Uncovering the role of cross-border strategic alliances and expertise decision centralization in enhancing product-service innovation in MMNEs

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ABSTRACT

Research is needed on effective servitization by multinational enterprises. This study examines whether Manufacturing Multinational Enterprises (MMNEs) can obtain better servitization outcomes by partnering with Knowledge Intensive Business Service (KIBS) firms and or by internationalizing their service function. In addition, the paper analyses the centralization of management decisions of human resources as an organizational mechanism to overcome coordination failure between product and service units. Our primary research data contain survey responses from 285 MMNEs collected in cooperation with an industry partner. Results show that cross-border strategic alliances and expertise decision centralization are critical to enhance product-service innovation.

Keywords: International partnerships, Cross-border alliances, Servitization, Product-service innovation, Human Resources, Expertise decision

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1. Introduction

Manufacturers worldwide are embracing new modes of production and mechanisms to engage with customers (Marsh, 2012). This is done through servitization by offering various services and solutions to enhance product experience at different stages of product lifecycle (Baines & Lightfoot, 2013; Cusumano, Kahl, & Suarez, 2015). Around 70% of manufacturers are adopting service business models (Crozet & Milet, 2017), and approximately 30% of their turnover can be associated with the service unit through innovative way firms offer and service their products (Fang, Palmatier, & Steenkamp, 2008). The latter innovation focuses on servicing products and services and is different from the conventional product or process innovation (Visnjic-Kastalli & Van Looy, 2013). In this study we focus on key determinants of manufacturers' product-service innovation (Bustinza, Gomes, Vendrell-Herrero, & Baines, 2017a) which not only requires enhancing product capabilities but also demands better understanding and engagement with customers.

We argue that the success of product service innovation depends on how firms manage three emerging complexities. Firstly, manufacturing firms developing product-service innovation increasingly need to deliver their services to global markets (Parida, Sjödin, Lenka, & Wincent, 2015; Zhang, Gregory, & Neely, 2016). This requires taking strategic decisions of which is the best entry mode to foreign markets. Secondly, to operationalize service-led growth strategies firms must decide whether to run service functions in parallel with existing business functions (Bustinza, Ziaee Bigdeli, Baines, & Elliot, 2015), create an independent service department (Rabetino, Kohtamäki, & Gebauer, 2017) or outsource it to a service provider (Ho, Ghauri, & Larimo, 2017). The latter often takes the form of a Knowledge Intensive Business Service (KIBS) firm (Lafuente, Vaillant, & Vendrell-Herrero, 2017). Therefore another important strategic decision is to whether internalize or externalize the service function.

Research to date has focused on internal provision of services (Baines et al., 2017). Our extensive review of the servitization literature reveals that only a small number of studies acknowledge the role of external partners in enhancing product-service innovation (Bigdeli, Bustinza, Vendrell-Herrero, Baines, 2017; Bustinza et al., 2017a; Ceci & Masini, 2011; Chiva, Ghauri, & Alegre, 2014; Durugbo & Erkoyuncu, 2016; Paiola, Saccani, Perona, & Gebauer, 2013; Xing, Liu, Tarba, & Cooper, 2017). Moreover, whilst recent studies have started to look at how service provision can be developed externally through collaborative partnerships with

KIBS firms (Bustinza et al., 2017a) and mergers and acquisitions (Xing et al., 2017), the cross-border component of those agreements is still underexplored.

In order to examine these strategic choices we investigate the product-service innovation outcomes of four different strategic options towards service provision in manufacturing multinational enterprises (MMNEs), namely: domestic strategic partnerships, cross-border service partnerships, domestic internal development, and captive service offshoring. Whilst some studies have analysed the performance impact of differences between internal development and external collaborative partnerships (Mudambi & Tallman, 2010; Stettner & Lavie, 2013), our study provides a finer grained analysis of these alternative methods of development by investigating internal vs. external development in both domestic and international settings. An important contribution of this research is in examining the innovation consequences of different forms of external and cross-border service provision in different international contexts (Bustinza, Vendrell-Herrero, and Baines, 2017b). By doing this we respond to recent calls for contextualizing international business research by testing the relevance of research findings and established and emerging theories in heterogeneous contexts (Teagarden, Von Glinow, and Mellahi, 2017).

Thirdly, there is a coordination failure between product and service departments (Einola, Rabetino, & Luoto, 2016; Johnstone, Wilkinson, & Dainty, 2014) that ultimately is translated into high failure rates for servitized manufacturers (Benedettini, Neely, & Swink, 2015). One possible organizational mechanism to resolve this structural tension is the introduction of a central coordination unit (Kim, Park, & Prescott, 2003). Based on this reasoning, we investigate the direct impact of expertise decision centralization, a key enabler of enhanced product-service innovation (Ghosh, 2013; Johnstone et al., 2014; Prajogo & Oke, 2016).

HRM has been identified as another key enabler of enhanced product-service innovation (Ghosh, 2013; Johnstone et al., 2014; Prajogo & Oke, 2016) and as a key factor in explaining the failure or success of strategic alliances, joint ventures, and mergers and acquisitions (Aklamanu, Degbey, & Tarba, 2015; Gomes, Angwin, Peter, & Mellahi, 2012; Gomes, Cohen, & Mellahi, 2011a; Rao-Nicholson, Khan, Akhtar, & Tarba, 2016; Vasilaki, Tarba, Ahammad, & Glaister, 2016; Weber & Tarba, 2014). Kim et al. (2003) advocate that servitized MMNEs managing service and integrated solutions in-house require a central global development of service design, while also configuring operational and structural decisions globally. That means that employees involved in product-service innovation should report to a central coordinator, a

strategy known as expertise decision centralization (Brewster, Brookes, & Gollan, 2015; Correia, Cunha, & Scholten, 2013; Mayrhofer, Brewster, Morley, & Ledolter, 2011; Smale, Björkman, & Sumelius, 2013). As the role of the central coordinator diminish when firms decide to outsource the service function to a KIBS, this article not only provides novel empirical evidence on the relationship between expertise decision centralization and organizational performance, but also analyses how partnerships with KIBS moderate this relationship.

2. Theoretical underpinning

2.1. New manufacturing strategies: Adding services to existing products

A new manufacturing model, termed the Fourth Industrial Revolution or Manufacturing 4.0, is emerging (Marsh, 2012). Technological changes and the pervasive penetration of digital technology are important components of smart manufacturing (Porter & Heppelman, 2015), and they are reshaping the nature of the manufacturing sector.

The particular case of service-led growth strategies is of special relevance for product firms with corporate clients seeking to obtain more integrated offerings (Cusumano et al., 2015) in such a way that they provide services to support traditional product supply, including fully fledged customizable solutions that address specific customer needs (Tuli, Kohli, & Bharadwaj, 2007). The rationales for undertaking service-led growth strategies in manufacturing sectors are subject to many variables, including product complexity (Raddats, Baines, Burton, Story, & Zolkiewski, 2016), customer proximity (Cusumano et al., 2015) and firm differentiation (Vandermerwe & Rada, 1989). These strategies represent a shift in the underlying business model of product firms in support of services (Visnjic-Kastalli & Van Looy, 2013) that is commonly referred in the literature as servitization and integrated solutions (Davies, 2004; Vandermerwe & Rada, 1989). More than two thirds of corporate product providers worldwide are developing service business models to a greater or lesser extent (Crozet & Milet, 2017; Fang et al., 2008). The anticipated benefits of servitization approaches include more stable revenues, higher profitability and firm growth (Baines et al., 2016; Wise & Baumgartner, 1999).

The innovation outcomes of servitization are referred as to product-service innovation (Bustinza et al., 2017a). The main outcome of product-service innovation is the generation of

additional value by taking service propositions to the market (Barnett, Parry, Saad, Newnes, & Goh, 2013; Visnjic-Kastalli & Van Looy, 2013). Yet as any other type of innovation servitization is a complex process with underlying uncertainties (Cusumano et al., 2015; Benedettini et al., 2015).

The literature agrees on the convenience of separating the service function from the product department, as product development employees might otherwise risk imposing their values and practices on newly-integrated service development employees (Rabetino et al., 2017). There is still no consensus, however, as to how the service unit should be managed. In this study, we pay particular attention to two key aspects of management of the service unit. First, from a strategic point of view, we examine geographical location (local vs. international) as well as ownership (in-house vs. outsourcing) of the service unit. Second, we explore a mechanism to resolve organizational tensions caused by lack of coordination between service and product units (Calof & Beamish, 1995; Einola et al., 2016; Johnstone et al., 2014). Specifically, we analyse whether expertise decision centralization assures a good level of communication between service and product units, and hence is a suitable mechanism to enhance firms' product-service innovation capabilities.

2.2. Geographical location and ownership of the service function

The literature on servitization implicitly assumes that the service function is developed in-house (Cusumano et al., 2015). This is especially true for MMNEs, which are assumed to have enough internal resources to undertake this function internally (Visnjic, Jovanovic, Neely, & Engwall, 2017; Woerkom & Zeijl-Rozema, 2017). The first research considering a different strategic option was undertaken by Ceci and Masini (2011), who found that half of manufacturers work in partnerships with software firms to enhance and customize their products. This result was extended by Paiola et al. (2013), who analysed the 'make or buy' decision of service capabilities. Through case study analysis, these authors found that service capabilities can be bought from external providers or partners. The advantage of buying service capabilities externally is that they reduce the uncertainties and risks associated with developing this function in-house (Bigdeli et al., 2017; Durugbo & Erkoyuncu, 2016). If research on development of the service function through partnerships with KIBS or other manufacturers is limited, study of how this function can be internationalized is practically non-existent though

the need to selling services globally has been spotted by recent research (Parida et al., 2015; Zhang et al., 2016).

A recent article by Xing et al. (2017) is an exception. Xing et al.'s (2017) case-study-based evidence illustrates that some manufacturers from emerging economies are buying the service capability through cross-border acquisitions. This phenomenon is important, as some firms have developed this knowledge base over the years, and firms located in other countries can enhance their service function through cross-border strategic options.

Our study goes a step further by developing a benchmark model of strategic options of service function using two central questions on management: make vs. buy and domestic vs. international. The four different strategic options derived from this model follow the flow of the diagram shown in Figure 1. To begin with, servitizing manufacturers face a choice between internal vs. external service provision. Similarly, the firm must decide whether to establish the service unit domestically (in the same country as its headquarters) or abroad (cross-border). As shown in Figure 1, these two decisions form four different strategic options. In our framework, service activities can be developed internally by manufacturing firms themselves in the home country (Internal Service Development) or offshored to a foreign country (Captive Service Offshoring). Alternatively, service activities can be developed in partnership with a domestic partner (Domestic Service Partnership), or with a foreign-based service partner (Cross-border Service Partnership).

-Insert Figure 1-

Internal service development is the domestic development of services internally by the company itself without the need to outsource or partner with any external organisation. This is the mainstream strategic choice analysed in the literature. Captive service offshoring involves service activities that are developed abroad in a firm's wholly-owned service development unit (Lewin & Volberda, 2011). An illustrative example of this strategic choice is the Japanese train manufacturer Hitachi. As it is described in Visnjic, Turunen, and Neely (2013), Hitachi has evolved from the sale of simple products – trains – to the provision of services and solutions, such as 'train availability' contracts with or without retained ownership', energy efficiency of its assets and real-time data transfer from in-service trains. Hitachi Rail was an established train manufacturer in Asia and the Americas, but lacked a presence in Europe. When entering the European market, it decided to present itself as a provider of advanced train solutions. Hitachi entered to the UK through various tenders. They did not use local partners. Hitachi Rail Europe

chose experienced rail service personnel hired locally developing a captive service offshoring through greenfield investment.

Domestic partnerships are the development of services through collaboration with external domestic partner/alliance firms, whereas cross-border service partnerships are the development of services through collaboration with external foreign partner/alliance firms (Gomes, Cohen, & Mellahi, 2011b; Gomes, Barnes, & Mahmood, 2016). As described in Bigdeli et al. (2017) an example of KIBS partnering to domestic and foreign manufacturers is the fleet management service company Microlise with its premises in the UK. The firm provides in its own webpage information about its partners[1], being MAN Trucks (UK manufacturer) and Tata Motors (Indian manufacturer) two of their main collaborators. Whilst in our framework the alliance between MAN and Microlise would be considered as domestic partnership, the alliance between Tata Motors and Microlise would be described as Cross-border service partnership.

Servitized organizations must develop new capabilities in order to identify and exploit opportunities in domestic and international markets. These new capabilities require a large investment in labour skills, as well as technological infrastructure (Rabetino et al., 2017). Since these skills and infrastructure are already in the possession of KIBS firms, we expect that partnerships with KIBS can be used as a mechanism to reduce financial investment, as well as to gain access to trained employees. Further, recent research indicates that servitized MMNEs obtain higher firm performance when they develop partnerships with KIBS (Bustinza et al., 2017a; Paiola et al., 2013). Previous evidence thus seems to indicate that the benefits of externalizing the service function (i.e., access to service capabilities without investment) overcome the drawbacks (i.e., losing ownership over a key business function of servitized MMNEs).

Beyond this, economic geographers emphasize that proximity is an important element of extracting more service capabilities from the service provider. By establishing partnerships with domestic KIBS firms, manufacturers are able to better understand and coordinate with the externalized service function, and ultimately to grow (Jacobs, Van Rietbergen, Atzema, Van Grunsven, & Van Dongen, 2016) and to stimulate their competitiveness in the local region (Lafuente et al., 2017). Overall, we hypothesize that firms undertaking domestic strategic KIBS

[1] http://www.microlise.com/about/partners/ last accessed 3rd November 2017.

partnerships will be able to reach higher levels of product-service innovation than firms with domestic internal provision of services.

Hypothesis 1a. *Manufacturers implementing services through domestic strategic KIBS partnerships have higher levels of product-service innovation than manufacturers with domestic internal provision of services.*

Contrary to the internationalization rationale of traditional manufacturing firms based on lower production costs, servitized firms with clients overseas may need physical representation abroad to establish service provision geographically close to existent (or new) customers (Jones & Wren, 2016; Vendrell-Herrero, Gomes, Mellahi, & Child, 2017). This is important, as recent research has established that firms selling services abroad can save considerable costs by locating the service function in the client's country (Ghauri, Wang, Elg, & Rosendo-Ríos, 2016; Peeters, Dehon, & Garcia-Prieto, 2015). We thus expect that captive service offshoring will produce higher levels of product-service innovation than domestic internal provision of services.

Hypothesis 1b. *Manufacturers implementing services through captive service offshoring have higher levels of product-service innovation than manufacturers with domestic internal provision of services.*

Building on previous arguments, cross-border service partnerships will benefit both from being established abroad close to foreign customers and from externalizing the service function (Bustinza et al., 2015; Paiola et al., 2013). International joint ventures also enhance the competitiveness of large manufacturers (Carnovale & Yeniyurt, 2014), as they can obtain more specialized knowledge from top leading technological companies (Hansen, Mors, & Løvås, 2005; Hoetker, 2005). Based on this reasoning, we hypothesize that cross-border service partnerships will show higher levels of innovation than firms with domestic internal provision of services.

Hypothesis 1c. *Manufacturers implementing services through cross-border service partnerships have higher levels of product-service innovation than manufacturers with domestic internal provision of services.*

2.3. Coordination between product and service functions through expertise decision centralization

With the expansion of global production, more attention has been devoted to management of human resources located in domestic and foreign subsidiaries (Collings, Scullion, & Morley, 2007; Farley, Hoenig, & Yang, 2004; O'Donnell, 2000). These policies aim to identify the optimal decision-making point in production, investment and customer-related issues to assure a good level of control and coordination between the headquarters and the workforce in subsidiaries (Child, 1972; Collings, Scullion, & Dowling, 2009). This is an interesting issue that has not been explored in previous research analysing the relationship between centralization of management decisions over human resources and product service innovation (Ghosh, 2013; Johnstone et al., 2014; Prajogo & Oke, 2016).

Kim et al. (2003) suggest broad strategies to produce optimal decision-making regarding the manufacturing (production), R&D (product development) and marketing (service development). As depicted in Table 1, Kim et al.'s (2003) study establishes different integrating modes: people, process standardization and centralization[2]. *People* consists of transferring managers from headquarters to subsidiaries (i.e., expatriates). This integrating mode uses face-to-face interaction to share the firm's vision, values and norms with employees in subsidiaries (Gupta & Govindarajan, 2000). Process standardization (or formalization) relies on codifying work procedures and activities. This integrative mode normally provides specific rules, policies and manuals to subsidiaries (Smale et al., 2013). Centralization is based on strategic involvement of human resources in the change process, resulting in expertise decision centralisation (Correia et al., 2013; Smale et al., 2013). Centralization thus implies that decision-making authority is located at the level of headquarters, where a more complete and fundamental understanding of the business exists, while the other business units are scattered around the world.

-Insert Table 1-

As shown in Table 1, the model developed by Kim et al. (2003) considers that the service development function must be managed through expertise decision centralisation, whereas production and product development functions should be managed with people and integrating standardization approaches. The rationale for these relations is that production and product development require sharing values and norms amongst employees and exploiting economies of scale and scope through standardization of procedures. Since service development is

[2] The research of Kim et al. (2003) also introduces the idea of using information technologies (i.e., email) to manage control of and coordination with subsidiaries. Since we understand that the use of these technologies nowadays (15 years later than the research was conducted) is so extensive that there is practically no heterogeneity, we omit this option. In a research article, Smale et al. (2013) follow the same interpretation of the model.

customer-centric, however; its activities must be connected through information flows to enhance industrial marketing innovation (Jain, 1989).

Recent research advocates that the importance of expertise decision centralisation is growing again in manufacturing (Brewster et al., 2015; Mayrhofer et al., 2011) and that this practice is likely to enhance information inflows and ultimately improve coordination between different business units (Reiche, Harzing, & Pudelko, 2015). Though some scholars suggest that higher levels of centralization of decisions on human resources might have been partly the result of the economic crisis of 2007-2010 and the intention of MNCs to impose some tighter control over local subsidiaries (Greve, 2011), based on Kim et al.'s (2003) model, we argue that the renaissance of expertise decision centralisation also stems from the fact that servitized manufacturers must transform their organizations and centralize decision making to ensure better coordination between service and product units (Einola et al., 2016; Johnstone et al., 2014). Better coordination between service and product units can be conducive to better understanding of industrial customers and ultimately to more effective development of integrated product and service solutions. Such coordination can be enhanced by technologies such as smart products (Porter & Heppelman, 2015) and big data (Opresnik & Taisch, 2015) that enable firms to improve analytical capabilities in the head office. Based on these arguments, we hypothesize that:

Hypothesis 2. *Manufacturers with greater expertise decision centralisation will achieve greater levels of product-service innovation.*

The role and importance of proper management decisions over human resources has been identified as a necessary condition for maximising resource complementarity and realising the potential synergetic gains expected from strategic partnerships or merger and acquisitions (Harrison, Hitt, Hoskisson, & Ireland, 2001). The synergetic effects of expertise decision centralization in strategic alliances are conducive to improved organizational performance (Correia et al., 2013). Although this finding is important, there is no research evidence on the relationship between expertise decision centralization and product-service innovation in strategic partnerships.

Strategic partnerships are important enablers of product-service innovation, and recent research demonstrates that firms involved in strategic partnerships tend to perform better than firms with in-house service development (Bustinza et al., 2017a). The rationale behind this result is that, by outsourcing the service function to external partners, manufacturers not only obtain know-how but also limit the degree of organizational change involved in setting the

service function in-house (Bustinza, Gomes, Vendrell-Herrero, & Tarba, 2018). Indeed, management of this (internal) organizational change has been acknowledged as one of the main causes for the high bankruptcy rate observed in servitized manufacturers (Benedettini et al., 2015), implying that establishing strategic partnerships with KIBS lowers manufacturers' need for centralization to undertake product-service innovation. Based on this finding, we posit that:

Hypothesis 3. *Partnerships negatively moderate the relationship between expertise decision centralization and product-service innovation.*

Figure 2 provides visual representation of the relationship predicted theoretically between relevant variables.

-Insert Figure 2-

3. Sample and variables

3.1. Sample

The study is based on a large survey of manufacturing practices, including specific items on product service innovation as well as management decisions of human resources to a sample of servitized firms. The survey was conducted by an industry partner specialized in service management solutions, in partnership with a global advisory firm. The industry partner defined the population using their internal business catalogue composed of 7,000 manufacturing firms, all of which had annual revenues of over $1 billion. The industry partner used an advisory board composed of external industry experts to validate the target sample size prior administration.

The target sample size was determined using the Gaussian distribution[3] and a confidence level required of 95%. This procedure yielded a target sample size of at least 365 MMNEs. Data were obtained using a recruited sample (Van Selm & Jankowski, 2006), meaning that respondents were given a password (by email) for controlling entry to the online survey. Between September 2013 and February 2014, companies were contacted by email and by phone periodically until 370 MMNEs had completed the online survey—five more companies than the required target sample size. Selected respondents were responsible for one or more

[3] $n = \frac{N*Z^2*p*(1-p)}{(N-1)*e^2+Z^2*p*(1-p)}$, where n is the target sample size, N is the population (N=7000), Z=1.0+1.96 (confidence level of 95%), e is the margin of error (e=5%), and p is a realistic estimate of the desired probability (p=50).

cost or profit centres within their company's service business. In particular, 43.2% of the respondents held a Corporate-level position, 45.9% were directors, and 11.9% executive vice-presidents. This study considers only the 285 MMNEs with headquarters in US (74), the UK (68), Germany (52), Japan (46) and China (45), as these countries had enough observations to be analysed separately and are considered as leading manufacturing countries globally. In line with best practices in international business research (Mellahi & Harris, 2016), the survey was translated and back translated into German, Chinese and Japanese whenever required by respondents. The sample consisted of Aerospace and Defence (14.4%), Automotive and Transportation (14.7%), Commercial or Cargo Airlines (15.7%), Electronics and High Tech Equipment (14.7%), Heavy and Industrial Equipment (14.0%), Medical Devices and Equipment (12.6%) and White Goods Manufacturing (13.7%).

3.2. Variables

Strategic Options: Informants were asked to identify the country in which the head office of the MMNE is located, and whether or not the manufacturer establishes strategic partnerships with domestic or foreign service providers. We use these data to identify and calculate the number of firms in the four categories depicted in Figure 1. The values are shown in Table 2.

-Insert Table 2-

Table 2 shows the percentage of firms undertaking the different strategic options for servitization. Interestingly, of the full sample, only 28.4% of firms undertake service business models through internal provision, suggesting that mainstream research is omitting an important segment of firms. The most common practice of service provision in our sample is captive service offshoring. Service provision is externalized to KIBS in 15.4% of the cases, a split in domestic (3.5%) and cross-border (11.9%) collaborative partnerships. Interestingly, as Table 2 depicts, Japan (21.8%) has the most external development of services, and European countries –UK (79.4%) and Germany (75.0%)– are establishing more cross-border service units.

Product-Service innovation: This variable is adopted from Bustinza et al. (2017a). The variable is operationalized using product-service development and customer engagement dimensions, critical variables dimensions of servitization since seminal Vandermerwe and Rada's paper (1998). Specifically, we include the following four 5-point Likert scale items

(1=completely disagree, 5=completely agree): New product innovation, Updated product lifecycle, Service feedback and analytics, and Product-service alignment.

Through principal component analysis with Varimax rotation –Kaiser-Meyer-Olkin test $KMO = 0.603$, and Bartlett's test of sphericity $x^2 = 86{,}785.233$ ($p = 0.000$), product-service development and customer engagement generated a representative construct with a total variance explained of 59.70%. Items are statistically significant ($t > 1.96$, confidence level 95%), factor loadings are above the recommended level of 0.4, and individual reliabilities higher than 0.6. All four items are positively correlated, and the mean inter-item correlation below takes the recommended value 0.5. The scale's internal consistency is measured through the *Cronbach's alpha* ($\alpha = 0.893$), yielding scale reliability measures 0.879 for *Composite reliability* and 0.558 for *Average variance extracted*. Mean Inter-item Correlation (MIC) is calculated as high internal consistency may work against content validity. Offering a value of 0.438, below 0.5 threshold for assuming that the items are overly redundant (Briggs & Cheek, 1986), the scale's validity is therefore confirmed. We operationalize the value of product-service innovation, taking its linear predicted value. The continuous variables created can be interpreted as an indicator (Vendrell-Herrero et al., 2018). When the value of product-service innovation imputed to a given firm is positive, the firm can reach a higher level of product-service innovation, as compared to the average firm in the sample.

Building on Gomes et al (2018) method we construct kernel density distributions to compare strategic options and product-service innovation, Figure 3. This visual tool provides a graphical indication that the distribution of product-service innovation differs between domestic internal provision of services and the other strategic options. The graphical exercise seems to show that top-performers are firms externalizing and/or internationalizing the service function. This result is supported by the averages reported in Table 3.

-Insert Figure 3 and Table 3-

Expertise decision centralization: This variable was adapted from the work of Reiche et al. (2015) to fit the items to the purpose of the present study. Whereas Reiche et al. (2015) ask who has decision-making authority over recruitment and selection, training and development, performance appraisal, compensation, promotion and general HR strategy, our study focuses more specifically on centralization of the decision-making in the service unit. Because servitized MMNEs both require a central global development of service design and configure operational and structural decisions globally, we operationalize expertise decision centralization by using three items that focus on measuring whether decision making in design,

operations and structure of service provision is local or global. Specifically, we include the following three 5-point Likert scale items (1=Total disagreement, 5=Total agreement): global service design, global service operations and global service structure.

Principal component analysis with Varimax rotation –Kaiser-Meyer-Olkin test $KMO = 0.654$, Bartlett's test of sphericity $x^2 = 75{,}542.117$ $(p = 0.000)$, total variance explained equal to 63.74% –indicate one representative dimension. Items are statistically significant ($t > 1.96$), with factor loadings and individual reliabilities above the threshold levels explained above. Mean inter-item correlation is below the recommended value 0.5, and the scale's internal consistency has a *Cronbach's alpha* ($\alpha = 0.799$) higher than the 0.7 recommended value. MIC is also calculated ($MIC = 0.442$), being below the 0.5 critical level. Scale reliability was measured through *Composite reliability* (value 0.865 higher than the critical level 0.7) and 0.549 for *Average variance extracted* (higher than the recommended level 0.500). As with the dependent variable, we compute the linear prediction and use it as an index. Thus, when the value of expertise decision centralization imputed to a given firm is positive, the firm has more global decision-making of the service function than the average firm in the sample.

Control Variables: In all analyses performed, we control for sector specificities. The firms in the sample belong to seven different manufacturing sectors (Aerospace and Defence, Automotive and Transportation, Commercial or Cargo Airlines, Electronics and High-Tech Equipment, Heavy and Industrial Equipment, Medical Devices and Equipment, and White Goods Manufacturing). We created dummy variables for each sector. All sectors were represented evenly across the sample. As can be seen in Table 3, while the sector most represented in the sample is Commercial or Cargo Airlines, with 15.7% of the observations, the sector with the least representation is Medical Devices and Equipment, with 12.6% of the observations. The baseline group in all analyses performed is Medical Devices and Equipment. We also include size in the analysis, using a threshold for medium-sized enterprises (*Medium*) with annual revenue between one and ten billion US dollars. If the firm has revenue above that threshold, it is considered to be *Large*. According to Table 3, 53% of the manufacturers in the sample are medium sized, while the rest (47%) are *Large*.

4. Results

Given the continuous nature of the dependent variable (product-service innovation), the consequences of strategic options (H1) as well as expertise decision centralization (H2) were analysed through ordinary least squares (OLS)[4]. Table 4 reports the results of estimating the model for the full sample, including size, country and industry fixed effects; remarkably, these effects do not seem to be significant in explaining product-service innovation. As the countries selected are expected to show heterogeneous relations between relevant variables, we have performed OLS regressions with country sub-samples (Columns 2 to 6).

-Insert Table 4-

According to the results of the full sample, firms with domestic strategic partnerships do not have higher levels of product-service innovation than firms with domestic internal service provision. This result rejects Hypothesis 1a. The parameter is positive and relatively high (0.457) but not statistically significant. A technical explanation as to why this parameter is not found to be distinct from zero is that the number of observations of firms with domestic partnership is rather limited. Interestingly, examination of the country sub-sample results shows that the parameter is positive and statistically significant at 10% (p-value<0.1) in the UK. This result must be taken with caution, as only 2.9% of the firms in the UK chose domestic partnership as a strategic option for delivering services as well as products, but the result at least provides an indication that this hypothesis could be tested more robustly with larger number of cases.

The results of the full sample pinpoint that firms with captive service offshoring have higher levels of product-service innovation than firms with domestic internal provision. On average, firms with captive service offshoring have an index of product-service innovation 0.280 higher than firms with domestic internal provision. This result is statistically significant at 10% (p-value<0.1), supporting Hypothesis 1b. Whilst the parameter remains positive in all country sub-samples, it is not statistically significant for any country. Even with a low level of significance, it is remarkable that China is the country where captive service offshoring seems to report higher benefits in terms of product-service innovation. This finding follows the research of Xing et al. (2017), who identify a pattern of Chinese MMNEs investing in Germany to achieve higher service capabilities.

[4] In addition to the OLS estimation we have performed other analysis. For instance we have estimated the model in Figure 2 using Generalized Structural Equation Modelling (GSEM) to check whether the results were dependent on the specification of the errors. The results of this estimation are qualitatively the same to the results shown in Tables 4 and 5. Since OLS is more flexible in the introduction to control variables and we have certainly important heterogeneities to control for in our sample we have decided to provide the results of the OLS, leaving the results of other specifications available upon request.

Another important result is that firms with cross-border service partnerships have higher levels of product-service innovation than firms with domestic internal service provision. On average, their index of product-service innovation is 0.561 higher than the firms with domestic internal provision of service. This result is significant at 5% (p-value<0.05), supporting Hypothesis 1c. Remarkably, this result also occurs for the sub-samples for the US (p-value<0.01) and Germany (p-value<0.05), the two countries with top-performers in servitization that can be taken as benchmarks by manufacturers in other countries.

Our results strongly confirm Hypothesis 2, since expertise decision centralization is positively linked to product-service innovation. This result is significant at 1% (p-value <0.01) and practically consistent in all sub-samples. The only exception is Japan, where we cannot rule out that the parameter is distinct from zero. We also analyse the moderating role of partnerships, whether domestic or international, in the relation between expertise decision centralization and product-service innovation[5] (results presented in Table 5). Although the moderating effect is not supported by our data in the full sample, thus rejecting Hypothesis 3, we find intriguing results on the US and German sub-samples. The results for the US sub-sample agree with our theoretical predictions. Strategic partnerships negatively moderate the relationship between expertise decision centralization and product-service innovation (p-value<0.05) and thus lower the requirements for organizational transformation in servitized firms. Our theoretical predictions contradict the German sub-sample, however, as strategic partnerships seems to be a positive moderator in the relationship between expertise decision centralization and product-service innovation (p-value>0.05).

-Insert Table 5-

Building on Ferris, Lian, Brown, and Morrison (2015) and Vendrell-Herrero et al. (2017) these results are illustrated graphically in Figure 4. The diagram shows the differences in linear predicted product-service innovation for different degrees of expertise decision centralization. Figure 4.a shows the result for the German sub-sample, in which the score of 0 for HR centralization produces a predicted product-service innovation for firms with partnerships of 0.8 higher than that of firms developing services internally. The difference grows to 1.2 when expertise decision centralization equals 1. Figure 4.b shows the result for US sub-sample. Here, when HR centralization score is 0, predicted product-service innovation for firms with partnership is 0.446. When expertise decision centralization grows, however, predicted

[5] We performed a similar analysis for the moderation role of undertaking service provision in other country (internally or through partnerships). The results are not significant for either the full sample or the sub-samples. This analysis is not reported in tables but can be made available upon request.

product-service innovation for firms with internal service provision grows faster than that of firms with partnerships. The product-service innovation predicted is equal for both groups (firms with and without strategic partnerships) when the score of expertise decision centralization equals 0.9. When the expertise decision centralization score equals 1, the predicted product-service innovation of firms with internal provision of services is 0.048 higher than that of firms with partnerships.

-Insert Figure 4-

5. Discussion and conclusion

5.1. Theoretical implications

This research draws on the strategic alliances and servitization literatures to understand how servitized MMNEs can better operationalize an independent service function through strategic partnerships as well as through adequate management decisions over human resources. This topic is important for both literatures. On the one hand, our study continues to build on the growing interest in studying cross-border and cross-sector strategic alliances (Gomes et al., 2016; Lew & Sinkovics, 2013; Luo, Wang, Jayaraman, & Zheng, 2013). On the other, it is amongst the first articles to study how the service function can be externalized through alliances (Bustinza et al., 2017a; Ceci & Masini, 2011; Durugbo & Erkoyuncu, 2016) or mergers and acquisitions (Xing et al., 2017) and to investigate the importance of expertise decision centralization in enhancing service-led growth strategies (Ghosh, 2013; Johnstone et al., 2014; Prajogo & Oke, 2016). More importantly, based on a unique survey-based sample of 285 MMNEs with head offices in the US, China, Germany, Japan and the UK, this study is, to the best of our knowledge, the first to investigate the innovation outcome of service-unit internationalization.

Our findings provide various important contributions. From the descriptive analysis, a key stylized fact is that 68% of MMNEs decide to establish their service function abroad, with roughly one sixth of those firms forming cross-border strategic partnerships. This finding goes against the general understanding in the field of product-service innovation that firms develop the service function internally and domestically (Baines et al., 2017). In addition, our evidence corroborates the predictions that cross-border service partnerships and captive service offshoring are strategic options that provide greater innovation outcomes than internal

provision of services, whereas domestic partnerships do not seem to be associated with an innovation premium. This finding is important, as it upholds the literature emphasizing proximity to foreign clients (Jones & Wren, 2016; Peeters et al., 2015) and international knowledge sharing (Hansen et al., 2005; Hoetker, 2005), rather than the literature highlighting proximity between production and suppliers underlying economic geography debates (Jacobs et al., 2016; Lafuente et al., 2017). This result must be taken with caution, however, since our data contains few cases of the MMNE establishing partnerships with domestic KIBS. We have already detected some country-specific nuances (i.e., domestic partnerships seem to be positive for British MMNEs) that open an avenue for further research to investigate in greater depth the benefits and drawbacks of domestic partnerships.

Another important result is that lack of coordination between service and product development units detected in previous research studies (Einola et al., 2016; Johnstone et al., 2014) can be overcome by establishing a central coordination unit. This result is in line with Kim et al.'s (2003) model, which shows that expertise centralization is essential for the decision-making process involved in development of integrated solutions, as it provides better grounding for coordination between departments. In this respect, our results strongly support the conclusion that expertise decision centralization is closely linked to product-service innovation.

Our evidence not only validates the results of Kim et al.'s (2003) model but also provides an interpretation of how an old-fashioned organizational mechanism like expertise decision centralization has been gaining adepts in recent years (Brewster, Sparrow, & Harris, 2005; Brewster et al., 2015; Mayrhofer et al., 2011). Our evidence seems to indicate that complexities and nuances beyond cross-sector operations and customer engagement may explain why organizations are re-centralizing their decision-making processes. Given the paradoxes involved in the decision to centralize/decentralize the management decisions over human resources, our results highlight the need for further research on the motives and impact of re-centralization of decision-making processes.

An intriguing result of our study is that, unlike other countries analysed, expertise decision centralization in Japan does not uphold product-service innovation outcomes. The reasons for this result are far from clear, and our data do not contain information to provide a clear answer. One plausible explanation is, however, that Japan has different manufacturing business models and organizational structures (i.e., Toyota just-in-time). These very specific organizational settings may influence how firms servitize and, more importantly, how expertise decision

centralization affects product-service innovation. A future research avenue could decipher country-specific conditions of Japanese MMNEs to provide a clearer explanation for this intriguing result.

A down-side aspect of centralization of decision-making is that middle managers and other intermediate managers could retaliate as they lose capacity to influence management practices at firm level (Child, 1972; Collings et al., 2009). An important academic contribution of our study is our test of whether or not these tensions can be alleviated through partnerships with external service providers. As manufacturing firms externalize the service function to KIBS, firms should derive fewer benefits from centralizing the decision-making process and thus have less need to transform the organization. We find intriguing results regarding this issue. Whilst the results of the US sub-sample support the view that resorting to partnerships negatively moderates the relationship between expertise decision centralization and product-service innovation, the German sub-sample shows the opposite results. Unfortunately, as our data do not allow us to provide tentative explanations for this difference, we can only suggest examination of country-specific nuances behind partnerships and expertise decision centralization policies as a line of research inquiry.

5.2. Managerial implications

The present research also has important implications for practitioners, with special focus on manufacturers that currently undertake or are in the process of embarking on service-led strategies. According to our findings managers of MMNEs must be aware that the organization will benefit from a transformation, particularly regarding centralization of information inflows and decision-making of the service function. Employees involved in the service design, structure and operations should thus report directly to the head office, as this structure improves understanding of the industry's customers and their needs, and ultimately greater service capabilities.

Organizational transformation is not cost free. Specifically, recent research indicates that manufacturing firms moving towards adding integrated solutions to their existing products have more complexities and risks (Benedettini et al., 2015) and must thus be cautious about initiating disruptive organizational changes. Organizational transformation can bring benefits in terms of innovation, but it can in the short run damage the business's financial position significantly. Interestingly, our results support the conclusion that US firms can use strategic

alliances with KIBS to reduce the need to centralize decision-making. As part or all of the service function and the relationship with the customer is outsourced to an expert partner, there is less need for controlling information inflows with employees.

Another important implication for managers is that, while partners with knowledge of foreign markets and outstanding technological skills are available, it is very unlikely that they are located next door. Firms must think globally when they search for suitable KIBS to establish a sustainable and successful strategic alliance.

Managers with a global view of the service unit might also consider the option of captive service offshoring, keeping the service function internal to the organization. This option seems to be superior to domestic internal provision. Our findings indicate, however, that the strategic option with the greatest innovation premium is the cross-border service partnership.

5.3 Limitations and avenues for further research

Our analysis identifies several country heterogeneities. For instance, we find that Japanese manufacturers seem not to extract innovation benefits from expertise decision centralization, and that domestic strategic alliances only have an innovation premium in the UK. One limitation of our study is that the dataset available does not contain information on the specific characteristics of the agreements, or on the country specificities of decision-making processes. One avenue for future research is to collect more information on these issues to obtain better understanding of country heterogeneities.

The field of servitization research is nearly silent on internationalization of the service function. An important avenue for future servitization research is to include the international angle by developing studies of how service provision is developed in countries other than the head office, as well as the export gains of implementing service-led growth strategies.

Our analysis is cross-sectional and does not capture dynamic strategic elements, an important factor in firms undertaking service business models. This means that other factors not included in the current model, such as organizational change, may also play a significant role. An important future research avenue is thus to validate the analysis in a longitudinal setting.

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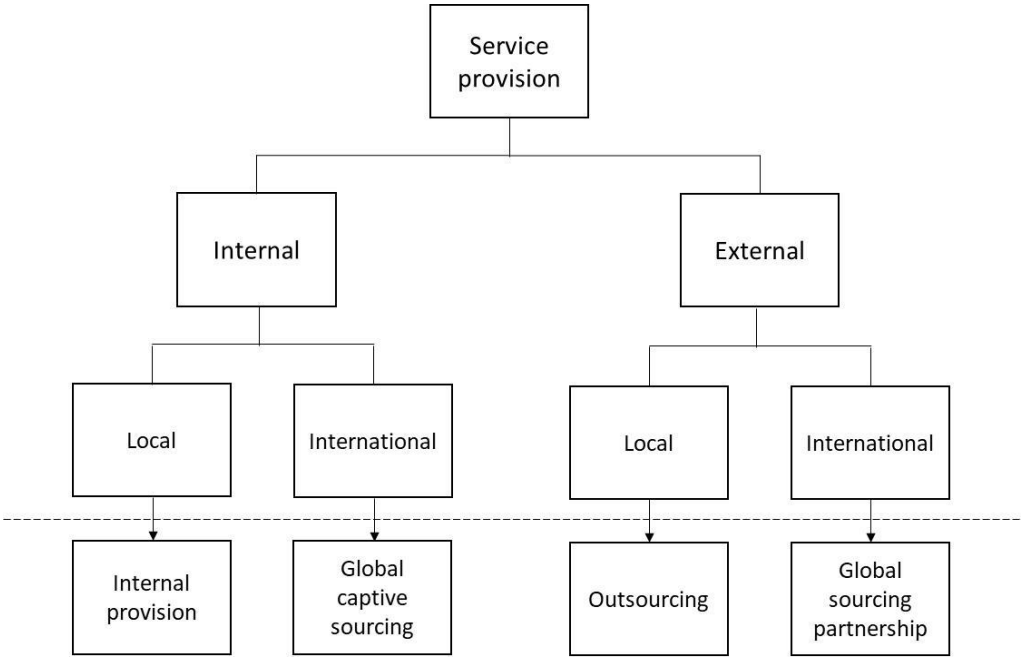

Fig. 1. Service provision strategic options

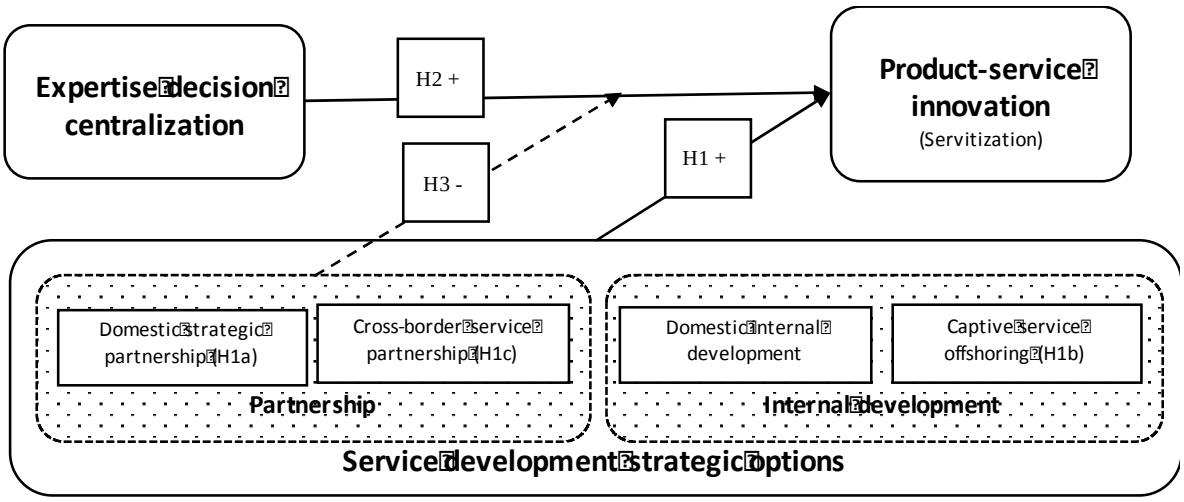

Fig. 2. Hypotheses

3.a Domestic internal Vs Domestic partnership 3.b Domestic Vs Captive service offshoring 3.c Domestic Vs Cross-border service partnerships

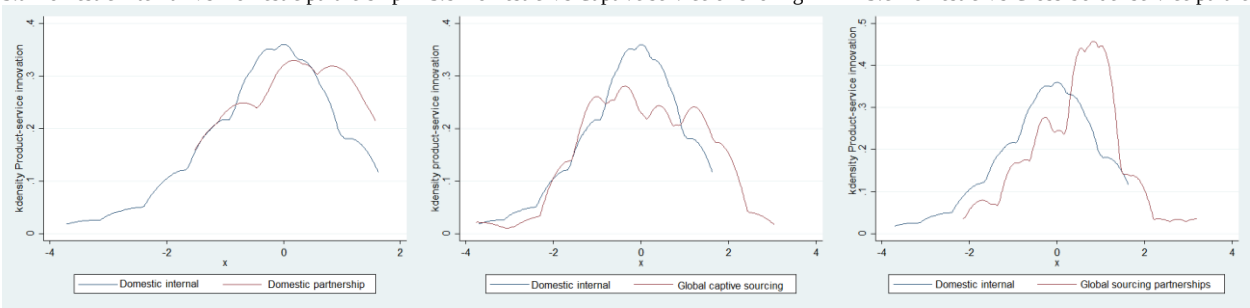

Fig. 3. Servitization Kernel density functions. A comparison between domestic internal development and alternative strategic options

4.a Germany 4.b US

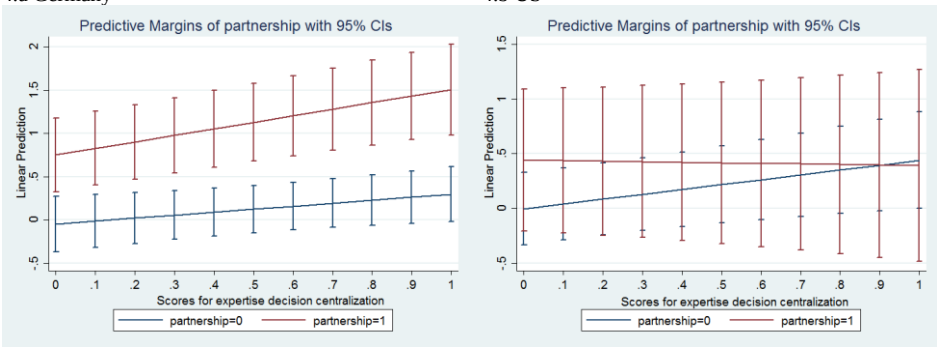

Fig. 4. Predicted product-service innovation margins for US firms with and without partnerships depending on its level of expertise decision centralization

Table 1

Optimal integrating modes in different business functions

	Production	Product Development	Service Development
People	**X**	**X**	
Process Standardization	**X**		
Centralization			**X**

Source: Author analysis based on Kim et al. (2003)

Table 2

Country average of outsourcing and cross-border operations behaviour of Servitized MMNEs

	Full sample		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 81 (28.4%)	Captive sourcing 160 (56.1%)
	Yes (Kibs)	Domestic partnership 10 (3.5%)	Cross-border service partnership 34 (11.9%)

	US		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 27 (36.5%)	Captive sourcing 37 (50.0%)
	Yes (Kibs)	Domestic partnership 5 (6.8%)	Cross-border service partnership 5 (6.8%)

	UK		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 12 (17.6%)	Captive sourcing 43 (63.2%)
	Yes (Kibs)	Domestic partnership 2 (2.9%)	Cross-border service partnership 11 (16.2%)

	Germany		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 13 (25.0%)	Captive sourcing 34 (65.4%)
	Yes (Kibs)	Domestic partnership 0 (0.0%)	Cross-border service partnership 5 (9.6%)

	Japan		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 12 (26.1%)	Captive sourcing 24 (52.2%)
	Yes (Kibs)	Domestic partnership 1 (2.2%)	Cross-border service partnership 9 (19.6%)

	China		
	Cross – Border		
Partnership		**No**	**Yes**
	No	Internal 17 (37.8%)	Captive sourcing 22 (48.9%)
	Yes (Kibs)	Domestic partnership 2 (4.4%)	Cross-border service partnership 4 (8.9%)

Table 3

Descriptive statistics for the full sample and the four strategic options sub-samples

	Full sample (285)	Domestic Internal (81)	Captive Sourcing (160)	Domestic partnership (10)	Cross-border service partnership (34)
Product-service innovation	-0.009	-0.231	0.003	0.145	0.417
Expertise decision centralization	-0.005	-0.066	0.004	-0.526	0.249
Aerospace	0.144	0.197	0.137	0.100	0.058
Automotive	0.147	0.148	0.143	0.000	0.206
Cargo	0.157	0.173	0.125	0.600	0.147
Electronics	0.147	0.148	0.150	0.200	0.118
Heavy	0.140	0.136	0.156	0.000	0.118
White	0.137	0.086	0.150	0.000	0.235
Medical	0.126	0.111	0.137	0.100	0.118
Medium (<$US 10m)	0.530	0.605	0.587	0.200	0.176
Large (>$US 10m)	0.470	0.395	0.417	0.800	0.824

Table 4

The impact of Partnership strategy and Expertise decision centralization on Product-service innovation (OLS)

	(1) OLS Servitization Full sample	(2) Servitization US	(3) Servitization UK	(4) Servitization Germany	(5) Servitization Japan	(6) Servitization China
Domestic partnership (H1a)	0.457	0.00313	1.305*		0.502	1.555
	(0.342)	(0.544)	(0.688)		(0.599)	(1.134)
Captive service offshoring (H1b)	0.280*	0.229	0.136	0.0470	0.389	0.700
	(0.160)	(0.324)	(0.454)	(0.338)	(0.431)	(0.464)
Cross-border service partnership (H1c)	0.561**	1.298***	0.0388	0.869**	0.874	0.304
	(0.232)	(0.357)	(0.515)	(0.425)	(0.692)	(0.778)
Expertise decision centralization (H2)	0.362***	0.335**	0.564***	0.393**	0.0336	0.431**
	(0.0622)	(0.162)	(0.113)	(0.161)	(0.183)	(0.174)
UK	-0.241					
	(0.206)					
US	0.0941					
	(0.201)					
Japan	-0.132					
	(0.233)					
China	0.336					
	(0.232)					
Aerospace	-0.0621	0.0175	-0.689	0.268	0.732	-0.647
	(0.309)	(0.601)	(0.868)	(0.678)	(0.715)	(0.589)
Automotive	0.142	-0.147	-0.212	-0.0561	1.342**	0.0708
	(0.271)	(0.600)	(0.562)	(0.616)	(0.623)	(0.850)
Cargo	0.0341	0.304	-0.640	0.340	0.479	-1.052
	(0.269)	(0.633)	(0.593)	(0.740)	(0.446)	(1.172)
Electronics	-0.191	-0.00194	-0.0923	-0.656	0.240	-1.481**
	(0.317)	(0.705)	(0.476)	(0.633)	(1.764)	(0.549)
Heavy	0.0991	0.502	-0.652	0.0776	1.099**	-0.544
	(0.274)	(0.644)	(0.651)	(0.650)	(0.462)	(0.445)
White	-0.210	-0.285	-0.820	-0.378	0.943	-0.504
	(0.284)	(0.643)	(0.539)	(0.685)	(0.717)	(0.590)
Medium	-0.213	-0.318	-0.546	-0.0460	0.0324	0.186
	(0.158)	(0.359)	(0.347)	(0.297)	(0.439)	(0.577)
Constant	-0.107	-0.0943	0.368	-0.0621	-1.152**	0.379
	(0.285)	(0.554)	(0.584)	(0.681)	(0.548)	(0.621)
N	285	74	68	52	46	45
R^2	0.168	0.194	0.345	0.323	0.183	0.284

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For independent variables the baseline categories are Internal, Large and Medical.

Table 5

The moderation role of Expertise decision centralization on the relation between Partnership and Product-service innovation (OLS)

	(1) OLS Servitization Full sample	(2) OLS Servitization US	(3) OLS Servitization UK	(4) OLS Servitization Germany	(5) OLS Servitization Japan	(6) OLS Servitization China
Expertise decision Centralization	0.362***	0.444**	0.568***	0.345**	0.00611	0.460**
	(0.0672)	(0.168)	(0.113)	(0.161)	(0.193)	(0.186)
Partnership	0.350*	0.446	0.0975	0.800***	0.459	0.149
	(0.186)	(0.383)	(0.397)	(0.259)	(0.589)	(0.667)
Expertise decision centralization*partnership (H3)	0.0266	-0.494**	-0.0454	0.412**	0.673	-0.401
	(0.182)	(0.240)	(0.407)	(0.154)	(0.596)	(0.351)
UK	-0.235					
	(0.210)					
US	0.0503					
	(0.196)					
Japan	-0.144					
	(0.237)					
China	0.284					
	(0.235)					
Aerospace	-0.0925	-0.211	-0.689	0.261	0.561	-0.767
	(0.311)	(0.585)	(0.867)	(0.667)	(0.703)	(0.612)
Automotive	0.117	-0.255	-0.241	-0.0610	1.069	-0.0429
	(0.274)	(0.575)	(0.599)	(0.609)	(0.789)	(0.859)
Cargo	-0.00780	0.0444	-0.457	0.247	0.365	-0.617
	(0.271)	(0.647)	(0.557)	(0.749)	(0.469)	(1.116)
Electronics	-0.192	-0.107	-0.0837	-0.329	0.345	-1.298**
	(0.319)	(0.703)	(0.489)	(0.624)	(1.618)	(0.606)
Heavy	0.0988	0.382	-0.635	0.116	1.059**	-0.628
	(0.274)	(0.655)	(0.639)	(0.647)	(0.448)	(0.504)
White	-0.196	-0.312	-0.845	-0.367	0.872	-0.310
	(0.286)	(0.669)	(0.546)	(0.682)	(0.728)	(0.619)
Medium	-0.210	-0.208	-0.642*	-0.0654	0.109	-0.0507
	(0.158)	(0.343)	(0.339)	(0.286)	(0.454)	(0.599)
Constant	0.110	0.114	0.505	-0.00580	-0.835*	0.912
	(0.278)	(0.590)	(0.476)	(0.613)	(0.464)	(0.698)
N	285	74	68	52	46	45
R^2	0.159	0.175	0.326	0.345	0.185	0.237

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For independent variables the baseline categories are Internal, Large and Medical.