja, Gilbert, and Ledingham, 2002).

How do industry conditions influence the choice that product firms make in offering product-oriented (PO) rather than customer-oriented (CO) services, and vice-versa? In order to address this question, we examine how the industry life cycle, level of competition, R&D intensity, and cyclicalities influence the decision to offer these two service types. We define product-oriented services as services that are performed on the product itself and primarily require deep technical knowledge of product functioning and operation (e.g. maintenance, repair). For example, SAP offered customization services to tune products to the specific needs of their clients in the early days of the sale of the Enterprise Resource Planning packaged software (Cusumano *et al.*, 2014).

In contrast, customer-oriented services are services that address broader customer needs beyond product functioning and operation, and require deeper knowledge and understanding of those broader needs (e.g. consulting, financing). These services are aimed at helping customers improve the functioning of their own business performance and, in contrast to PO services, they are provided independently of the product (Mathieu, 2001). Unlike PO services that require (and further develop) knowledge of product functioning and use, CO services require and build knowledge around communication with customers, understand their business processes and related challenges, and undertake project and relationship management and coordination with customer as well as other service providers (Raddats, Burton, and Ashman, 2015). For example, IBM – the mainframe manufacturer at the time – ventured into offering management consulting services (Agarwal and Helfat, 2009).

We argue that product-oriented services are used to learn about customers' product needs, alleviate uncertainty about them, and use the acquired knowledge to develop *products* that more closely fit customer needs. On the other hand, firms use customer-oriented services in order to learn about customer needs *beyond* products, in industry conditions where the underlying product knowledge may no longer be a sufficient source of differentiation and competitive advantage. We theorize that product-oriented services are more likely to be offered under conditions of uncertainty regarding customers' core product needs, such as in the earlier stages of the industry life cycle, or in industries with high R&D intensity and competition. On the other hand, customer-oriented services are more likely to be offered by firms when their core product industry is maturing (later stages of the industry life cycle) or when their core product industry is highly cyclical (where customer preferences are changing). We empirically investigate the above propositions and find support for our hypotheses using longitudinal data on 410 publicly traded product firms from a wide variety of industries, tracked from 1990 to 2011.

We contribute to the nascent literature on servitization by helping to answer its main question: what type of services do product firms offer and when? First, we complement the service taxonomy from the customer's perspective on the product-service relationship introduced by Cusumano *et al.* (2014) with a knowledge-based perspective by theoretically distinguishing between product-oriented and customer-oriented services. Second, we theorize and provide empirical evidence that the industry drivers of product-oriented services are distinct from those of customer-oriented services. Third, we shed new light on the second fundamental question of the servitization literature – *why* product firms offer services

(Suarez *et al.*, 2013; Visnjic, Kastalli and Van Looy, 2013) – by examining the industry determinants of product firms' decisions to offer specific types of services. Finally, we contribute to the industry life cycle literature by showing how firms use different service strategies to navigate challenging industry conditions.

## Theory and Hypotheses

Servitization has been defined as a tendency of product firms to add services to their product offering (Fang *et al.*, 2008; Bowen *et al.*, 1989; Vandermerwe and Rada, 1988.). In relation to existing concepts in strategic management, servitization has been conceptualized as a differentiation strategy (Fang *et al.*, 2008; Gebauer, Gustafsson, and Witell, 2011; Zott and Amit, 2008) accompanied by a shift towards a service business model (Suarez *et al.*, 2013; Visnjic, Wiengarten, and Neely, 2014; Zott and Amit, 2007; Storbacka *et al.*, 2013; Ferreira *et al.*, 2013). Evidently, servitization represents a complex phenomenon or indeed an umbrella phenomenon encompassing a variety of strategic choices that may offer different strategic benefits as well as require different investments. What differentiates servitization from other strategic phenomena is the special relationship between the products and services offered by a product firm since most types of services could not exist without the underlying products (Mathieu, 2001) and, moreover, the products and services offered can be both complements as well as substitutes (Visnjic, Kastalli and Van Looy, 2013; Cusumano *et al.*, 2014).

### Types of service strategy

To understand why and when product firms offer services, we need to gain deeper insight into the types of services that product firms offer, particularly from the perspective of the interdependencies between products and services (Visnjic, Kastalli and Van Looy, 2013; Visnjic *et al.*, 2014). The extant literature has offered different classifications to shed light on various aspects of this relationship, focusing on the strategic, marketing, or operational aspects of the relationship (Mathieu, 2001; Kowalkowski *et al.*, 2015; Eggert *et al.*, 2011; Fang *et al.*, 2008; Johnstone, Dainty, and Wilkinson, 2009; Tukker, 2004).

In the strategy literature, Cusumano and colleagues (2014) have recently developed a taxonomy of services that highlights the relationship that products and services have from a consumption perspective. They argue that services can be complementary to products, as in the case where services facilitate product sales and usage (e.g. product financing or warranty/maintenance services). On the other hand, services can also be substitutive to products when the service purchase replaces a product purchase (e.g. leasing of products).

While this classification offers important insights and elucidates the tradeoffs made by customers, a knowledge-based perspective could help shed light on the type of resources, and particularly knowledge and capabilities, that a firm needs to possess or develop in order to provide specific types of services as well as the knowledge that the firm will develop in providing them (von Hippel, 1990; Grant, 1996).

The marketing and operations literature has already made inroads into recognizing the knowledge perspective on servitization (Raddats *et al.*, 2015). More specifically, scholars have acknowledged the importance of distinguishing between services according to whether they target products directly or customers' needs more broadly (Visnjic *et al.*, 2014; Eggert *et al.*, 2014; Mathieu, 2001; Fang *et al.*, 2008). Several labels have been offered for this typology, including the distinction on services supporting products versus services supporting customers (Eggert *et al.*, 2011; Eggert *et al.*, 2014; Mathieu, 2001) or product-oriented versus customer-oriented services (Tukker, 2004; Paiola *et al.*, 2013; Visnjic *et al.*, 2014).

Product-oriented services (e.g. installation, maintenance, repair, or product optimization and monitoring) require deep knowledge of the underlying product, such as engineering skills as well as knowledge of product design and architecture, and they can be easier to provide for the product firm already possessing that knowledge (Visnjic *et al.*, 2014). At the same time, providing services for the product generates insights into how product design and operation can be improved to better fit the needs of the



customer. Therefore, product-oriented services can generate valuable product knowledge and can help innovate and optimize products (Visnjic *et al.*, 2014). Types of knowledge developed through the process of offering product-oriented services encompasses knowledge of the specific technical characteristics of products, functioning of products, customer interaction with the product throughout its use, and product changes across the life cycle (Raddats *et al.*, 2015).

On the other hand, customer-oriented services that go beyond product functioning and operation (e.g. management consulting, logistics, or financial services) draw on different knowledge and competencies, and they yield insights into the functioning of the customers' business model and his organization rather than the firm's products or even the customer's use of the product. While product firms may target the same customer base to provide these services and, therefore, leverage some 'functional' competencies and resources (e.g. customer knowhow and relationships), the core technological knowledge base cannot be leveraged to the extent that it can in the case of product-oriented services. Stated differently, customer-oriented services are more diverse and go beyond the functioning of the product, so that the product firm will need to acquire separate capabilities to perform them (Sawhney, Balasubramanian, and Krishnan, 2004; Baveja, Gilbert, and Ledingham, 2002).

The types of knowledge that a product firm needs to develop throughout the provision of customer-oriented services include process and project capabilities (Sawhney *et al.*, 2004), solution integration, collaboration and co-production with customers as well as other product and service providers (Paiola *et al.*, 2013; Windhal *et al.*, 2004; Homburg, Fassnacht, and Guenther, 2003; Homburg, Workman, and Krohmer, 1999; Davies, Brady, and Hobday, 2006), problem scoping and service definition (Selviaridis, Spring, and Araujo, 2013), customer knowledge (Gebauer, Edvardsson, and Bjurko, 2010), and managing subcontracted employees (Vadaele and Gemmel, 2004). At the same time, customer-oriented services offer insights into how the customer's business operates and what the customer may need in addition to the products presently offered. This deeper knowledge of underlying customer needs can be considered as an input into the development of products and services that are more 'distant' from the products that the product firm currently offers (Visnjic *et al.*, 2014).

### **Matching Servitization Strategies to Environmental Conditions**

The extant literature has documented a number of industry conditions that prompt product firms to offer services (in general) (Cusumano *et al.*, 2014; Eggert *et al.*, 2015; Fang *et al.*, 2008; Suarez *et al.*, 2013). First, the research has shown that firms offer services in the mature stage of the industry life cycle when products become increasingly commoditized and growth and profit potential in the native product industry falls as a consequence (Shankar, Berry, and Dotzel, 2009; Wise and Baumgartner, 1999). More recent work by Cusumano *et al.* (2014) has, however, demonstrated that product firms may offer services at the early stages of the industry life cycle as well. In the latter case, though, it is claimed that the introduction of services has been driven by different objectives – instead of offering a new source of growth and relatively higher profit margins, services are seen as offering a way to reduce market and customer uncertainty and, thereby, better exploit the opportunities provided by the emerging product industry (Cusumano *et al.*, 2014).

Other industry characteristics may also influence the propensity of firms to offer services. For one, services have been seen as a way to improve customer understanding and better channel investments in product and technology, and thereby decrease market uncertainty in industries with higher R&D intensity (Teece, 1986; Visnjic *et al.*, 2014). Furthermore, services have been seen as a response to increased competition in the native product industry since they may help a product firm differentiate and decrease market uncertainty by securing service relationships with clients (Cohen, Agrawal, and Agrawal, 2006). Moreover, offering services has been seen as an adequate strategic choice when a firm's core product industry is characterized by high cyclicity and prone to the ups and downs of the business cycle (Sawhney *et al.*, 2004).

While prior research has offered insights into when firms may offer services, very little is known about the type of service that product firms would choose under given industry conditions, particularly when it comes to product-oriented versus customer-oriented services. Below, we theorize and develop hypotheses regarding the industry conditions under which a product firm would be more likely to opt for product-oriented as against customer-oriented services.

**Industry life cycle.** The early stage of the industry life cycle is characterized by high technological and market uncertainty (Utterback and Abernathy, 1975; Klepper, 1996). The product ‘dominant design’, which contains all the functionalities that a consumer appreciates in the product, has not yet been reached and different competitors converge on the market place and engage in trial and error learning by proposing different product designs. At this early stage of the industry evolution, the production process is flexible and inefficient, and entry barriers are relatively low (Abernathy and Utterback, 1978). Nevertheless, as product innovation stems from insights into user needs and users’ technical inputs, proximity to the customer is of vital importance (Abernathy and Utterback, 1978). Moreover, custom designs are fairly frequent, since they help customers assess the benefit of the product, and they make it easier for the product firm to improve functional product performance (Abernathy and Utterback, 1978; Cusumano *et al.*, 2014).

Product-oriented services are well placed to help with the aforementioned challenges. First, they offer more frequent interaction and higher proximity to customers, which can be used to initiate conversations with customers about product development, particularly with stakeholders on the customer side who are directly involved in the use of the product, such as facility managers and technicians (Visnjic, Kastalli and Van Looy, 2013). Second, the manufacturer can monitor and collect data about the way that the product ‘behaves’ in use and elicit valuable tacit knowledge that can then be used to improve product design (Visnjic *et al.* 2014). Third, services such as product optimization and customization may be necessary to identify the functionality that the customer would benefit from and, in the interim, provide higher satisfaction to the early customers and ensure higher involvement of the lead users (Cusumano *et al.*, 2014; Murmann and Frenken, 2006). Fourth, product-oriented interaction with customers offers the opportunity to acquire tacit knowledge about customers’ product-related needs, which can help firms to establish customer loyalty and to survive once the dominant design is reached and a ‘shakeout’ occurs (Suarez *et al.*, 2013). Finally, the product firm has a competitive advantage in offering product-oriented services early in the industry life cycle given that specialized service providers may not yet have emerged or may be limited in number and/or inferior in quality since they are still at a knowledge disadvantage.

**Hypothesis 1a:** *The likelihood that a product firm offers product-oriented services will be higher in the earlier stages of the life cycle of its core product industry.*

However, as a firm’s product industry matures, it will tend to be increasingly characterized by a lower level of technological change and a higher level of product standardization (Utterback and Abernathy, 1975)<sup>1</sup>. As products become increasingly commoditized, cost competition often leads to a consolidation of the industry and a reduction in the number of competitors (Klepper, 1997; Utterback and Abernathy, 1975). Product firms tend to converge on a dominant design of the product, and customers tend to adopt a dominant use (Kahl, 2007; Cusumano *et al.*, 2014). After the dominant design and dominant use are established, market demand typically stabilizes, products commoditize, and prices drop. At this stage of the industry life cycle, opportunities for product innovation diminish. The market and technological uncertainty that characterized the early stages of industry evolution are increasingly resolved, yet the technological opportunities to design highly differentiated new products decrease as well. Value creation and capture potential diminish, and product firms find it increasingly difficult to grow the market as and to increase or even maintain profit margins.

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<sup>1</sup> Occasionally, the industry life cycle can be disrupted in order to establish new cycles (Anderson and Tushman, 1990). Such disruptions can be considered as re-establishing a new ferment phase, in that it increases uncertainty, product variation, and investment in product innovation (Cusumano *et al.* 2014).

The 'shakeout survivors' are interested in discovering new sources of differentiation, revenues and profits. As product-oriented services are closely tied to the core-product business, if the core-product business stalls, its growth and margins may decline as well (Gadiesh and Gilbert, 1998). Product knowledge becomes increasingly commoditized at this stage of the industry life cycle, offering limited differentiation potential. Conversely, knowledge on unsatisfied customer needs that go beyond the operation and functionality of the core product increasingly becomes the basis for creating new sources of advantages (Visnjic *et al.*, 2014). Customer-oriented services may help product firms enter new knowledge fields where the opportunity for value creation and capture is higher (Agarwal and Helfat, 2009; Sawhney *et al.*, 2004), potentially leveraging existing relationships with customers. Offering services that tap into the understanding of the customer business model as well as the knowledge on *customers'* customers may be a source of exploration that could generate ideas for more radical innovation in products or for offering entirely new products or services. For example, IBM repositioned itself by entering management consulting services and subsequently exited the maturing and highly competitive laptop industry (Agarwal and Helfat, 2009).

**Hypothesis 1b:** *The likelihood that a product firm offers customer-oriented services will be higher in the later stages of the life cycle of its core product industry.*

**Industry competition.** In recent decades, many product industries have witnessed an increasing number of non-traditional competitors such as high-tech startups or low-cost competitors from developing countries (Wise and Baumgartner, 1999). As industry competition has intensified, firms have been looking for ways to sustain competitive advantage and fight off insurgents (Chen, 1996; Chen *et al.*, 2010). High competition puts pressure on firms to reduce prices and/or improve differentiation (Porter, 1996). Moreover, firms engage in a number of other competitive actions in order to increase customer loyalty and the likelihood that customers will choose their products over those of competitors (Chen *et al.*, 2010, Fang *et al.*, 2008).

Offering product-oriented services may provide another way to achieve differentiation from competitors by strengthening customer relationships (Gebauer *et al.*, 2012). Through servicing, manufacturers have a reason to visit customers on a regular basis, maintain close customer relationships, and – through customer proximity – be the first to identify customer need and realize the opportunity to sell a replacement product or cross-sell other related products (Visnjic Kastalli and Van Looy, 2013). Thus, offering services can provide timely knowledge of customer needs and a first-mover advantage in meeting those needs.

**Hypothesis 2:** *Tougher competition in a firm's manufacturing industry increases the likelihood that a firm will offer product-oriented services*

**Industry R&D intensity.** Sometimes, significant technological advances introduce discontinuous changes to the marketplace. In highly R&D intensive industries facing ongoing technological change, competition based on the technological superiority of the products is reignited periodically (e.g. the mobile phone market). Consequently, R&D intensive industries often experience the so-called 'battle for dominance' between two or more rival technologies (Suarez, 2004). This R&D intensity induces ongoing uncertainty regarding the ability to transition existing customers to the new technology, and it requires knowledge about how their needs and usage of products will change with the adoption of subsequent generations of new technology. Thus, uncertainty about customer needs is rekindled periodically over the course of the industry life cycle.

As argued early on, customer insights on the use of products obtained through offering product-oriented services can help in reducing customer uncertainty. For example, by providing services such as maintenance or optimization, product firms get valuable feedback about product use and customer needs which feeds into new product development and supports product innovation (Visnjic *et al.*, 2014). Moreover, product-oriented services can help alleviate customer uncertainty with respect to each new

generation of technology as they can be used to help and support customers who do not yet have the confidence or expertise to buy or use the latest generation of the product (Cusumano *et al.*, 2014).

**Hypothesis 3:** *The likelihood that a product firm offers product-oriented services increases with the R&D intensity of its core product industry.*

**Industry cyclicalities.** Cyclical manufacturing industries are characterized by rapid and steep changes in the demand for products and, correspondingly, in fluctuating sales (Fang *et al.*, 2008; Cohen *et al.*, 2006). These changes may be induced by the volatility of the business cycles (Cohen *et al.*, 2006) or by the changing preferences of customers (Jaworski and Kohli, 1993).

Durable goods, such as industrial machinery, are a case in point. Industrial customers purchase durable goods either to extend the capacity of their plants or to replace aging equipment with similar or new equipment. A related example is investment in IT infrastructure where customers periodically purchase and renew enterprise hardware and software. Indeed, products subject to a high degree of technological depreciation (high clock speed) may face abrupt changes in customer demand, which could surprise product firms that have tenuous connections with their customers or do not have a deep understanding of changes in how their customers' businesses operate.

Services are known in general to be less cyclical than product sales since they generate recurrent revenue streams rather than just a one-time purchase (Wise and Baumgartner, 1999). In order to secure more stable revenues over time, firms in cyclical manufacturing industries have an incentive to provide product-oriented services or customer-oriented services to reduce the cyclicalities of product revenues. While both product-oriented and customer-oriented services may achieve this direct financial effect, customer-oriented services have greater effect in helping the product firm understand and respond timely to the underlying causes of the changes in demand. More specifically, customer-oriented services, such as consulting, can help product firms identify imminent changes in customer preferences or business models at an early stage and learn about the underlying needs driving them. These insights have the potential to help product firms anticipate cycles, understand the forces behind changes in industry cyclicalities, and respond to changes in customer preferences or business models by developing new products or entering new businesses.

**Hypothesis 4.** *The likelihood that a product firm offers customer-oriented services increases with the level of cyclicalities of its core product industry.*

## Methods

### Sample and Data Collection

To study the effect of the industry life cycle and different industry conditions on the firm's strategy to offer product-oriented and customer-oriented services, we first identify the product industries where firms offer services as suggested by prior research. These industries encompass a comprehensive set of product industries ranging from chemical products to heavy machinery and transportation equipment, computer hardware as well as pre-packaged software products (Neely, 2008, Fang *et al.*, 2008; Suarez *et al.*, 2013). We leverage the Compustat Global and Compustat North America databases to focus on publicly traded firms in these industries over a period of twenty-one years, from 1990 to 2011.

To identify the service offerings of these product firms, we follow prior research by using the Compustat Business Segment database (cf., Fang *et al.*, 2008; Suarez *et al.*, 2013). Firms generally separate out product revenues from service revenues in their annual reports, which is then captured and coded by Compustat. For firms with a public listing in the US, the database provides information on firm sales for different business segments as reported by the firm's management. Compustat then interprets these business segment descriptions and allocates corresponding SIC codes.



We used SIC codes and segment descriptions firstly to classify each of the approximately 1,200 business segments in our sample as either products or services. We further classified these service segments as either product-oriented or customer-oriented services<sup>2</sup>. The criteria used is whether the service is performed on the product such as repair, installation, optimization, or maintenance services, or whether the service is not performed on the product such as finance, management consulting, or public relations services (see Appendix 1 for further details). The classification was carried out independently by two expert judges, and the small number of differences were resolved through discussion (less than 5%). The final dataset consists of a panel of 410 manufacturing firms that offer product-oriented and/or customer-oriented services at least once during the period observed, 1990-2011. Firms are on average observed over 13 years, resulting in a total of 5,320 firm-year observations<sup>3</sup>.

## Measures

**Dependent variables.** We calculate three binary dependent variables capturing a product firm's service offerings. *Service<sub>f,t</sub>* equals one when firm *f* reports sales in at least one service segment in year *t* and equals zero otherwise. *Product – oriented service<sub>f,t</sub>* equals one when firm *f* reports sales in at least one product-oriented service segment in year *t* and equals zero otherwise. *Customer – oriented service<sub>f,t</sub>* equals one when firm *f* reports sales in at least one consumer-oriented service segment in year *t* and equals zero otherwise.

**Independent variables.** To calculate characteristics of a firm's primary manufacturing industry in a particular year, we use the Compustat databases to retrieve data on all firms with the same primary four-digit SIC code. For variables whose measurement is based on US Dollars, nominal values are transformed into real 1990 values using US Dollar GDP deflators. *Industry maturity<sub>i,t</sub>* captures the maturity level of industry *i* in year *t* based on the number of remaining firms in the industry. The number of firms in an industry typically grows in the emerging stage of the industry life cycle until it reaches a peak, which is typically followed by a shakeout in the maturity stage (Utterback and Suarez, 1993). In line with Suarez et al. (2013), industry maturity is calculated as  $\left[ \frac{-1}{\text{number of active firms in industry } i \text{ in year } t} \times 100 \right]$  for all the years before the peak in the number of active firms in the particular product industry as well as the year of the peak, and as  $\left[ \frac{1}{\text{number of active firms in industry } i \text{ in year } t} \times 100 \right]$  for all years after the peak. Industry maturity is negative and increasing before the peak in the number of active firms and positive and increasing after the peak. Next, *Industry competition<sub>i,t</sub>* is calculated as one minus a Herfindahl index of industry concentration based on the market shares of all firms *f* active in manufacturing industry *i* in year *t*, i.e.  $\left[ 1 - \sum_f (\text{market share}_{f,i,t})^2 \right]$ . *Industry turbulence<sub>i,t</sub>* is calculated as the standard deviation in total sales of all firms in industry *i* over the previous four years divided by the mean of total sales over the past four years (Fang et al., 2008). Finally, *Industry R&D<sub>i,t</sub>* is calculated as the median R&D expenditures of all firms active in industry *i* in year *t* expressed as a share of firm sales in year *t* multiplied by one hundred.

**Controls.** We include a number of firm-level time-varying control variables that may affect a firm's servitization strategy. Firms with larger market shares in the primary manufacturing industry, with higher profit margins, who are more R&D intensive, larger in size, and/or who have slack resources, may be more likely to provide product- or customer-oriented services. *Market share<sub>f,i,t-1</sub>* is calculated as the sales of firm *f* in year *t-1* divided by the total sales of all firms active in industry *i* in year *t-1*. *Firm ebitda margin<sub>f,t-1</sub>* is calculated as firm *f*'s earnings before interest, taxes, depreciation and amortization in year *t-1* as a fraction of firm sales. *Firm sales<sub>f,t-1</sub>* is the log of firm sales in year *t-1*, which

<sup>2</sup> When we encountered a description of a business segment that did not match the SIC code, we used two independent judges to decide whether this was a product or a service, and a product-oriented or a customer-oriented service. Differences between judges were minor and were resolved through discussion.

<sup>3</sup> Following Fang et al. (2008), we include in our dataset only firms that include service sales at least once during the observation period. Reporting sales in separate business segments represents a voluntary managerial disclosure, and firms may be offering services even if they do not disclose them in separate business segments. Thus, we restrict the sample to those firms that voluntarily report sales in a service segment.

is included as a control for firm size.  $Firm\ R\&D_{f,t-1}$  is calculated as firm  $f$ 's R&D expenditures in year  $t-1$  expressed as a share of firm sales multiplied by one hundred. Finally,  $Firm\ slack_{f,t-1}$  is calculated as the cash and short-term investments of firm  $i$  in year  $t-1$  as a percentage of total firm assets. All firm-level control variables are lagged one year because of endogeneity concerns. Firms may obtain a larger market share in the manufacturing industry when they offer services. It has also been found that profit margins and overall sales are affected by servitization (Fang et al. 2008, Visnjic Kastalli and Van Looy 2014) Finally, by providing product-oriented services, firms can access value information on the consumer and the product's use, which may well stimulate R&D investment by the firm seeking to exploit this knowledge for the development of better products. Estimating the regressions without these firm-level control variables renders very similar coefficients in terms of size and level of significance. Table 1 provides an overview of descriptive statistics and correlations.

**TABLE 1: Descriptive Statistics (n=5,320; 410 firms)**

		Mean	Stdev	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
<i>Dependent variables</i>															
(1)	service	0.42	0.49	1.00											
(2)	product-oriented service (PO)	0.12	0.33	0.44	1.00										
(3)	customer-oriented service (CO)	0.32	0.47	0.80	-0.13	1.00									
<i>Independent variables</i>															
(4)	industry maturity	-0.30	2.86	0.07	0.06	0.04	1.00								
(5)	industry competition	0.65	0.25	0.00	0.00	0.00	0.01	1.00							
(6)	industry cyclicality	0.32	0.37	0.03	-0.01	0.04	-0.03	-0.22	1.00						
(7)	industry R&D	6.74	6.44	0.04	0.08	-0.01	0.08	0.01	-0.04	1.00					
<i>Control variables</i>															
(8)	market share t-1	0.92	4.45	0.08	0.05	0.09	0.02	0.02	-0.02	-0.09	1.00				
(9)	firm ebitda margin t-1	0.03	0.41	-0.01	0.01	-0.02	-0.02	-0.02	0.01	-0.10	0.05	1.00			
(10)	firm sales t-1	5.95	2.70	0.11	0.05	0.11	0.02	-0.10	0.11	-0.29	0.23	0.43	1.00		
(11)	firm R&D t-1	7.73	11.39	0.02	0.04	-0.01	0.05	0.08	-0.06	0.44	-0.08	-0.45	-0.32	1.00	
(12)	firm slack t-1	0.17	0.18	0.03	0.09	-0.03	0.06	0.13	-0.10	0.39	-0.06	-0.15	-0.25	0.46	1.00

## Methodology

To estimate the likelihood that a manufacturing firm offers product-oriented and customer-oriented services in a given year, we estimate conditional logit models with firm fixed effects (McFadden, 1973; McFadden, 1980). Firm fixed effects control for unobserved time invariant firm characteristics affecting a firm's servitization strategy, such as the firm's core manufacturing industry and its main product offerings. In addition, we include annual indicators to control for the increasing tendency of manufacturing firms to move towards offering services over time.

We only include firms in the analysis for which we have variation in offering product-oriented and/or customer-oriented services over time. Hence, our sample only includes firms that start and/or stop offering one or both types of services during our period of observation (1990 to 2011). We use temporal variation in the life cycle of the firm's manufacturing industry and in different industry conditions to predict the adoption of product-oriented and customer-oriented servitization strategies.

## Results

Table 2 reports the results of the conditional firm fixed effects logit models on the likelihood of offering product-oriented services (columns 1 to 6), customer-oriented services (columns 7 to 12), and services in general (column 13). Because we use logit models with firm fixed effects, the fixed effects are assumed to be zero when calculating marginal effects. We will use the models presented in columns 6, 12, and 13 to calculate the marginal effects on, respectively, the likelihood of offering product-oriented, customer-oriented, and services in general.

**TABLE 2: Firm-Fixed Effects Logit**

	(1) PO	(2) PO	(3) PO	(4) PO	(5) PO	(6) PO	(7) CO	(8) CO	(9) CO	(10) CO	(11) CO	(12) CO	(13) service
industry maturity		-0.06** (0.03)				-0.05* (0.03)		0.05** (0.02)				0.05** (0.02)	0.00 (0.02)
industry competition			1.18*** (0.31)			1.18*** (0.32)			-0.00 (0.21)			0.04 (0.21)	0.35* (0.19)
industry cyclicalit				-0.18 (0.18)		-0.08 (0.18)				0.20* (0.12)		0.21* (0.12)	0.18 (0.11)
industry R&D					0.15*** (0.04)	0.15*** (0.04)					0.02 (0.02)	0.02 (0.02)	0.05** (0.02)
<i>Firm controls</i>													
market share t-1	-0.01 (0.03)	-0.01 (0.03)	-0.02 (0.03)	-0.01 (0.03)	-0.02 (0.03)	-0.04 (0.03)	0.03 (0.02)	0.03* (0.02)	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)	0.03 (0.02)	0.02 (0.02)
firm ebitda margin t-1	-0.19 (0.21)	-0.20 (0.21)	-0.18 (0.21)	-0.18 (0.21)	-0.19 (0.21)	-0.20 (0.22)	-0.00 (0.13)	-0.01 (0.13)	-0.00 (0.13)	-0.00 (0.13)	0.00 (0.13)	-0.01 (0.13)	0.03 (0.14)
firm sales t-1	0.65*** (0.11)	0.65*** (0.11)	0.68*** (0.11)	0.65*** (0.11)	0.67*** (0.11)	0.70*** (0.11)	0.73*** (0.08)	0.73*** (0.08)	0.73*** (0.08)	0.73*** (0.08)	0.72*** (0.08)	0.72*** (0.08)	0.84*** (0.07)
firm R&D t-1	0.02** (0.01)	0.02** (0.01)	0.03*** (0.01)	0.02** (0.01)	0.02** (0.01)	0.02*** (0.01)	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	0.01** (0.01)
firm slack t-1	0.27 (0.46)	0.22 (0.47)	0.22 (0.47)	0.26 (0.46)	0.32 (0.47)	0.22 (0.47)	0.02 (0.34)	0.03 (0.34)	0.02 (0.34)	0.01 (0.34)	0.01 (0.34)	0.02 (0.35)	0.28 (0.32)
year fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
firm fixed effects	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.	Incl.
log likelihood	-900.526	-898.430	-893.295	-900.016	-891.978	-882.795	-1807.867	-1805.641	-1807.867	-1806.478	-1807.393	-1803.593	-2109.926
observations	2,316	2,316	2,316	2,316	2,316	2,316	4,480	4,480	4,480	4,480	4,480	4,480	5,320
firms	174	174	174	174	174	174	343	343	343	343	343	343	410

Robust standard errors in parentheses,

\* p<0.1

\*\* p<0.05

\*\*\* p<0.01

With respect to product-oriented services provision, we find that manufacturing firms offer this type of service particularly in the early stage of the industry life cycle, probably to attract lead users and stimulate initial product sales, and to learn about the product's functioning and customer needs. In line with the hypothesis, a standard deviation increase in industry maturity decreases the likelihood of providing product-oriented services by 1%. Firms in emerging manufacturing industries are 7% more likely to sell product-oriented services compared to firms in the most mature industries. Besides the industry life cycle, we find that industry competition prompts firms to provide product-oriented services. A standard deviation increase in competition improves the likelihood of providing product-oriented services by 2%. Firms in the most competitive manufacturing industries are 6% more likely to offer product-oriented services compared to firms in the least competitive industries, probably because this type of service offers a means of securing differentiation from the competition. In addition, we find that R&D intensity positively affects the provision of product-oriented services. A standard deviation increase in industry R&D intensity boosts the likelihood by 5%. Firms in the least R&D intensive industries are 41% less likely to offer product-oriented services compared to firms in the most R&D intensive industries. Supporting services enable a company to capture value from product innovation, while knowledge about the product's functioning and use obtained from servicing provide a valuable input for R&D.

With respect to customer-oriented servitization, the effect of the industry life cycle is the opposite to product-oriented servitization. As a manufacturing industry matures, the remaining firms increasingly sell customer-oriented services rather than product-oriented services. A standard deviation increase in industry maturity increases the likelihood by 2% with a maximum increase of 10%. The effect of industry competition is insignificant. In addition, we find that the cyclical nature of the product industry impels firms to provide customer-oriented services. A standard deviation increase in industry cyclical nature increases the likelihood of customer-oriented servitization by 1%. Firms in most cyclical industries are 5% more likely to offer this type of service compared to firms in less-cyclical industries. Hence, in cyclical manufacturing industries with more heavily fluctuating sales, firms tend to move towards offering customer-oriented services.

Finally, without making a distinction between product-oriented and customer-oriented services, we find no effect of the life cycle of a manufacturing industry, i.e. maturity, on the firm's likelihood to provide services. With respect to the conditions in the industry, we find that industry competition and R&D intensity have significant positive effects. A standard deviation increase in industry competition increases the likelihood of servitization by 0.3%. A standard deviation increase in R&D intensity of the industry boosts the likelihood of a move towards services by 1.2%.

In terms of firm-level control variables, we find that firm size positively affects the move towards both product-oriented and customer-oriented services and that firm R&D intensity positively affects the move towards product-oriented services.

## Discussion

In spite of the growing importance of offering services to product firms, management research has only recently begun to explore the determinants of this phenomenon (Neely, 2008; Cusumano *et al.*, 2014; Suarez *et al.*, 2013, Visnjic *et al.*, 2014). Early evidence suggests that a number of different



industry conditions may prompt product firms to offer services (Wise and Baumgartner, 1999; Shankar *et al.*, 2009). Nevertheless, it remains unclear how these conditions influence a firm's choice of specific service types, making it difficult to theorize about the firm's service choice and investment patterns, and their corresponding performance outcomes (Cusumano *et al.*, 2014; Baveja *et al.*, 2002; Eggert *et al.*, 2015; Fang *et al.*, 2008).

Our study addresses the key question of servitization research: what type of services product do firms offer and when (Gebauer *et al.*, 2012). This study, therefore, complements recent research efforts to unpack the black box of service portfolio design (Cusumano *et al.*, 2014; Kowalkowski *et al.*, 2015; Fang *et al.*, 2008; Johnstone *et al.*, 2009). While extant research has offered taxonomies distinguishing between services that complement rather than substitute products from a customer's point of view (e.g. Cusumano *et al.* 2014), the literature has been fairly muted on how firm learning and knowledge considerations determine the product firm's choice of what types of services to offer in different industry environments (Eggert *et al.*, 2015). To address that research gap, this study examines how different industry conditions influence the learning and knowledge requirements of product firms, and their corresponding choice of the specific (product- vs. customer-oriented) types of services to offer.

In doing so, we make a number of contributions to servitization research in specific areas. First, by conceptually and empirically distinguishing between product-oriented and customer-oriented services, we propose a typology of services that captures key differences in the knowledge that services require in order to be delivered, and generated once delivered. Product-oriented services draw substantially on a firm's existing product knowledge base (e.g. they leverage, to a significant extent, the technical domain knowledge that underpins the firm's products) and they can be used to acquire product-related knowledge that can expand the firm's product knowledge base (e.g. by collecting data on product functioning, which can be used subsequently in new product design and product optimization) (Davenport and Klahr, 1998; Alavi and Leidner, 2001).

Customer-oriented services, on the other hand, draw on the firm's core product knowledge to a lesser extent since they address customer needs that go beyond mere product functioning and operation (Zott, Amit, and Massa, 2011). Thus, product-oriented services will likely require lower investment and will contribute to the 'deepening' of a firm's existing product knowledge base, while the development and delivery of customer-oriented services will likely require greater investment, yet will enable the 'broadening' of a product firm's knowledge base beyond product-specific knowledge. In sum, the two service types can help attain different strategic objectives and imply different levels of knowledge and types of investment.

Second, we provide theory and evidence on the industry determinants of the two different types of services offered by product firms. Empirical analysis of a panel of 410 firms, tracked over a 21-year period from 1990 to 2011, suggests that the decision to 'stick' to product knowledge, versus expand beyond it, is conditioned by the environmental challenges of the product firm's 'native' industry. More specifically, in examining how industry life cycle stage, competition, R&D intensity, and cyclicity influence the decision of product firms to offer product-oriented or customer-oriented services, we find that the two service types are likely to be offered under different industry conditions. Product firms in emerging industries (earlier stages of the industry life cycle) and in R&D intensive industries

are more likely to offer product-oriented services, while product firms in maturing industries (later stages of the industry life cycle) and in cyclical industries are more likely to opt for customer-oriented services.

Therefore, the distinction between product- and customer-oriented services enables us to clarify what the driving industry-level forces behind product firms' move to services truly are. By doing so, we are able to theorize and empirically demonstrate that product firms choose to offer these two different types of services under very different industry conditions – which prior research looking at services in the aggregate has overlooked. Taking this distinction into account would likely be important for future research that seeks to explore the industry determinants of other service types (e.g. research on the antecedents of complementary versus substitutive services) (Cusumano et al. 2014).

Third, we propose that, by viewing services as learning mechanisms, one can connect the learning needs and challenges that product firms face to their choice of specific service types and get closer to answering the question of 'why' product firms offer services. We argue that the mechanism connecting specific industry conditions to specific service design choices is the desire of firms either to deepen the product knowledge base when product knowledge is a source of differentiation or to broaden the knowledge base beyond products when product knowledge is no longer a significant source of differentiation or when knowledge of broader customer needs can increase the value that the firm can extract from its product knowledge.

More specifically, when there is significant uncertainty regarding the product needs of customers, as in the earlier stages of the industry life cycle and/or in highly R&D intensive industries, product knowledge is a valuable source of differentiation, and firms can compete more effectively if they possess this deeper product knowledge. We argue that product-oriented services are used to build relationships around the products that facilitate the flow of knowledge and help firms to alleviate uncertainty about customers' product needs. On the other hand, when the core product industry is maturing (in the later stages of the industry life cycle) or customer preferences begin to change (thus, making the product industry more cyclical), deepening product knowledge does not help alleviate domain knowledge commoditization or obsolescence. The effects of the industry life cycle are, however, conditioned by the level of attention and investment that firms can sustain: competitive pressure makes the leveraging of existing product knowledge more likely while lack of competitive pressure allows firms to build more distant knowledge.

Understanding the 'why' behind servitization is also central to establishing servitization as a subject of interest in the strategic management literature. Prior studies (Cusumano et al. 2014, Suarez et al. 2013) have set the stage by discussing the motives for servitization: how firms capture value by offering services (profitability, growth). We have contributed to this exercise by moving the discussion to value creation and by theorizing about how underlying resources and knowledge are cross-leveraged and how different opportunities for value creation are explored by offering different types of services.

Fifth, the theory and evidence provided by this study suggest that firms need to prioritize which services they choose to develop and to focus their efforts and their investments on the service strategy that best matches the conditions of their core product industry. This runs counter to conventional wisdom, which suggests that services (in general) should be embraced as a solution to

challenging industry conditions. Stated differently, firms choose a specific service in order to achieve a specific outcome under specific industry conditions rather than choosing any service for its potential direct effect on firm performance (value capture).

The knowledge lens is particularly helpful in explaining why manufacturers would venture into services that are far removed from their product knowledge base – a practice that has often been called into question (Benedettini, Neely, and Swink, 2015). Here again, our research takes forward the existing research on servitization and offers novel explanations why prior research has found contradictory evidence on the performance effects of servitization, i.e. failing to distinguish between product-oriented and customer-oriented services (Suarez et al. 2013, Visnjic, Kastalli and Van Looy, 2013).

Finally, we contribute to research on the industry life cycle by showing how the challenges of different life cycle stages can be addressed using services as a learning mechanism to acquire essential knowledge on products and customer needs, and then leverage that knowledge to develop products and services that can help satisfy those needs. Services, therefore, may be an attractive response for product firms facing the increasingly prevalent issue of product commoditization. They can use services as a vehicle to tap into less obvious and ubiquitous sources of knowledge (e.g. private data on machine functioning at a specific site and for a specific customer) and into tacit knowledge on how the product is actually perceived by and used by customers, in addition to evolving customer needs.

Our research has a number of implications for the nascent literature on servitization in product firms (Bowen *et al.*, 1989; Visnjic *et al.*, 2014). First, our study is the first to provide empirical evidence on the industry antecedents of specific servitization strategies, in addition to the more commonly considered firm-level antecedents and customer antecedents (Eggert *et al.*, 2015; Kowalkowski *et al.*, 2015).

From the theoretical perspective, we extend and complement extant research on service taxonomies (e.g. Cusumano *et al.*, 2014; Guajardo *et al.*, 2012) by providing a firm knowledge perspective on the servitization choices of product firms. As our empirical research suggests, ignoring the type of knowledge that services are based on may impede future studies attempting to empirically examine how industry antecedents affect firms' choices governing the services they offer.

Furthermore, our study suggests that the performance implications of servitization are contingent on service type (product-oriented vs. customer-oriented) and on the match between service type and industry conditions (Suarez *et al.*, 2013; Fang *et al.*, 2008; Visnjic, Kastalli and Van Looy, 2013). We qualify extant research on the performance implications of servitization by suggesting that product firms may consider not only the direct performance effects of offering services but also the indirect learning effects. Therefore, any recommendations with respect to whether to offer or not offer particular service types should be made with caution (particularly when it comes to customer-oriented servitization). This realization, we believe, can help further research efforts seeking to find a rationale why product firms offer services that are not directly related to products (cf. Eggert *et al.*, 2014).

Our research has several limitations. For one, the distinction between product-oriented and customer-oriented services may be a matter of degree rather than the categorical distinction that we use for the sake of parsimony in theory development and empirical analysis. Furthermore, data on service types is

self-reported by companies, and some product firms that offer services may be excluded from our sample by virtue of not reporting the sales of these services – a limitation common to all studies using publicly available data to assess servitization strategies (Fang *et al.*, 2008; Suarez *et al.*, 2013). Finally, we have focused on a few selected industry determinants of services that prior literature has suggested is the most significant.

## References

- Abernathy WJ, Utterback JM. 1978. Patterns of industrial innovation. *Technology review* **80**(7): 40-47.
- Agarwal R, Helfat CE. 2009. Strategic renewal of organizations. *Organization Science* **20**(2): 281-293.
- Alavi M, DE Leidner. 2001. Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly* **25**(1): 107-136.
- Anderson J, Narus J. 1995. Capturing the value of supplementary services. *Harvard Business Review* **73**(1): 75-83.
- Baines T, Lightfoot H, Peppard J, Johnson M, Tiwari A, Shehab E, Swink M. 2009. Towards an operations strategy for product-centric servitization. *International Journal of Operations & Production Management* **29**(5): 494-519.
- Baveja SS, Gilbert J, Ledingham D. 2002. From products to services: Why it is not so simple. *Harvard Management Update* **9**(4): 3-5.
- Benedettini O, Neely A, Swink M. 2015. Why do servitized firms fail? A risk-based explanation. *International Journal of Operations & Production Management* **35**(6): 946-979.
- Bowen D, Siehl C, Schneider B. 1989. A framework for analyzing customer service orientations in manufacturing. *Academy of Management Review* **14**(1): 75-95.
- Chen EL, Katila R, McDonald R, Eisenhardt KM. 2010. Life in the fast lane: Origins of competitive interaction in new vs. established markets. *Strategic Management Journal* **31**(13): 1527-1547.
- Chen M. 1996. Competitor analysis and interfirm rivalry: Toward a theoretical integration. *Academy of Management Review* **21**(1): 100-134.
- Chesbrough H. 2011. *Open Services Innovation: Rethinking Your Business to Grow and Compete in a New Era*. Jossey Bass: San Francisco.
- Cohen M, Agrawal N, Agrawal V. 2006. Winning in the aftermarket. *Harvard Business Review* **84**(5): 129-138.
- Cusumano M, Kahl S, Suarez F. 2014. Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal* **36**(4): 559-575.
- Davenport TH, Klahr P. 1998. Managing customer support knowledge. *California management review* **40**(3): 195-208.
- Davies A, Brady T, Hobday M. 2006. Charting a path toward integrated solutions. *MIT Sloan Management Review* **47**(3): 39-48.
- Davies A, Brady T. 2000. Organisational capabilities and learning in complex product systems: towards repeatable solutions. *Research Policy* **29**(7-8): 931-953.
- Eggert A, Hogreve J, Ulaga W, Muenkhoff E. 2011. Industrial services, product innovations, and firm profitability: A multiple-group latent growth curve analysis. *Industrial Marketing Management* **40**(5): 661-670.



- Eggert A, Hogreve J, Ulaga W, Muenkhoff E. 2014. Revenue and profit implications of industrial service strategies. *Journal of Service Research* **17**(1): 23-39.
- Eggert A, Thiesbrummel C, Deutscher C. 2015. Heading for new shores: Do service and hybrid innovations outperform product innovations in industrial companies? *Industrial Marketing Management* **45**: 173-183.
- Fang E, Palmatier R, Steenkamp J. 2008. Effect of service transition strategies on firm value. *Journal of Marketing* **72**(5): 1-14.
- Ferreira FNH, Proença JF, Spencer R, Cova B. 2013. The transition from products to solutions: External business model fit and dynamics. *Industrial Marketing Management* **42**(7): 1093-1101.
- Gadiesh O, Gilbert J. 1998. Profit pools: A fresh look at strategy. *Harvard Business Review* (May-June): 139-147.
- Gebauer H, Edvardsson B, Bjurko M. 2010. The impact of service orientation in corporate culture on business performance in manufacturing companies. *Journal of Service Management* **21**(2): 237-259.
- Gebauer H, Fischer T, Fleisch E. 2010. Exploring the interrelationship among patterns of service strategy changes and organizational design elements. *Journal of Service Management* **21**(1): 103-129.
- Gebauer H, Gustafsson A, Witell L. 2011. Competitive advantage through service differentiation by manufacturing companies. *Journal of Business Research* **64**(12): 1270-1280.
- Gebauer H, Ren GJ, Valtakoski A, Reynoso J. 2012. Service-driven manufacturing provision, evolution and financial impact of services in industrial firms. *Journal of Service Management* **23**(1): 120-136.
- Grant RM. 1991. The resource-based theory of competitive advantage: Implications for strategy formulation. *California Management Review* **33**(3): 114-135.
- Guajardo JA, Cohen MA, Kim S-H, Netessine S. 2012. Impact of performance-based contracting on product reliability: An empirical analysis. *Management Science* **58**(5): 961-979.
- Homburg C, Fassnacht M, Guenther C. 2003. The role of soft factors in implementing a service-orientated strategy in industrial marketing companies. *Journal of Business-to-Business Marketing* **10**(2): 23-51.
- Homburg C, Workman J, Krohmer, H. 1999. Marketing's influence within the firm. *Journal of Marketing* **63**(2): 1-17.
- Jaworski BJ, Kohli AK. 1993. Market orientation: Antecedents and consequences. *Journal of Marketing* **57**(July): 53-70.
- Johnstone S, Dainty A, Wilkinson A. 2009. Integrating products and services through life: An aerospace experience. *International Journal of Operations & Production Management* **29**(5): 520-538.
- Kahl S. 2007. Considering the customer. *Unpublished PhD diss., Sloan School of Management MIT: Cambridge, MA.*
- Klepper S. 1996. Entry, exit, growth, and innovation over the product life cycle. *The American Economic Review* **86**(3): 562-583.
- Klepper S. 1997. Industry lifecycles. *Industrial and Corporate Change* **6**(1): 37-61.
- Kowalkowski C, Windahl C, Kindström D, Gebauer H. 2015. What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. *Industrial Marketing Management* **44**(2): 59-69.

- Martinez V, Bastl M, Kingston J, Evans E. 2010. Challenges in transforming manufacturing organisations into product-service providers. *Journal of Manufacturing Technology Management* **21**(4): 449-469.
- Mathieu V. 2001. Service strategies within the manufacturing sector: Benefits, costs and partnership. *International Journal of Service Industry Management* **12**(5): 451-475.
- McFadden D. 1973. Conditional logit analysis of qualitative choice behavior. In *Frontiers in econometrics*. Zarembka P (ed). Academic Press: New York; 105-142.
- McFadden D. 1980. Econometric Models for Probabilistic Choice Among Products. *The Journal of Business* **53**(3): 13-29.
- Murmann JP, Frenken K. 2006. Toward a systematic framework for research on dominant designs, technological innovations, and industrial change. *Research Policy* **35**(7): 925-952.
- Neely A. 2008. Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research* **1**(2): 103-118.
- Neu WA, Brown SW. 2005. Forming successful business-to-business services in goods-dominant firms. *Journal of Service Research* **8**(1): 3-17.
- Oliva R, Kallenberg R. 2003. Managing the transition from products to services. *International Journal of Service Industry Management* **14**(2): 160-172.
- Paiola M, Sacconi N, Perona M, Gebauer H. 2013. Moving from products to solutions: Strategic approaches for developing capabilities. *European Management Journal* **31**(4): 390-409.
- Porter M. 1996. What is strategy? *Harvard Business Review* (November-December): 61-78.
- Raddats C, Burton J, Ashman R. 2015. Resource configurations for services success in manufacturing companies. *Journal of Service Management* **26**(1): 97-116.
- Reinartz W, Ulaga W. 2008. How to sell services more profitably. *Harvard Business Review* **86**(5): 90-129.
- Santamaria L, Nieto MJ, Miles I. 2012. Service innovation in manufacturing firms: Evidence from Spain. *Technovation* **32**(2): 144-155.
- Sawhney M, Balasubramanian S, Krishnan VV. 2004. Creating growth with services. *MIT Sloan Management Review* **45**(2): 34-43.
- Selviaridis K, Spring M, Araujo L. 2013. Provider involvement in business service definition: A typology. *Industrial Marketing Management* **42**(8): 1398-1410.
- Shankar V, Berry LL, Dotzel T. 2009. A practical guide to combining products and services. *Harvard Business Review* **87**(11): 94-99.
- Storbacka K, Windahl C, Nenonen S, Salonen A. 2013. Solution business models: Transformation along four continua. *Industrial Marketing Management* **42**(5): 705-716.
- Suarez FF, Cusumano MA, Kahl SJ. 2013. Services and the business models of product firms: An empirical analysis of the software industry. *Management Science* **59**(2): 420-435.
- Suarez FF. 2004. Battles for technological dominance: An integrative framework. *Research Policy* **33**(2): 271-286.
- Teece DJ. 1986. Profiting from technological innovation - Implications for integration, collaboration, licensing and public-policy. *Research Policy* **15**(6): 285-305.
- Tukker A. 2004. Eight types of product-service system: Eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment* **13**(4): 246-260.
- Utterback J, Abernathy W. 1975. A dynamic model of process and product innovation. *Omega* **3**(6): 639-656.

- Utterback J, Suarez FF. 1993. Innovation, competition, and industry structure. *Research Policy* **22**(1): 1-21.
- Vandaele D, Gemmel P. 2004. Development of an assessment scale for business-to- business service quality: assessment in the facility services sector. Available at: [www.feb.ugent.be/nl/Ondz/wp/Papers/wp\\_04\\_259.pdf](http://www.feb.ugent.be/nl/Ondz/wp/Papers/wp_04_259.pdf) (accessed June 23, 2014).
- Vandermerwe S, Rada J. 1988. Servitization of business: Adding value by adding services. *European Management Journal* **6**(4): 314-324.
- Visnjic I, Wiengarten F, Neely A. 2014. Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of Product Innovation Management* doi:10.1111/jpim.12254.
- Visnjic Kastalli I, Van Looy B, Neely A. 2013. Steering manufacturing firms towards service business model innovation. *California Management Review* **56**(1): 100-123.
- Visnjic Kastalli I, Van Looy B. 2013. Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management* **31**(4): 169-180.
- von Hippel E. 1990. Task partitioning: An innovation process variable. *Research Policy* **19**(5): 407-418.
- Windahl C, Andersson P, Berggren C, Nehler C. 2004. Manufacturing firms and integrated solutions: Characteristics and implications. *European Journal of Innovation Management* **7**(3): 218-228.
- Wise R, Baumgartner P. 1999. Go downstream: The new profit imperative in manufacturing. *Harvard Business Review* **77**(5): 133-141.
- Zahra SA, Ireland RD, Hitt MA. 2000. International expansion by new venture firms: International diversity, mode of market entry, technological learning, and performance. *Academy of Management Journal* **43**(5): 925-950.
- Zott C, Amit R, Massa L. 2011. The business model: Recent developments and future research. *Journal of management* **37**(4): 1019-1042.
- Zott C, Amit R. 2007. Business model design and the performance of entrepreneurial firms. *Organization Science* **18**(2): 181-199.
- Zott C, Amit R. 2008. The fit between product market strategy and business model: implications for firm performance. *Strategic Management Journal* **29**(1): 1-26.

## Appendix I - Categorization of products and services

As mentioned before, we operationalize engagement in servitization in two steps. First, by distinguishing between products and services and, second, by splitting the services offered into product-oriented and customer-oriented. For this purpose, we developed a code book identifying, in the universe of segmental SIC codes, the one that is reputed to be services.

**Services vs. Products:** In order to perform our categorization of the SIC codes, we obtained definitions and labels of the codes from the US Department of Labor, and we analyzed each code with respect to whether it represents a product or a service. We focused principally on co-production with the customer as a criteria to distinguish between products and services (Cusumano et al. 2014). After extensive consideration of the information gathered, we proceeded in three steps. Firstly, the complete SIC code divisions Services (7000-8999), Transportation, Communications, Electric, Gas, and Sanitary Services (4000 - 4991) and Finance, Insurance and Real Estate excluding investment activities on own account and the real estate codes (6000- 6411) were classified as services. Secondly, similar to Neely (2008), we identified all SIC code definitions containing strings such as 'maintenance', 'consult', 'develop'. The search following the keywords led to the consideration of 37 additional codes. However, after more thorough analysis of the definition, 18 codes were deemed not to be service related. Thirdly, we manually reviewed all SIC codes. This led to a reclassification as non-service or services for 28 SIC codes based on a more precise analysis of the full SIC code definitions. Generally speaking, the approach adopted for coding was conservative. When in doubt, codes were classified as non-services. It should be noted that services in the context of this study are looked at from a manufacturing perspective. Strictly excluded from being categorized as service are the sale/re-sale of (own) products and the pure investing of own capital. Finally, 315 out of 1164 SIC codes have been classified as services.

**Product-oriented versus customer-oriented.** We identify which services belong to the two categories and classify all manufacturers according to the nature of the services offered. Again, the approach followed for categorization is very structured. SIC codes in the division Finance, Insurance and Real Estate (6000-6799) and the major groups Mobility (4000-4173), Transportation / Logistics / Warehousing / Storage (4200 – 4785), Communications (4800- 4899) and Utilities (4900-4971) are classified as customer-oriented services since they are not strictly performed on products. Indeed, services such as transportation are classified in this way, even though they involve products. Such services support products for the purpose of improving operations directly and not the functioning of the products themselves.

Thereafter, SIC codes within the division Services (7000-8999) are manually divided into product-oriented and customer-oriented services. Indicatively, customer-oriented services concern the health, education, amusement and consulting sectors, while product-oriented services cover repairing and maintenance. All remaining SIC codes were classified as product-oriented services since all definitions contained explicit references to the enhancement of specific product categories. After applying the above methodology, the categorizations were reviewed manually and questioned one by one. This resulted in a reassessment in seven cases. A random sample test comparing classifications with information available on company websites resulted in satisfactory results. As a final step, all of our classifications have been reviewed by an independent judge familiar with servitization research. The review produced no noteworthy disagreements.