

Another performance paradox? A refined view on the performance impact of servitization

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Case evidence and quantitative studies warn of the mixed impact of services on the financial performance for manufacturing firms. In this study we disentangle different aspects of servitization strategies and their impact on the financial performance of manufacturing firms. Results suggest that service investments represent a prerequisite for growth. When it comes to characteristics of service offering, we identify the negative effect of increasing service “breadth”, measured in number of services offered, while increasing service “depth”, measured in completeness / sophistication of service offering, results in higher profit margins and an increase in market value.

Besides the implications for the service business per se, we find that the fine-tuning of the service portfolio has the effect on the product strategy as well. More specifically, we find that the interplay between service depth (sophisticated services) and investments in product innovation, measured in R&D, is positive only to certain extent; highest levels of service sophistication and focus coupled with high level of product innovation may result in the negative impact on performance as manufacturers spread themselves too thin to achieve excellence on both ends.

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Another Performance Paradox? A Refined View on the Performance Impact of Servitization

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Abstract

Manufacturing firms are increasingly adopting 'servitization' – a business model innovation whereby existing product offerings are extended through related services. Despite the widespread uptake, questions remain regarding the impact of servitization on firm performance. This study investigates the performance effects of two core dimensions of servitization: service investments and service market approach, characterized by breadth and depth of service offering. Results suggest that service investments – though often underestimated by manufacturers – represent a prerequisite for growth. With respect to profit performance, we identify the negative effect of increasing service breadth, measured in number of services offered, while increasing service depth, measured in completeness of service offering, results in higher margins and an increase in market value. Depth of service offering also has a positive effect on market value. At the same time, the interplay between service depth and product innovation investments turns from positive to negative at the highest extent of service depth, suggesting trade-offs between 'full-scope' servitization strategy and innovation strategy.

Introduction

A key question facing manufacturers in established economies is how to compete, especially when faced with low-cost competition. Many argue that one approach for manufacturing firms to secure their future competitiveness is to shift from selling pure products towards providing 'solutions' or 'product-service bundles' (Levitt 1980; Ovans 1997; Sawhney et al. 2004). Empirical evidence suggests that globally one-third of manufacturing firms have followed this approach, a figure that rises to almost 60 per cent in the United States (Neely 2008). Both academics and practitioners have praised this business model innovation (Spring and Araujo 2009), often labelled 'servitization', as a route to growth, profitability and economic stability (Canton 1984; Cusumano 2004; Lele 1986; Quin and Gagnon 1986; Spohrer and Maglio 2008; Van Looy et al. 2003).¹ However, contrary to the widespread uptake and anecdotal evidence of the expected benefits, previous research provides mixed evidence with regards to the impact of servitization on firm performance (Brax 2005; Fang et al. 2008; Gebauer et al. 2005; Lapre 2011; Neely 2008; Neu and Brown 2005; Oliva and Kallenberg 2003).

¹ Servitization has been present in literature under various labels. See, for example, Mills et al. (2008) for an overview. In this article we will continue to use servitization or service strategy interchangeably, while omitting the other labels.

² From all the companies listed on the OSIRIS database we selected those with primary SIC codes representative of industrial manufacturing sectors, given that industrial manufacturing firms represent a

Fang et al. (2008) argue that, once a critical mass of service sales has been reached, transitioning to services positively affects firm value. However, the impact of servitization is highly contingent on the industry and the 'proximity' of service offering to the existing product offering (Fang et al. 2008). Neely (2008) shows that servitized firms achieve lower profit margins than do pure product manufacturers, especially in the case of large firms. In addition, servitized firms are more likely to declare bankruptcy than are pure manufacturing firms (Neely 2008). In addition, some case studies suggest that servitized manufacturers experience implementation issues when pursuing a strategy of servitization, which in some situations might even result in decreased performance – the so-called servitization paradox (Gebauer et al. 2005). In contrast, Visnjic et al. (2009) analyzed a servitized manufacturer and demonstrated how this firm can reap revenues and profit by servitizing.

It seems that, while manufacturing firms continue to embrace servitization in growing numbers, the literature remains undecided on the characteristics of a successful service strategy from the perspective of the service offering as well as organizational implementation. This study seeks to further investigate the impact of the core characteristics of servitization – investments and type of service offering – on performance, shedding light on the contradictory findings reported in the extant literature. Subsequently, this research explores the following research question: *How do core aspects of servitization influence a company's performance?*

We explore our research question through analysing various financial performance dimensions of 133 servitizing manufacturers between 2000 and 2008. We constructed service variables through manually performed content analysis of publically available information. Initial results suggest that tangible service investments – though often underestimated by manufacturers – represent a key growth factor. Hence, even though statistics suggest that setting up milestones of service business within a manufacturing firm may not be preceded by investments – as in the case of most product strategies – investments throughout servitization become indispensable. Furthermore, the choices that manufacturers should make concerning the service market approach may be even more complex. Increasing breadth, measured in number of services offered, puts downward pressure on margins, while increasing depth, measured in completeness of the portfolio of services, results in higher margins and an increase in market value. Nevertheless, depth implies certain trade-offs; interplay of the highest levels of depth and investments in product innovation impacts negatively upon profitability and market value. It seems that attempting to spread the competence base over the full spectrum of product and service offerings may result in decreases in performance. Manufacturers may have to decide either to limit their aspirations to moderate levels of service depth with product-focused (e.g. total maintenance solution) service offering, or fully focus on complete service solutions, rich in knowledge-intensive services (e.g. consulting), at the expense of giving up their product innovation. These findings will be discussed within the realm of theoretical and managerial impact.

Theoretical background and hypotheses development

The term servitization was first coined by Vandermerwe and Rada (1988) to delineate the tendency of manufacturing firms to offer fuller market packages or bundles of customer-

focused combinations of goods, services, support, self-service, and knowledge. The innovative nature of the servitization trajectory has been considered more recently. Neely (2008) argues that servitization implies the innovation of an organisation's capabilities and processes so that it can better create mutual value through a shift from selling product to selling product-service systems.

Service investments and performance

While early adopters of servitization were primarily drawn to this strategy by the strategic benefits that services offer to products, most notably increased customer loyalty and competitor lock-out (Hatzakis et al. 2010; Lele 1986; Levitt 1980; Vandermerwe et al. 1988), manufacturers have recently been increasingly attracted by the direct economic benefits that services might entail (Cohen et al. 2006; Sawhney et al. 2004). In particular, services were expected to offer growth opportunities, especially when firms have large bases of installed products (Canton 1984; Sawhney et al. 2004). In addition, services are reputed to be more resistant to economic cycles, and therefore generate a steadier flow of revenues (Canton 1984; Cohen et al. 2006; Cusumano 2004; Quin et al. 1986).

Growth opportunities represent one of the most evident motivating factors for a manufacturing firm to servitize (Canton 1984; Sawhney et al. 2004). *The Aberdeen Group* estimates the sale of aftermarket services at 8 per cent of annual gross domestic product, or approximately \$1 trillion (Cohen et al. 2006). Cohen et al. (2006) report that in durable goods sectors companies have accumulated sizeable installed bases of products – products that have been sold over the years and continue to be used by firms. These installed bases offer market potential for service business that exceeds four to five times the potential for the sales of new equipment (Cohen et al. 2006). Besides the accumulated installed base, Reinartz et al. (2008) put forward an additional growth driver for industrial services: the growing tendency of customers to outsource their non-core activities. The opportunities in the service market are not only sizeable, but they can also be reaped as soon as the engagement in servicing starts (Wise and Baumgartner 1999). Given the readily available demand and the fact that service activities are characterized by simultaneity of production and exploitation (Van Looy et al. 2003), we could expect all the investments in services to be promptly translated into growth opportunities. Hence, besides having high potential for value creation, servitization is often presented as a low-risk and easy-to-achieve strategy. Most authors argue that manufacturers are already service providers in disguise and that their involvement in various service provisions should merely be formalized and extended (Anderson and Narus 1995; Quin et al. 1990; Reinartz et al. 2008; Wise et al. 1999). Unfortunately, this perception of servitization as being an easy strategy also seems to imply a lack of attention from top management (Gebauer 2009; Gebauer et al. 2008). Several authors point out that this lack of interest leads to the lack of investments that hampers service development that may be a condition *sine qua non* for growth (Gebauer et al. 2005; Gebauer et al. 2010; Oliva et al. 2003). Subsequently, we propose the following hypothesis:

H1: Service investments have a significant positive impact on a company's growth performance.

Service characteristics and performance

The preceding section has highlighted previous findings with regards to the service investments–performance relationship. This section provides a more refined view of service characteristics and performance. However, only a limited number of studies have assessed the impact of various service characteristics on the economic performance of firms.

Previous studies show the predominantly positive impact that servitization, as a strategic direction overall, has on the manufacturing firm. More specifically, some researchers state that manufacturing firms that engage in servitization outperform manufacturing firms that do not (Fang et al. 2008; Neely 2008; Visnjic et al. 2009). Nevertheless, the fragmented evidence these studies provide with respect to the impact of the chosen service business model and the core characteristics – breadth and depth of service offering – seems to suggest that failing to remain ‘modest’ with respect to the number and sophistication of service offerings results in performance decline. Neely (2008) finds that the size of service portfolio has a negative impact on the profit performance of the firm. Fang et al. (2008) argue that by exploiting service opportunities that require competencies, which are more distant from the product competency base, as, for example, financial services, the manufacturer loses its competitive advantage over specialized providers and decreases its market value. While Fang et al. (2008) assume that services are unrelated to products when they are not directly performed on products (e.g. product repair would be considered related, while financial services would be considered unrelated), this comes as a surprise as previous literature, labelling these services as customer-oriented services, contemplates this as the natural extension of a service strategy (Mathieu 2001; Vandermerwe and Chadwick 1989).

To summarize, extant literature provides results that suggest a negative impact of two key characteristics of servitization on different aspects of the performance: size of the service portfolio has a negative impact on profit margin (Neely 2008), while the scope of service offering has a negative effect on market value (Fang et al. 2008). Subsequently, in an effort to test the impact of breadth and depth of service offering on both profits and market value within one study, we state the following hypotheses:

H2_{a,b}: Service opportunity exploitation, in (a) breadth and (b) depth will have a negative impact on a company’s profitability.

H3_{a,b}: Service opportunity exploitation, in (a) breadth and (b) depth will have a negative impact on a company’s market value.

Interplay of servitization and product innovation on performance

Some authors suggest that companies can overcome the service paradox through innovation. Literature points out the development of new services (Gebauer et al. 2008; Neu and Brown 2005, 2008) that may then result in an entirely new product–service solution (Gann and Salter 2000; Windahl and Lakemond 2006). Similarly, as in the case of user-driven innovation, further interactions with customers and their equipment may become a good starting base to develop new products. Technical teams providing services could suggest product improvements that facilitate servicing or report back

customer requirements to the manufacturer. Furthermore, the information from servicing products reported by the technicians or collected via distributed information technology, such as sensors and RFID tags, would illustrate design deficiencies and help design products that require less service. While literature speculates on some form of cross-fertilization between servitization and innovation efforts, this relationship and the impact of their parallel deployment has not yet been comprehensively tested. Subsequently, we propose the following hypothesis:

H4: Joint deployment of innovation strategy and servitization, and the development of service scope in particular, will have a positive impact on a company's performance in terms of market value and profitability.

Methodology

Sample

To construct the representative data set of servitized firms, we first examined all companies that had a potential to servitize and selected the ones that claimed to have provided services in 2008. Then we collected publically available data for the companies under study and finally, we analyzed the data in order to understand the companies' approach to services and to construct relevant variables.

The aim of the selection process was to find a robust and focused sample consisting of 1,995 servitized companies. After applying several criteria to identify manufacturing firms with the potential for servitization,² we reached a sample of 1,995 manufacturing firms and acquired their financial data from the Datastream database. After eliminating firms that lacked data on the product/market segment necessary to further understand what services were being provided, we ended up with a sample of 390 firms. Furthermore, we used the business description to understand which companies had servitized. Manual analysis revealed that of 390 companies, 133 companies mentioned providing some type of 'services' in their business description in 2008.³ These 133 companies represent the sample used for our further investigation.

After financial data for the 1999 to 2009 period was obtained from Datastream, we proceeded with the collection and analysis of the publically available data on servitization for the companies in the sample. To investigate the impact of type of servitization strategy on firm performance, we collected data corresponding to the previously defined dimensions of servitization – service investments and breath (size) and depth (scope) of the service portfolio.

² From all the companies listed on the OSIRIS database we selected those with primary SIC codes representative of industrial manufacturing sectors, given that industrial manufacturing firms represent a hotbed for servitization strategy (Bowen et al. 1989; Gebauer et al. 2005; Neely 2008; Quin et al. 1990). In addition, we examined SIC codes of companies that had been cited several times in the existing literature to make sure that we were not omitting any relevant sectors. Finally, the primary SIC code classification was determined to range between 10 and 39 of the OSIRIS database. Furthermore, we chose to work with listed companies, because we relied on publically available information that reveals their service approach. We also determined that the minimum number of employees should be more than 100. The other criteria was country of incorporation, as companies operating in developed economies have more opportunities to develop and sell services compared to those operating in developing countries (Neely 2008).

³ We also searched for keywords on different services and solutions, as defined by Neely (2008).

Initially, we worked with annual reports for each year between 2000 and 2008. However, given the constraints of time and resources, we had to make a trade-off decision between the number of firms that could be studied and the number of years that could be covered. As the pilot study revealed that the differences between annual reports one year apart were relatively small, we decided to sample annual reports every two years. Hence, in the final data set we only included data from annual reports for the years 2000, 2002, 2004, 2006 and 2008. To code the data we developed a structured excel template containing several subjects, including: ISIN number, company name, year of annual report, notes on investment, notes on scope of service offering, number of services, financial results of products, financial results of services, operating problems with products and operating problems with services. The categories were inspired by our research question and the extant literature, but we extended the template as appropriate to capture a rich set of data for each firm.

In the second phase of data collection we hired a research assistant to review and analyze the annual reports, using an established technique of expert panellists (MacCormack et al. 2001; Zott and Amit 2007). The advantage of using an expert panellist (expert rater) over an automated content analysis was that we had a better understanding of the context in which the key words appeared and furthermore we were able to obtain a good grasp of the extent or importance of the context in which a service word has appeared. Initially two coders – the research assistant and the principal investigator – reviewed annual reports, compared notes and categorizations, and only when there were limited discrepancies was the single rater used. Using raters to analyze and evaluate strategy was appropriate, given the lack of objective measures available for servitization strategy (Dess and Robinson 1984; Zott et al. 2007).

The majority of the annual reports that we needed could be found on individual company websites or on the website of the US securities exchange commission (form 10-K or 20-F). When reports were not available for one year or more we contacted the firms requesting replacement copies. Fifty requests were sent to the companies, which resulted in an additional 30 annual reports. In a number of cases though, annual reports were not available (e.g. the firm was not yet listed) and hence it was impossible to access annual reports in these cases.

To identify service-related sections of the annual reports we searched each report using keywords that had previously been used in similar studies (Neely 2008).⁴ Our analysis continued with the translation of quotes into ‘servitization’ variables that represent the dimensions of the servitization process already identified – Service investments and Service scope, and one additional variable derived from the data: Intent to Servitize. After analyzing each report, the rater gave every observation a provisional mark on a scale from one to five – with one being very low and five being very high – based on three factors: service investment, scope and completeness of service offering. Using Likert-based categories is a preferred way of consolidating diverse qualitative data on this subject

⁴ The key words were inspired by the Neely (2008) typology of service offering and extended by keywords used in other types of literature. After testing all the key words in the pilot study, we continued to work with the following keywords: service(s) – aftermarket – spare parts – customer solutions – repair – maintenance – customer relationship – training – acquisition – expand.

matter and has been extensively used by prior studies (Zott et al. 2007). The number of services in the service offering was a simple sum of all services offered. At the same time, we restricted differences in interpretation by creating clear rules concerning the assignment of scores and by validation of rater's reliability (Zott et al. 2007).

We validated the rater's reliability by thoroughly examining her work. The principal investigator first examined the comprehensiveness of data collection and capture, by reviewing the information captured in the excel file for five randomly selected companies. This quality check highlighted no issues with the rater's work and the excel template was therefore accepted as a valid summary of the relevant annual report data. The principal investigator then verified the content analysis by reviewing the scores given for all 572 observations. Only 31 observations were disputed and subsequently corrected. The rater and principal investigator were highly consistent in their assessments, with no disagreements in over 95 per cent of cases.

Measures

In order to test our hypotheses we collected data on the dimension of servitization and performance. More specifically, we constructed the variables on the investments in services and the exploitation level of service market opportunities, in terms of both service size and scope; and we linked them to three performance measures: growth, profitability and market value. It is worthwhile mentioning that these servitization variables are not mutually exclusive. For example, a product-service provider with extensive scope of service portfolio can still have the intention of investing in services, or a 'young' service provider could already reap certain benefits from servitization and announce further investments.

Service Investment. This variable entails tangible investments that a company has effectively made throughout the relevant period (e.g. for fiscal 2004: the relevant period for investments begins in 2001 and ends in 2004). In service investments, we would consider all the efforts being made by a firm, ranging from service-related acquisitions to internal investments in restructuring or hiring of service FTEs.

The level or extent of the investment is assigned according to the magnitude of the investment categorized as follows:

- 1: No service-related investments are mentioned in the annual report.
- 2: A company made some operating investments (e.g. new software program to better help the customers) or got involved in operational service partnerships or agreements.
- 3: A company expanded its service network or restructured its organizational structure in order to provide increased or better services to its customers, or a company started a strategic joint venture related to services.
- 4: A company made a service-related acquisition (e.g. acquired another firm that has both product and service offering).
- 5: A company made one service acquisition or several service-related acquisitions or a company formed a separate service division.

The distinction should be made between the *proof of investment* and *intent to invest*: while in the case of the former we can find some tangible evidence of the investments, in the case of the latter we are just encountering declarations in the form of promises. We

would take a claim of investment into account for ‘service investments’ variable *only* if the proof of investment has been provided. This notion is as important for the interpretation of the variables, as it is necessary for the appropriate treatment of the sources we have. Given that in annual reports, firms hope to present themselves optimally to the stakeholders, we need to make a clear distinction between what is a proof and what is an unproven statement (David 2001).

Service completeness. This variable describes the depth of a firm’s involvement with clients and the scope of a client’s service needs that the manufacturer is prepared to cover. Service completeness is used to grade manufacturers according to their value proposition and inclusiveness of their service offerings in this respect. For example, service completeness would range from basic after-sales services (e.g. spare parts), to full coverage of product-related needs (e.g. performance-based contracts on a machine) and further to the integrated solution (e.g. ‘power by the hour’ concept where the manufacturer covers all the customer needs, including, for example, financing or training). It is worth noticing that, going along this trajectory, manufacturers move towards knowledge-intensive customer services requiring specific service competencies that start to depart from the technological know-how of the product base. For example, in the context of the manufacturing sector that we are researching, services such as maintenance and repair would be close to the customer’s core competencies, as they require knowledge of the product that the manufacturer has already developed (Mathe and Shapiro 1993; Mathieu 2001). On the other hand, more sophisticated and customer-oriented service offerings, such as consulting, finance or training, require competencies that are further away from the manufacturer’s technological knowledge base.

Hence, a manufacturer can exploit service market opportunities that are distant from its competency base but demanded by the same group of customers, or it can decide to remain conservative and stick close to the services that are closely related to product offering. We refrain from referring to the services that are distant from the existing competency base as ‘unrelated’ services (Fang et al. 2008), as firms usually stay close to their customer base even when they provide services that are ‘distant’ from the competency base (e.g. financial services). We would label services as ‘unrelated’ if service provision had limited links with either competence base or customer base (Rumelt 1974), for example, a provider of printers that is trying to offer facility-maintenance services to a distinct customer base.

Service completeness is categorized as follows:

- 1: Nothing is mentioned in the annual reports. A company offers no services to its customers.
- 2: A company offers only spare parts, supplies, components for its products and (technical) information/documentation about its products.
- 3: A company offers basic services such as repair, maintenance, upgrades, construction, installation, logistics services, and overhaul service.
- 4: A company starts to offer solutions based on a combination of basic service components and a limited number of knowledge-intensive services such as engineering services, customer support, technical support, 24/7 support, financial services.

- 5: A company offers total solutions with full need coverage; besides the service components of basic and medium knowledge intensity, total solutions would also include 'advanced' service components such as training, education and consulting.

Number of services. Besides the completeness of the service portfolio described earlier, a company may also decide what range of services it will offer. For example, a firm that remains low on the service evolution ladder and provides basic services can decide to climb this ladder and offer only total solutions or it can try to play on both sides of the spectrum and offer a number of service variants. 'Number of services' captures this decision with respect to the scope of service offering or the size of the service portfolio (Neely 2008) and represents a sum of all services that the manufacturer reports to be offering.

In addition, we have used **R&D/sales ratio** as an estimate for the extent of investments in product innovation in a firm and an interaction effect between **R&D/sales ratio and Service completeness** to account for the link or interdependency between the completeness or knowledge intensity of service offering and product innovation strategy.

We have controlled for the size of the firm using the log of **number of Employees**. **Fixed-effects** were introduced to control for time-invariant and unobserved heterogeneity among subsidiaries, while expected yearly effect of price increases is countered by introducing **trend variable** in each model. The two last controlled will be revisited in a discussion on empirical design.

In terms of dependent variables we have used three indicators to assess the outcomes of servitization and its stages. All indicators have been sourced from the Datastream database, provided by Thompson Reuters.

Sales Growth. This financial performance measure (Venkatraman and Ramanujam 1986) has frequently been used to assess the effectiveness of different types of diversification strategies (Palich et al. 2000; Tanriverdi and Lee 2008). Growth has equally been one of the motivating factors for manufacturing firms to venture into service markets (Cohen et al. 2006; Gebauer et al. 2005). In line with the discussion on the profitability of servitization strategy (Gebauer et al. 2005; Neely 2008; Visnjic et al. 2009) we used the **EBIT margin** to assess the efficiency of this strategy. In line with Fang et al. (2008), we have used **Tobin's Q** to understand the effect of servitization on a firm's market value. The market value of a firm reflects a change in the market's expectations of future cash flows to shareholders, and can be viewed as a measure of perceived firm performance, as opposed to the realized performance described by measures of firm profitability (Zott and Amit 2008). Table 1 provides an overview of all the descriptive statistics.

Table 1: Descriptive statistics and correlation

Rank	Variable	Obs	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12
1	Service investments	572	1.98	1.09	1											
2	No. of services	572	3.16	2.16	0.21	1										
3	Service completeness	572	3.45	1.20	0.19	0.71	1									
4	R&D/sales (%)	1281	5.80	12.65	-0.10	0.01	0.00	1								
5	S. comp.* R&D/sales	526	14.74	19.12	-0.08	0.21	0.29	0.76	1							
6	S. comp.* R&D/sales ²	526	582.02	1397.28	-0.06	0.06	0.11	0.62	0.84	1						
7	Employees (log)	1363	7.82	1.78	0.29	0.15	0.11	-0.26	-0.30	-0.16	1					
8	Time dummy	1360	5.50	2.87	0.01	0.17	0.18	-0.06	0.00	0.01	-0.02	1				
9	Time dummy ²	1360	38.50	32.43	0.02	0.14	0.17	-0.06	-0.01	0.00	-0.01	0.97	1			
10	Sales growth	1250	0.08	0.24	0.05	-0.05	-0.03	-0.16	-0.19	-0.16	-0.04	-0.02	-0.02	1		
11	EBIT margin	1352	0.06	0.13	0.07	0.08	0.08	-0.76	-0.44	-0.36	0.24	0.05	0.06	0.21	1	
12	Tobin's Q	1283	1.27	0.86	-0.14	-0.04	-0.04	0.05	0.08	0.04	-0.22	-0.12	-0.14	0.16	-0.01	1

Empirical analysis and results

In all econometrical models, we use panel data analysis with fixed effects to predict the impact of the two dimensions of servitization on several aspects of current performance (H1–H4). The fixed-effects model includes dummy variables for each subsidiary, thereby ‘specifying an estimable conditional mean’ and addressing biased and inconsistent parameter estimates (Greene 2003; Wooldridge 2002). We introduce fixed effects to control for time-invariant, unobserved heterogeneity among subsidiaries, given that we expect that time-constant differences may determine the effectiveness of service strategy (Greene 2003). The expected yearly effect of price increases and growth targets is countered by introducing a trend variable in each model. Independent variables are introduced with a one-year lag to account for the time lag between changes in strategy and the performance effects.

The models that we tested are presented below:

Model 1 (Hypothesis 1)

$$\text{Sales growth}_{i,t} = a3 + b3 \times \text{Service investment}_{i,t-1} + c3 \times \text{Number of services}_{i,t-1} + d3 \times \text{Service completeness}_{i,t-1} + e3 \times \text{R\&D_sales}_{i,t-1} + f3 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1} + g3 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1}^2 + h3 \text{ Employees}_{i,t-1} + i3 \times \text{Time}_{t-1} + j3 \times \text{Time}_{t-1}^2 + \varepsilon_{i,t}$$

Model 2 (Hypotheses 2 and 4)

$$\text{EBIT margin}_{i,t} = a6 + b6 \times \text{Service investment}_{i,t-1} + c6 \times \text{Number of services}_{i,t-1} + d6 \times \text{Service completeness}_{i,t-1} + e6 \times \text{R\&D_sales}_{i,t-1} + f6 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1} + g6 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1}^2 + h6 \text{ Employees}_{i,t-1} + i6 \times \text{Time}_{t-1} + j6 \times \text{Time}_{t-1}^2 + \varepsilon_{i,t}$$

Model 3 (Hypotheses 3 and 4)

$$\text{Tobin's } Q_{i,t} = a9 + b9 \times \text{Service investment}_{i,t-1} + c9 \times \text{Number of services}_{i,t-1} + d9 \times \text{Service completeness}_{i,t-1} + e9 \times \text{R\&D_sales}_{i,t-1} + f9 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1} + g9 \times \text{Service completeness} \times \text{R\&D_sales}_{i,t-1}^2 + h9 \text{ Employees}_{i,t-1} + i9 \times \text{Time}_{t-1} + j9 \times \text{Time}_{t-1}^2 + \varepsilon_{i,t}$$

Models 1A, 1B and 1C in Table 2 suggest that tangible service investments are indispensable for service growth. Nevertheless, descriptive statistics suggest that most of

the servitizing manufacturers do not commit upfront investments for service development.

While most of (product) business development projects start with a significant upfront investment in the milestones or business infrastructure (e.g. a production facility or R&D unit), our data suggests that a manufacturer's upfront investments in services are rarely that sizeable and that the time before these investments begin to be exploited may be short. In only 9 out of 572 observations do firms seem to have 'green field' service investments, without simultaneously exploiting market opportunities by offering services.

The fact that service business milestones can be set up with minimal effort may be deceiving manufacturers into neglecting service investments. Hence, while manufacturers setting up initial milestones of a service business may experience these as cheap and fast, tangible service investments are necessary to develop service business beyond this.

Models 2A, 2B and 2C offer the results of Hypothesis 2 testing, with respect to the effect of service market exploitation – in terms of breadth and depth of service portfolio – on profitability. Firstly, results seem to suggest that these two dimensions of service market exploitation have different implications for profitability. The scope of service portfolio (breadth) negatively effects profitability and, as already noticed by Neely (2008), manufacturers seem to put themselves at a disadvantage by expanding the range of their service portfolio. Staying focused on a selected set of services seems like a better strategy. On the other hand, completeness of service offering (depth) seems to have a positive effect on profitability. As Model 2C suggests, a focus on complete service offerings, rich with knowledge-intensive service components, increases profit margins.

Model 2C also points to another interesting facet of service completeness with respect to testing Hypothesis 4: the relationship between completeness of service portfolio and product innovation affects profitability of the firm. More specifically, there seems to be a curvy-linear relationship between interaction of service completeness and product R&D investment, and profitability. Initially, the combination of service completeness and R&D investments puts downward pressure on the margin, but once the initial period is over, interdependence positively affects profit margin. This argument becomes more plausible once we consider investments that need to be incurred; investing in knowledge-intensive services and product innovation concurrently is costly and takes time to recoup. Knowledge-intensive services are further away from the product competence base, and hence, require more investments compared to the less sophisticated service, while at the same time the nature of product innovation usually requires longer investment cycles. In addition, setting up an interrelationship between the product and the service side of the organization can be costly with respect to the coordination costs of the organizational mechanisms that help establish this linkage. However, once the investments are made and a relationship is set, a manufacturer may be able to reap additional economies of scope enacted between the R&D unit and client-facing professionals.

Table 2: Results of testing Hypotheses 1–2

	Sales growth			EBIT margin		
	1A	1B	1C	2A	2B	2C
Service investments _{t-1}	0.025*	0.025*	0.025*	0.004	0.004	0.003
No. of services _{t-1}	-0.002	-0.001	-0.001	-0.010*	-0.010*	-0.011*
Service completeness _{t-1}	0.008	0.023	0.018	0.008	0.015	0.030*
R&D/sales _{t-1}	-0.003	0.014	0.011	-0.008**	0.001	0.010
S. comp.* R&D/sales _{t-1}		-0.004	-0.002		-0.002	-0.009**
S. comp.* R&D/sales ² _{t-1}			0.000			0.0005*
Log Employees _{t-1}	-0.115**	-0.115**	-0.116**	-0.038*	-0.038*	-0.032†
Time dummy	0.101***	0.100***	0.100***	0.025***	0.025***	0.025***
Time dummy ²	-0.012***	-0.012***	-0.012***	-0.003***	-0.003***	-0.003***
Constant	0.795**	0.735*	0.747*	0.362*	0.334*	0.275†
R ²	27.1	27.3	27.4	9	9.4	11.2
F-stat P-value	0.00	0.00	0.00	0.00	0.00	0.00

***p < 0.001; **p < 0.01; *0.01 ≤ p < 0.05; †0.05 ≤ p < 0.1

The results of Model 3C presented in Table 3 suggest a somewhat different but complementary reading. Firstly, markets seem to be indifferent to the scope of service portfolio. Secondly, the impact of service completeness on the market value remains positive. Finally, there is no evidence that markets acknowledge the synergetic potential of the interplay between service completeness and product R&D, and their joint impact on the performance. Moreover, it seems that analysts penalize firms that fail to focus on one side of the value chain and risk being 'stuck in the middle'; opting for either service expertise or product expertise seems appealing to the markets, while failing to focus on either of the two results in loss of market value.

The last finding becomes even more intriguing when we consider the results of this analysis on the subsample of firms with service completeness scores ranging between 1 and 3; within this subsample the link between the service completeness and product R&D investments has a positive effect on the Tobin's Q. Hence, if firms expand coverage or completeness of their service offerings up to level 3, where service offering remains composed of sophisticated but product-related services (e.g. performance-based maintenance contracts), the link with product innovation remains 'effective'. Comparing this again with the results of the complete sample, there seems to be a sharp distinction between increasing the completeness of the service offering to the extent that services are product-oriented, and going beyond the product-oriented services and embracing customer-oriented service components that are represented in the completeness scores of 4 and 5 (e.g. financial services, consulting, trainings). This suggests that there seem to be two viable service business models for manufacturers to choose from: a) keeping service offering to the intermediary level of completeness and fostering the relationship between these (product-oriented) services and product innovation; or b) opting for a focused service strategy that resides in the top range of the most sophisticated, knowledge-intensive services, but denouncing product strategy.

Table 3: Results of testing Hypothesis 3

	Tobin's Q			
	3A	3B	3C	3B (subsample)
Service investments _{t-1}	-0.009	-0.004	-0.002	-0.020
Number of services _{t-1}	-0.014	-0.006	-0.004	0.083
Service completeness _{t-1}	0.033	0.181*	0.151†	-0.141
R&D/sales _{t-1}	-0.003	0.165***	0.147**	-0.158†
S. comp. * R&D/sales _{t-1}		-0.041***	-0.028	0.002*
S. comp. * R&D/sales ² _{t-1}			0.000	
Log Employees _{t-1}	-0.137	-0.134	-0.141	0.003
Time dummy	0.221***	0.209***	0.209***	0.187***
Time dummy ²	-0.021***	-0.020***	-0.020***	-0.013***
Constant	1.974**	1.382†	1.456†	0.940
R ²	10.6	14.4	14.6	28.0
F-stat P-value	0.00	0.00	0.00	0.00

***p < 0.001; **p < 0.01; * 0.01 ≤ p < 0.05; †0.05 ≤ p < 0.1

Note: Subsample contains firms that have service completeness level between 1 and 3.

Discussion and conclusion

While extant literature brought us closer to understanding the reality behind this phenomenon, the relationship between servitization and performance still needed to be clarified. Through this contribution, we attempt to shed light on the performance effect of the core strategic dimensions of servitization: investments in service resources and the exploitation of service market opportunities, in terms of scope and completeness of service offering.

First, descriptive statistics that underpin our data may challenge established thinking on how investments and exploitation of market opportunities interact in the service domain. While the linear stage-gate conception, whereby strategic undertaking starts by significant upfront investments, may explain the trajectory of product-related strategies (e.g. product innovation, diversification), servitization initially tends to be characterized by low asset intensity. Servitization, to the advantage of the manufacturing firms, seems to begin by exploiting existing product resources and competence base, as well as the elementary service resources that usually exist in every manufacturing firm, dating back to times when manufacturing firms were obliged, even by law, to provide basic servicing. At those times a necessary spare-part provision and one or two service technicians who assured warranty coverage were usually regarded as a cost and a 'necessary evil'. Once a manufacturer starts to perceive services as a market opportunity, it starts to exploit these existing resources instead of having to secure these investments up front.

While milestones of service business in a manufacturing firm are relatively easy to establish, manufacturers shouldn't be deceived: service-specific investments remain necessary if a firm wants to get services off the ground to enact service growth. The necessity of the investments becomes particularly outspoken as services start to expand in scale, scope and complexity. Manufacturers need to invest in, for example, service

information systems that support transparent reporting practices and help efficiently plan service provision; further investment in resources and capabilities for service sales, pricing and business development are warranted as well.

While servitization can be seen as a good growth strategy, firms need to be careful when conceiving its boundaries, given that there seem to be limitations to what can be seen as profitable service growth. In this respect our results suggest that extending the breadth of service offering by expanding in the spectrum of service portfolio may result in diminishing efficiency. More specifically, for firms that intend to grow by expanding the scope of service offering, adding more and more services to the portfolio may realize inferior profit margins.

On the other hand, growing by deepening the relationships with customers may be a more lucrative service avenue. Our findings suggest that manufacturers that start offering more complete service offerings containing knowledge-intensive service components – such as consulting or training – may realize superior margins and even market value. Nevertheless, even this strategic choice is not without controversy; it seems that firms need to take into consideration the interdependencies with product innovation investments when deciding on a degree of completeness of service offering. Concerning its impact on profitability, combining sophisticated service offering with product innovation strategy may result in higher profit margins, once the initial investment period passes. It seems that while a product–service provider would face higher investment costs initially and therefore a dip in profit margin, combining knowledge intensive services with product innovation may result in economies of scope and an increase in profitability in the long term.

Conversely, interdependency between product innovation and service completeness doesn't seem to be rewarded by the markets. Though product innovation and service completeness both seem to be viable strategies when considered individually, joint implementation of both strategies results in a loss of market value. Here, one could stipulate that markets prefer focused strategies and are reluctant to consider the synergetic potential between the two. Before putting into question their judgement, it is important to consider that once service portfolio is limited to the provision of moderately sophisticated service components, yet remains complete within the boundaries of product-related service offering, the impact of the product–service interrelationship on performance becomes positive. Hence, one can propose an alternative reading: markets reward parallel product–service developments as long as they remain technically and functionally connected. Once this relation is lost, a firm is advised to choose its focus strategy and either to remain a product innovation expert or transition to become a full-scope service expert.

We contribute to the literature by disentangling the relationship between the core dimensions of servitization – investments and exploitation of market opportunities – and performance. While prior studies infer the impact of service investments from the interplay of service scale and performance (Fang et al. 2008; Visnjic et al. 2009), our study is the first to confirm that investing in service resources has a beneficial effect on performance. Furthermore, we confirm prior findings that extending the breadth of

service offering by adding different services might be an unprofitable growth strategy. Concerning the impact of depth of service offering, our findings build on and extend the insights brought by received literature. While we find that completeness of service offering represents a source of profitable growth and market value in itself, once in conjunction with product innovation strategy, it should be deployed with moderation. This insight resonates well with Fang et al.'s (2008) conclusions regarding the low performance of unrelated services, given that the most complete service offering represents a certain departure from the product competence base. At the same time, our conclusion departs from insights put forward by Fang et al. (2008) and even Visnjic et al. (2009) by suggesting that complete migration from product to service strategy might also be a viable choice.

Nevertheless, this research does suffer from some limitations. We are confined by a relatively small data set and our core service variables are derived from the qualitative assessment of public data, rather than from hard, quantitative evidence. In addition, models could be further sharpened by introducing certain refinements; firstly the extent of servitization – measured as, for example, service sales relative to total sales – would help to put in perspective other variables. Better control variables for industry-level performance are also warranted. These represent some of the refinements that we plan to implement in order to bring this analysis to its optimal maturity level.

Once more quantitative data on service strategy becomes available, future studies could also add value by tackling these questions with more precision or by replicating the analysis on a larger data set and in different industrial settings. Furthermore, disentangling strategic choices with respect to servitization and the accompanying organizational arrangements could be another promising avenue for future research. For example, it would be relevant to understand whether internal development in services offers more potential than the acquisitions or vice versa. The success of various business models, whereby the manufacturer outsources certain aspects of service provision while retaining the rest, should also be considered (Cohen et al. 2006).

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