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The relevance of service in European manufacturing industries

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Abstract

Purpose – Case study findings increasingly indicate that the implementation of service-based business concepts is becoming a global business trend. The purpose of this paper is to analyze a broad European survey to understand the extent to which service infusion has already deeply affected manufacturing industries and the factors influencing service infusion.

Design/methodology/approach – Data from 3,376 companies participating in the European Manufacturing Survey were included in an evaluation of service offerings and service sales. Multivariate data analyzes were used to develop statistically relevant conclusions regarding service infusion and the factors influencing it.

Findings – Whereas, the vast majority of companies surveyed offer services, the turnover generated by services was still low, and the adopted service strategies did not seem fully developed. The most significant determinant of service sales was the breadth of services offered. Other relevant explanatory factors included the characteristics of the type of products sold, whereas the position in the supply chain did not seem to affect service infusion.

Research limitations/implications – Using large-scale survey data, this analysis provides a representative picture of service infusion in manufacturing industries and related causal relationships. Further qualitative research should develop interpretations of the relationships found in our quantitative analysis; as such, subsequent quantitative analyzes are necessary.

Originality/value – As most previous studies on service infusion are based on case study reports, the value of this paper comes from its use of a broad empirical database. Thus, the paper supports, confirms, and generalizes previous qualitative findings.

Keywords Europe, Customer service management, Manufacturing industries, Quantitative methods, Management strategy

Paper type Research paper

1. Introduction

Traditionally, manufacturing industries have focused on product-related strategies aimed at technological innovation, quality improvement and/or cost reduction, depending on their market position. Recent changes in the business environment, such as the increased competitiveness of developing countries, the globalization of markets,

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heightened consumer awareness, and shifts in customer demand, have made it difficult to rely exclusively on these traditional strategies. As a response to these new challenges, an increasing number of manufacturing firms are shifting their focus from pure manufacturing to a combination of manufacturing and services (Matthyssens and Vandenbembt, 1998; Wise and Baumgartner, 1999).

This business trend, which involves increasing the relevance of services within manufacturing industries, has been described in the literature in various ways, such as "product-service systems" (Mont, 2002; Tukker and Tischner, 2006), "servitization" (Vandermerwe and Rada, 1988), "integrated solutions" (Davies *et al.*, 2007; Windahl, 2007; Davies, 2004), "service infusion" (Brax, 2005) and "tertiarization" (Leo and Philippe, 2001).

The research addressing this trend has been predominantly based on case studies (Auramo and Ala-risku, 2005; Brax, 2005; Davies *et al.*, 2007; Gebauer *et al.*, 2008; Malleret, 2006; Windahl *et al.*, 2004). So far, only a few quantitative studies (Neely, 2008; Fang *et al.*, 2008; Gebauer, 2008) have been the exception to this. With this need in mind, this paper analyzes a broad empirical database of manufacturing companies to understand the factors influencing the extent to which service infusion has affected manufacturing industries.

2. Theoretical framework

Service infusion in manufacturing industries has been discussed in the literature for at least two decades and has been the subject of a multitude of scientific papers. Mathieu (2001a) summarized the benefits of servitization by elaborating three categories of benefits for service suppliers, namely, financial, strategic, and marketing benefits. This framework was used by other authors to emphasize service benefits (Oliva and Kallenberg, 2003; Brax, 2005; Gebauer *et al.*, 2005; Malleret, 2006). Summarizing the scientific debate regarding servitization, Baines *et al.* (2009) highlighted strategic differentiation benefits for producers, benefits derived from assets, non-ownership benefits for customers and environmental sustainability benefits for society.

As compared to the general agreement on strategic service value and its enthusiastic endorsement by various authors in recent years, the current literature claims that service infusion in manufacturing is still limited. Research has shown that service infusion processes are slow, and companies are unable to extract benefits from service strategies (Oliva and Kallenberg, 2003; Windahl *et al.*, 2004; Brax, 2005). However, quantitative studies proving these contentions are rare. For example, Gebauer *et al.* (2005) surveyed 199 companies and reported that about a third earn more than 20 percent of their revenue from service sales. Roughly, another third receive between 10 and 20 percent of their revenue from service sales, whereas the rest of the manufacturers in their survey generated service sales that were below 10 percent. Based on analyzes using 477 datasets from the COMPUSTAT database, Fang *et al.* (2008) reported that service sales accounted for about 42 percent of revenue for US manufacturers in 2005. Neely (2007, 2008) analyzed the content of more than 10,000 firm descriptions in the OSIRIS database and concluded that only 30 percent of manufacturers have been servitized.

The literature has put forward a series of possible factors affecting a company's success in implementing service strategies. The strategic commitment of companies is one of the most cited determinants. Whereas, some authors allude to the fact that service infusion might be due to market pull (Vandermerwe, 1994; Davies, 2003;

Windahl *et al.*, 2004; Gebauer, 2007), the general opinion is that companies must trigger a cultural shift within the company toward a proactive, clear and strong service strategy to succeed in the services market (Mathieu, 2001a; Oliva and Kallenberg, 2003; Gebauer *et al.*, 2005; Malleret, 2006).

The breadth of services offered is considered to be another variable affecting returns from services. Mathieu (2001a), Homburg *et al.* (2002), Oliva and Kallenberg (2003) and Antioco *et al.* (2008) have proposed that the benefits associated with services are proportional to the number of services in the value proposition. However, as Gebauer (2008) outlined, the breadth of services has not been included in services debates as a possible determinant of service performance until recently.

According to Homburg *et al.* (2003), the breadth of services offered by a company and the emphasis used to promote them to customers – thus its service strategic commitment – together define the level of strategic orientation toward a given service. The more a company introduces services in its value proposition and the more it considers them to be an important strategic option for competitiveness, the greater is the company's service orientation. We thus derive the following hypothesis:

H1. Service infusion in a manufacturing firm depends on the firm's level of strategic service orientation.

Some other aspects have received less explicit attention in past research.

For example, the type of product that companies offer is generally cited as a possible determinant of service offerings. Characteristics of products that push customers toward additional services include complexity (Leo and Philippe, 2001; Oliva and Kallenberg, 2003), technological innovation (Windahl *et al.*, 2004) and customization (Hobday *et al.*, 2005). For that reason, until now, the empirical research has focused on business-to-business products, particularly capital goods (Mathieu, 2001a; Oliva and Kallenberg, 2003; Windahl *et al.*, 2004; Brax, 2005; Gebauer, 2008). The case of "commodities," which are simple, standard products produced in large volumes, has not yet been explored with the same level of attention. It might be hypothesized that standard products could be complemented by financially oriented services, which may indicate that the nature of an available service could depend on the type of physical products offered. Taking a manufacturer's perspective, Windahl *et al.* (2004) hypothesized that modular structures of products are needed to achieve scale economies in the provision of services. These considerations lead to the second hypothesis:

H2. Service infusion in a manufacturing firm depends on the type of products that are produced.

Finally, another characteristic that could influence service infusion is a company's position in the supply chain. Brax (2005) has stated that manufacturer service initiatives can sometimes be seen as taking up new positions in the value chain. The service literature has treated the topic of service supply chains in normative terms, suggesting that manufacturers "go downstream" to assist customers with services during a product's life cycle (Wise and Baumgartner, 1999). This suggests the privileged position of original equipment manufacturers (OEMs) in the provision of services. Whereas, manufacturers should move downstream, Davies (2003) reported that some service companies move upstream toward manufacturing stages to ensure that their solutions

can operate on an integrated physical platform. This would encourage the upstream vertical integration of service companies and preclude the existence of service value chains in which services are exchanged at different levels. In contrast, the majority of authors have suggested that wide recourse to networked supply chains is advisable for service supplies (Mathieu, 2001a; Davies, 2003; Oliva and Kallenberg, 2003; Gebauer *et al.*, 2005). The opportunity to offer services at all supply chain and network levels is also supported by Vargo *et al.* (2008). These analyzes affirm the notion that value is created through the active participation of all service systems engaged in an exchange. With rare exceptions, past research has mainly adopted the perspective of OEMs and has neglected the service opportunities available to companies upstream in the supply chain. Thus, our final research hypothesis is the following:

H3. Service infusion in a manufacturing firm depends on the position of the firm in the supply chain.

In line with previous research (Baines *et al.*, 2009; Jacob and Ulaga, 2008), we additionally assume that a firm's general economic context also plays a role in service infusion; therefore, our hypotheses are tested by controlling the company size, main industry sector, and country.

3. Database and methodology

Data from the European Manufacturing Survey (EMS) are used to test our hypotheses. This mailed questionnaire-based survey provides a large and cross-national database for product-related services in manufacturing industries. The survey is carried out on a triennial basis and targets a random sample of manufacturing establishments with more than 20 employees belonging to sectors 15-37 of the "Nomenclature statistique des activités économiques dans la Communauté européenne" (NACE Rev. 1.1). The persons contacted to complete the questionnaire include the production manager or the CEO of the selected manufacturing firms.

The data used for our analysis include the Austrian ($n = 281$), Swiss ($n = 690$), German ($n = 1{,}663$), French ($n = 148$), Croatian ($n = 108$), Dutch ($n = 263$), Slovenian ($n = 72$), and Spanish ($n = 151$) datasets collected in 2006-2007. Overall, these national databases are comprised of 3,376 cases, including small (up to 49 employees; 37 percent), medium (50 to 249 employees; 46 percent), and large manufacturing establishments (250 or more employees; 17 percent).

Methodology

To test the hypotheses presented in Section 2, the following econometric model was built:

$$\textit{Service infusion} = f(\textit{level of service strategic orientation}, \textit{type of product}, \textit{supply chain position})$$

The constructs included in this model were generated using metrics available from previous research (Churchill, 1979). One way to measure service infusion is to identify the share of service revenues in manufacturing companies. To do so, Gebauer *et al.* (2005) used the percentage of service turnover. However, the process of collecting data on service revenues in manufacturing sales must address the fact that product and service sales often are not strictly separated in company accounting (Malleret, 2006). To address

the possible underestimation of service infusion that this problem might cause, both directly and indirectly invoiced service shares of the total turnover of the firm were chosen as the dependent variable.

The type of product was expressed using three variables. According to the product profiling tool proposed by Hill (2000), the batch size and product-development process, which indicate the level of the product's customization, were measured using two categorical variables, each differentiating among four types. Furthermore, the innovation level of the offered products was measured indirectly through the share of turnover realized by new products (Muller *et al.*, 2005).

To measure the position in the supply chain, OEMs and suppliers of components were distinguished using a binary variable.

Two indicators were used to measure the level of service strategic orientation, namely, the level of strategic intent to develop a service offering and service breadth. According to the literature on competitive strategy (Porter, 1980; Sharma and Lambert, 1994), the level of strategic intent to develop a service offering was measured using rankings of the competitive priorities that companies were pursuing, among which service was an option (together with price, quality, innovation/technology, delivery time, and customization). This strategic assessment, which is based on success factors, is consistent with the three types of competing strategies highlighted by Gebauer (2008), that is, cost leadership, product differentiation and service differentiation. Finally, consistent with Homburg *et al.* (2003) and Gebauer (2008), service breadth was evaluated according to the total number of service types that were offered based on a list of eight types. The list discriminates among product-oriented, user-oriented, transactional and relationship-based services (Oliva and Kallenberg, 2003). As an extension, financial services have also been included (Copani *et al.*, 2007).

In addition to the above-mentioned constructs that are required to test the hypotheses, the size of the firms was included as a control variable expressed as the logarithm of the number of employees in the firm; the country and sector were expressed as categorical variables.

In this paper, the selection of econometric strategy was based on the idea that the dependent variable "share of turnover with services" can be described as a corner solution outcome (Wooldridge, 2002). A significant share of firms has no services sales at all; however, the range of turnover with services is fairly broad. Thus, a Tobit estimation procedure was chosen to estimate our model (Cameron and Trivedi, 2009). A Tobit model is an econometric regression model that was intended to address censored data, but it can handle corner solution outcomes as well. Heteroskedasticity-corrected (i.e. robust) standard errors were used in the estimation to handle moderate departures from the model's assumption of homoscedasticity.

The model was based on reports from 1,972 firms. Some cases were excluded due to missing values in the independent variables, but comparisons revealed no systematic biases. To avoid highly influential cases, 1 percent of the cases with the highest values of the dependent variable were excluded. Tests used to detect multicollinearity among the independent indicators confirmed that multicollinearity was not a concern, as bi-variate correlations did not show strong dependencies between regressors. Specifically, their values for the variance inflation factors were less than three with a mean value of 1.4.

4. Results and discussion

The EMS data show that the vast majority of manufacturers appear on the market as service providers. In our sample, more than 85 percent of European manufacturing companies reported offering at least one type of the service that was on our predefined list. Thus, in contrast to Neely (2008), our data suggest that service infusion has affected a relatively broad range of manufacturers. The reason for this difference seems to be the different methodological approaches to measuring the share of manufacturers offering services. Our use of predefined lists of potential services seems to encourage surveyed companies to conduct a comprehensive review of their offerings, whereas an open question requesting a description of a firm's main activities may apparently not guarantee the listing of all service offerings. In this context, 35 percent of manufacturers (Neely, 2008) can be regarded as servitizers (i.e. manufacturers with service offerings) in terms of actively mentioning service offerings as core competences, whereas 85 percent of manufacturers offer services more generally and thus form the upper boundary of service infusion in manufacturing.

In our sample, the overall value of sales generated by services was reported to be about 16 percent on average, thereby supporting the figures reported by Gebauer *et al.* (2005) but diverging from the results provided by Fang *et al.* (2008). By transforming the data reported by Gebauer *et al.* (2005), we see that their findings fall in a range between 12.3 and 27.8 percent for the service share of the overall sales. However, the results of Fang *et al.* (2008) indicate an average service share of more than 40 percent and thus seem to be overestimated due to the fact that their sampling technique relied on firm data, which probably included only service sales data relevant to the surveyed companies and hence turned out comparatively high. Additionally, an analysis of price politics revealed that only the smaller part of service sales was directly invoiced to customers at an average rate of about 7 percent. The larger part (at 9 percent) was realized by services that were invoiced indirectly, i.e. as part of the product's price. This bundling practice is said to indicate a low level of maturity with respect to the service strategy pursued by a company (Malleret, 2006).

This consideration is strengthened by our results on the type of services offered. The services that manufacturers analyzed refer mostly to are product-related services, such as the design of customized goods, engineering, the provision of technical documentation, installation, and maintenance. More than two-thirds of the interviewed manufacturers reported such service offerings. In contrast, operational and financial services are offered very rarely by only about one-sixth of surveyed companies. These results are in line with previous case study results (Mathieu, 2001a; Oliva and Kallenberg, 2003) that indicate that the most advanced services are still not offered on a regular basis, particularly services that require a closer partnership with customers, a new attitude toward organizational change and a commitment to increasing customer value beyond the boundaries of the traditional offerings of the company.

The hypotheses presented in Section 2 were tested using a multiple Tobit regression model to evaluate the relevance of services for manufacturing companies. Table I shows the results of the regression estimation, focusing on the indicators related to our hypotheses. The estimated coefficients and the marginal effects on the increase in the share of services sales for reference firms with mean characteristics are displayed.

The explanatory power of the model is reasonable, with roughly 11 percent of service sales explained. The findings obtained using our model clearly indicate

Table I.
Tobit regression model analyzing the determinants of service sales in manufacturing industries

Constructs	Variables	β	Robust standard error	Marginal effects on extent of service sales
Number of service areas (up to eight different areas)		2.40	0.239***	1.71
Rank of services as competitive factors (among six strategic aims)		−0.81	0.254**	−0.57
Producer of finished goods (OEM) (reference: supplier)		−1.17	0.892	−0.82
Batch size (reference: large batch)	Small batch/single unit production	3.77	1.161**	2.83
	Medium batch	1.92	1.138	1.41
	No discrete parts production	0.40	1.440	0.29
Product development (reference: standard program)	According to customer demands	3.44	1.271**	2.57
	Basic program	1.91	1.222	1.40
	No product development	−2.02	2.147	−1.39
Share of turnover with new products (%)		0.07	0.022**	0.05
Constant		5.13	3.050	
Sigma		16.21	0.476	
Model statistics	Pseudo-R^2 (predicted/observed values)	0.109		
	log likelihood	−7,464.382		
	N	1,972		

Notes: Significance at: *5, **1, and ***0.1 percent levels; all estimates include a constant; the table displays the model coefficients and robust standard errors and the marginal effects on the unconditional expected value of the share of service sales for firms characterized by the reference group or the mean of the indicators; the model was calculated considering firm context by controlling for firm size, country, and sector

that the breadth of service offerings impacts service sales to a great extent. The expansion of the service offer to one type of service more than offered in the mean, increases the share of service sales by 1.7 percentage points. Also, a company's strategic commitment to services impacts service infusion significantly. Moving the strategic rank of services from a rank of four to a rank of two results in an estimated increase in service sales of 1.18 percentage points. The model indicates that the type of product also plays a statistically significant role, i.e. service infusion is higher for products that are realized in small batches (as small batch producers realize 2.8 percentage points more share of service sales than large batch producers) or as single units that are customized and that represent technological innovations (such units generate 2.6 percentage points more than a standard program). Position in the supply chain did not explain the service infusion.

To provide more clarity on our hypotheses, additional likelihood-ratio tests were conducted. The level of strategic service orientation, measured through the strategic commitment in services and the service breadth, most determines service infusion (LR $\chi^2 = 124.84$ (2 df), $p = 0.000$). In particular, the number of offered service types yielded in very high explanatory power (LR $\chi^2 = 106.79$ (1 df), $p = 0.000$). The type of products also affects service infusion but to a lesser degree (LR $\chi^2 = 37.88$ (7 df), $p = 0.000$). By contrast, company positions in the supply chain do not improve explanatory power (LR $\chi^2 = 1.83$ (1 df), $p = 0.176$).

In the light of our three research hypotheses, results can be interpreted as follows. The level of strategic service orientation explained service infusion in manufacturing, and we can consequently accept *H1*. This result confirms previous qualitative findings about the importance of strategic commitment for the success of service strategies (Mathieu, 2001b; Gebauer *et al.*, 2005; Malleret, 2006). It also quantitatively confirms the findings of Oliva and Kallenberg (2003), who suggested that manufacturing companies turning to services should incrementally add new services into their value proposition, and Antioco *et al.* (2008) and Homburg *et al.* (2002), who claimed that service volume is a function of the number of services supporting a product. However, it must be noted that the role of service breadth is far more important than the role of strategic commitment to services in determining a company's share of services. Indeed, the model suggests that service turnover can be increased by offering a vast range of services, even if companies are not strongly strategically committed to this. This apparent contradiction situation can be explained by hypothesizing that companies may assume a generally passive attitude with respect to service provision, where they offer services because they are asked to do so by customers without acting with strategic intent (Copani, 2009; Mathieu, 2001b; Gebauer *et al.*, 2005). This results, of course, in an increase in service turnover, but it does not reveal anything about the profitability of the services due to the potential turnover increase in the case of higher strategic commitment. Thus, additional quantitative research, which includes profit variables, is needed.

Considering all of our results, we can also accept our *H2*, which states that the relevance of services in the manufacturing industries depends on the type of product. We found that batch sizes and level of product customization seem to be relevant for service infusion. Manufacturers of smaller batches producing goods according to customer demands obtain higher service shares than manufacturers of large batches of standardized products. This finding supports the theoretical assumption that individualized production offers a greater opportunity and necessity to combine

products and services into an integrated offering based on customization needs because mass producers are located farther away from their customers and hence do not have the option of providing services in the way that single-unit or small-batch producers can. Finally, we found that manufacturing companies offering innovative products are more likely to achieve high service sales. Innovative products require more customer support if customers are to exploit the benefits of innovative products. These findings confirm the qualitative findings of Davies (2003) and Gebauer *et al.* (2005).

Finally, we hypothesized that the position of manufacturing companies in the supply chain affects the relevance of services in terms of sales share. This relationship could not be detected, which means that OEMs do not realize significantly higher shares of service sales than suppliers. We therefore reject *H3*. This finding indicates that despite the huge attention paid until now to OEMs as companies in a privileged position to benefit more from service opportunities, companies upstream in the supply chain have the same opportunities as those downstream. This strengthens the assertion of Vargo *et al.* (2008) that in order to co-create value with services, different value co-creation systems should interact at different network and supply chain levels. More than just the chance to interact with final customers, the absolute driver of service infusion seems to be the possibility to co-create value at different interaction levels. This result suggests that further research is needed to better understand the service infusion processes and opportunities upstream in the supply chain by joint research on industrial services and supply chain management.

5. Conclusions and further research

To address a gap in quantitative research in the product-service literature, the present paper reports the results of a study based on the EMS in 2006. These results indicate that the vast majority of companies offer services and that the turnover generated with services is still low. Service strategies are not fully developed because they involve price bundling and mainly focus on basic product-related services. The most significant determinants of service sales were the strategic commitments of companies, in particular, the breadth of service offerings, and the types of products that are offered. The position of companies in the supply chain did not affect service infusion in manufacturing, indicating that companies upstream in the supply chain have the same service opportunities as companies downstream, provided that they find the right mechanisms to co-create value at each interaction. These results have managerial implications for manufacturing companies. They prove that manufacturers offering customized technological products have the opportunity to increase their revenues by strategically committing themselves to designing new ways of generating value through services along the entire supply chain.

Based on the results presented above, future research should address the profitability issues associated with service infusion and the mechanisms by which value can be generated at different supply chain levels.

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Appendix 1.

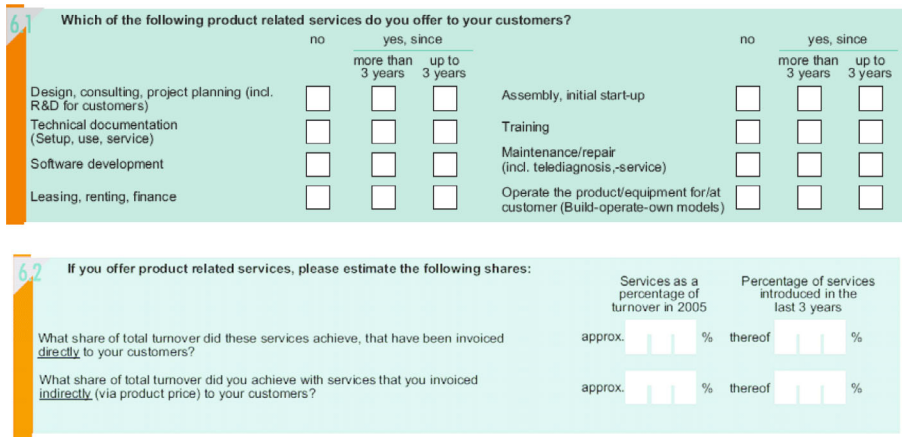

Figure A1.
Excerpt from the questionnaire

Appendix 2. Descriptive statistics of indicators used in the Tobit model

Variable	Mean	SD
Total share of turnover with services (%)	14.9	15.65
Number of service types offered	3.9	2.07
Rank of services as competitive factors (among six strategic aims)	4.4	1.54
Share of turnover with new products (%)	13.4	16.67

Table AI.

Constructs	Variables	n	%
Share of firms regarding service sales	positive share of service sales (1)	1,726	87.5
	share of service sales equals zero (0)	246	12.5
Position in supply chain	OEM (1)	1,259	63.8
	Supplier (0)	713	36.2
Batch size	Single unit	688	34.9
	Medium batch	546	27.7
	Large batch	525	26.6
	No discrete parts production	213	10.8
Product development	According to customer specifications	870	44.1
	Basic program with alternative	733	37.2
	Standard program	277	14.0
	Does not exist	92	4.7

Table AII.

Note: $n = 1{,}972$

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