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Innovation practices of B2B manufacturers and service providers: Are they really different?

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ABSTRACT

Service innovation is of critical importance for western economies. But, in sharp contrast with product innovation, the service innovation literature is fragmented and it is not clear to what extent B2B service innovation differs from B2B product innovation. This article contributes to this ongoing debate by analyzing the innovation practices of 372 B2B product manufacturers and service providers.

The findings show that, compared to B2B products-focused firms, B2B services-focused firms are overall less sophisticated in their innovation practices: they manage less explicitly for innovation, have lower innovation expectations, favor incremental innovation and, when they do initiate more innovative or radical projects, they spend less time taking them to market. Nevertheless, they have innovation outcomes that are equivalent to products-focused firms.

This study also acknowledges the reality that the vast majority of B2B firms actually offer product-service hybrid offerings to their customers. It shows that most B2B firms offer both products and services to customers, and that mixed product strategy firms with 75% products (services) and 25% services (products) are most committed to innovation. Therefore, firms need to simultaneously develop both new products and related services and are looking for the concepts and tools to effectively do so.

1. Introduction

Innovation is increasingly recognized as the driving force behind firm performance and sustaining a competitive advantage. Chemical companies launch some 1000+ new products every year and even smaller business-to-business (B2B) companies with a more limited product range are betting heavily on innovation. Product innovation has been studied for several decades by academic researchers, resulting in a large, well-documented and coherent body of knowledge about the product innovation process and its key success factors (Hauser, Tellis, & Griffin, 2006; Henard & Szymanski, 2001; Markham & Lee, 2013).

The innovation literature's strong bias towards products is in sharp contrast with the dominant role of services in most advanced economies, where services often generate > 70% of the gross domestic product and employ 70% of their workforce (CIA World Factbook, 2015; Ostrom et al., 2010). In addition, new services are considered one of the key drivers of a firm's continual growth and competitive strategic advantage (Randhawa & Scerri, 2015; Thakur & Hale, 2013). On the one hand, this dominant and increasing role of services and service innovation in advanced economies has resulted in a growing attention from innovation scholars (Biemans, Griffin, & Moenaert, 2016; Jiménez-Zarco, Martínez-Ruiz, & González-Benito, 2006; Papastathopoulou & Hultink, 2012), who have studied a broad range of topics such as success factors (De Brentani, 1989; Storey, Cankurtaran, Papastathopoulou, & Hultink, 2016), service innovation processes (Easingwood, 1986; Kindström & Kowalkowski, 2009), customer and supplier involvement (Alam & Perry, 2002; Carbonell, Rodríguez-Escudero, & Pujari, 2009; Heirati & Siahtiri, in press), organizational factors and capabilities (De Jong & Vermeulen, 2003; Kindström, Kowalkowski, & Sandberg, 2013), service ecosystems (Vargo, Wieland, & Akaka, 2015) and service innovation in the context of limited resources (Witell et al., 2017).

On the other hand, despite this increasing understanding, the service innovation literature still remains rather fragmented and fails to coalesce into an overall coherent body of knowledge (Biemans et al., 2016). Indeed, numerous researchers emphasize that the service innovation domain remains underdeveloped and that much additional research is needed (Droege, Hildebrand, & Forcada, 2009; Salunke, Weerawardena, & McColl-Kennedy, 2011; Storey & Hull, 2010). For instance, Kuester et al. (2013: 533) conclude that “Although researchers

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have shown growing interest in [service innovation] issues, this area is still underutilized."

The dearth of conclusive service innovation research also appears to be reflected in service innovation performance, as there is no evidence that service firms are getting better at innovation (Storey & Hughes, 2013). Lacking guidance from service innovation research, firms tend to fall back on established models and concepts from the product innovation literature, such as the familiar Stage-Gate™ process (Cooper, 2008). But there is an ongoing debate about the extent to which service innovation differs from product innovation, and therefore, about the extent to which concepts from the product innovation literature apply to service innovation (Biemans et al., 2016; Storey et al., 2016). While some scholars argue that the essentials of product and service innovation are similar and thus concepts developed for product innovation are easily applied to service innovation, others reason that the unique characteristics of services require innovation concepts, processes and models specifically designed for a service context (Droege et al., 2009; Nijssen, Hillebrand, Vermeulen, & Kemp, 2006).

This discussion is particularly relevant for B2B firms; not just for B2B services providers, but also for the growing number of B2B manufacturers working to create a competitive advantage by adding services to their core products[1] (Gebauer, Gustafsson, & Witell, 2011; Kowalkowski, Gebauer, & Oliva, 2017; Neu & Brown, 2005). PricewaterhouseCoopers's 2016 Global Innovation 1000 study found that the world's largest innovators generally are shifting their R&D focus from products to software and services and sometimes face new competitors as a result (Jaruzelski, Staack, & Shinozaki, 2016). For instance, John Deere, an innovation leader throughout its 180-year history by continuously improving the mechanical and functional performance of its farm equipment, is now investing heavily in software and data analytic service add-ons that help their farmer customers optimize their planting, fertilizing and harvesting processes. As a result of this servitization trend, B2B manufacturers are looking for ways to effectively integrate product and service innovation (Kowalkowski, Gebauer, Kamp, & Parry, 2017; Vandermerwe & Rada, 1988).

This article contributes to this ongoing debate about the relationship and differences between product and service innovation. Product (service) innovation refers to both the process of devising a new or improved product (service), from idea or concept generation to market launch, and the result from such a process, that is, the new product (service) offering. While the literature cites four overall differences between products and services, the primary one affecting innovation is the intangibility of the offering: products are highly tangible and services highly intangible (Miller & Foust, 2003; Moeller, 2010).

Numerous studies have hypothesized and tested relationships between antecedents, innovation practices and innovation outcomes, as summarized in meta-analyses of success factors for product innovation (Evanschitzky, Eisend, Calantone, & Jiang, 2012) and service innovation (Storey et al., 2016). Based on their meta-analysis, Storey et al. (2016) conclude that service innovation success factors differ significantly from those for product innovation.

Our research takes a different, and complementary, approach by investigating what companies are actually doing when they develop new products or services. Based on the central conclusion from a recent literature review, that the service innovation literature is much less sophisticated than the product innovation literature (Biemans et al., 2016), we hypothesize:

H1. : The innovation practices of B2B service providers are less sophisticated than those of B2B manufacturers.

[1] Many authors distinguish between tangible goods and intangible services and use "products" as a generic term. In this article, we distinguish between products (i.e. tangible goods) and services (i.e. intangible offerings) as the corollary of the distinction between product innovation and service innovation.

Using data from 372 B2B companies from three continents we test this hypothesis by comparing numerous innovation practices of B2B service providers and manufacturers. As appropriate, we also compare the innovation practices of B2B firms with those of B2C firms from the same sample.

This study offers several contributions to the ongoing product versus service innovation debate. First, it shows that the innovation practices of B2B firms in reality do not differ much from those of B2C firms and describes the few areas where they do differ and how they do so. Second, it provides insight into the differences between the innovation practices of B2B product manufacturers and B2B service providers. These findings support the contention from both academics and firm practitioners that product and service innovation differ by illustrating a number of significant differences for how innovation is implemented across these two types of firms. Further, and more importantly, we find that the vast majority of firms actually implement both types of innovation in combination. Finally, it contributes to the ongoing debate about the product/service distinction and offers several suggestions for future research in light of the complex relationship between product and service innovation.

The article is structured as follows. The literature background discusses the differences between products and services, and as a corollary between product and service innovation. Next, the research method is discussed. This is followed by our findings about differences in innovation cultures and strategies, R&D spending and knowledge protection, innovation processes and innovation performance. The final section discusses the findings in terms of contributions to the literature, implications for managers and suggestions for future research.

2. Literature background

Academics have argued for decades about the differences between products and services, and thus the differences between product and service innovation. Over time, this has resulted in three scholarly schools of thought (Droege et al., 2009; Nijssen et al., 2006):

1. *Assimilation approach*: Services are similar to products, so the theories and concepts developed in product innovation can easily be transferred to service innovation;
2. *Demarcation approach*: The distinctive characteristics of services require concepts and models specifically designed for service innovation;
3. *Synthesis approach*: Products and services are different but related, requiring an integrated product-service innovation approach.

2.1. Assimilation approach

The service innovation literature originated in the mid-1980s as a spin-off from the more established product innovation literature. Early service innovation researchers used largely qualitative methods to explore the nature and stages of the service innovation process (Bowers, 1989; Easingwood, 1986; Johne & Harborne, 1985). But these early researchers were quickly overshadowed by those who considered services just another type of product and who thus applied the quantitative research methods of product innovation success/failure studies to identify key service innovation success factors (De Brentani, 1989; Edgett, 1994; Storey & Easingwood, 1993). While these researchers acknowledge the four idiosyncratic characteristics of services – intangibility, heterogeneity, inseparability and perishability, the IHIP framework (Fisk, Brown, & Bitner, 1993; Zeithaml, Parasuraman, & Berry, 1985) – their perspective on services was very much product-oriented. They investigated variables derived from familiar product innovation studies, quickly accepting the conclusion that service innovation does not differ significantly from product innovation. For instance, Cooper and De Brentani's (1991: 87) much-cited early study concludes: "In summary, factors that underlie new product success are

remarkably consistent across different types of products – manufactured items versus financial services." That Cooper and De Brentani consider services as just a type of product is illustrated by a content analysis of their short conclusion section: they use the terms "product" six times, and "service" only twice (Cooper & De Brentani, 1991: 89–90). They consistently refer to service innovations as "new service products".

To describe services as products is common practice in many early service innovation studies. Easingwood's (1986) landmark service innovation article is even titled "New product development for service companies" and Cooper, Easingwood, Edgett, Kleinschmidt, and Storey (1994) investigate "the top performing products in financial services". This perspective, which considers service innovation as part of the overall product innovation domain, has long prevailed among many innovation researchers. For instance, Sirilli and Evangelista (1998) found that the differences between services and manufacturing seem to be smaller than they are within either the manufacturing or service sectors. More recently, a broad review of innovation research devotes only one minor paragraph to service innovation (Hauser et al., 2006).

Overall, then, the assimilation approach emphasizes the similarities between products and services. For instance, Grönroos (2000: 88) argues that "services and physical goods should not be kept apart anymore…. physical goods marketing and services marketing converge, but services-oriented principles dominate." This convergence has culminated in the service-dominant logic, which postulates that all economic exchange revolves around service provision with the customer as a collaborative partner (Lovelock & Gummesson, 2004; Lusch, Vargo, & O'Brien, 2007; Vargo & Lusch, 2004). The service-dominant logic emphasizes that customers do not want to purchase products or services, but rather the benefit available through the service of the provider. More recently, this line of thinking is expressed in the concept of 'job to be done', which states that customers hire products and services to get a job done, further shifting the focus from products or services, per se, to the benefits derived from them (Bettencourt, 2010; Christensen, Cook, & Hall, 2005; Christensen, Hall, Dillon, & Duncan, 2016). The service-dominant logic has also been used to reconceptualize service innovation and emphasize the role of service ecosystems, service platforms and value co-creation (Lusch & Nambisan, 2015; Vargo et al., 2015).

2.2. Demarcation approach

Although early service innovation success/failure research treated services like products and found similar success factors (Cooper & De Brentani, 1991; De Brentani, 1989; Edgett, 1994), later service innovation research has found different results. Based on a later review of the service innovation literature, Menor et al. (2002: 143) warned that "it would be overly premature to suggest that what works for NPD applies to NSD".[2] A more recent meta-analysis of service innovation success factors identified significant differences between those for products and services and concludes that "it would be wrong to treat the development of new services and new products as the same" (Storey et al., 2016: 542).

Some service innovation researchers emphasize that services differ inherently from products *because* of their intangibility, heterogeneity, inseparability and perishability (Fisk et al., 1993; Moeller, 2010; Zeithaml et al., 1985). These researchers argue that these unique characteristics of services require innovation concepts, processes and models specifically designed for a service context (Hipp & Grupp, 2005; Song, Song, & Di Benedetto, 2009). In particular, service intangibility, heterogeneity and inseparability may all change a firm's innovation process. Service perishability, however, the inability to store service capacity for sale in the future, has little impact on innovation processes.

[2] NPD (new product development) denotes product innovation and NSD (new service development) denotes service innovation.

Of the IHIP differentiating characteristics, service intangibility is considered the most important (Miller & Foust, 2003; Moeller, 2010) and is most commonly used to distinguish services from products (Storey et al., 2016). That services are mostly intangible complicates communications, both internally between departments and innovation team members and with customers, who may also be involved in the innovation process (Alam & Perry, 2002; Athanassopoulou & Johne, 2004).

Service heterogeneity makes it difficult to standardize service delivery because of the variability in human performance of the service provider and/or varying participation of customers (Frei, 2006; Zeithaml et al., 1985). Service firms deal with heterogeneity through interface flexibility and closely coordinating front-office (marketing and sales) and back-office (operations). As a result, R&D tends to be less involved in service innovation, while customer-facing departments, such as sales and customer service, play a key role.

Service inseparability, the simultaneous production and consumption of services, emphasizes the importance of effective service delivery and the role of customers and frontline employees in achieving it (Cadwallader, Jarvis, Bitner, & Ostrom, 2010; Carbonell et al., 2009). This suggests that service innovation requires simultaneously developing both the new service and the service delivery system (Djellal & Gallouj, 2001; Gebauer, Krempl, Fleisch, & Friedli, 2008), again emphasizing the importance of the client interface and thus frontline employee involvement in the service innovation process (Stock, Jong, & Zacharias, 2017).

Despite the expected differences between services and products identified above from the IHIP framework, and the implications for how service innovation likely differs from product innovation from them, and despite some growing support for that perspective, "Leaders of most service businesses find little guidance in existing writing on innovation" (Lyons, Chatman, & Joyce, 2007: 174). Similarly, Biemans et al. (2016) recently conclude that there is no generally accepted service innovation process model and no consensus about how intangibility, heterogeneity and inseparability impact the service innovation process. Furthermore, while inseparability implies that service employees are key to successful service delivery, the role of service employees remains largely ignored in the service innovation literature (Cadwallader et al., 2010; Ramdas, Teisberg, & Tucker, 2012; Stock et al., 2017).

2.3. Synthesis approach

In contrast to the rather opposing assimilation and demarcation perspectives, a few researchers have adopted a more nuanced perspective on the nature of products versus services. As early as 1977, Shostack argued against a dichotomous distinction, suggesting that a firm's offerings are typically a mix of tangibles and intangibles on a continuum from tangible-dominant products to intangible-dominant services. Recent scholars have pointed out that many services have shifted to online platforms, eliminating the need for extensive employee-customer interaction, making them less heterogeneous and thus more tangible like products (Brännback & Pukakainen, 1998). B2B firms, in particular, try to objectify and standardize the services they buy, treating them more like products (Lindberg & Nordin, 2008). However, other products, including CDs, DVDs, books and cars, have been transformed into services: Spotify, Netflix, Kindle Unlimited and Zipcar. And it is not just consumer products: B2B manufacturers like Rolls-Royce and Phillips have incorporated their products into full-service offerings, selling them as "power-by-the-hour" and "pay-per-lux".

These blurring product/service boundaries have led to the stance that product and service innovation research should be integrated, rather than treated as two separate domains:

- Nijssen et al. (2006: 248) present findings that "provides a basis for

further synthesizing NPD and NSD research in general and developing one model suited for explaining NPD and NSD in particular".
- Droege et al. (2009: 135) conclude that "the stream of demarcation or assimilation seems to decline in its impact and relevance, and many researchers now turn to the most recent approach of trying to "synthesize" innovation research in product and service innovation".

That many manufacturing firms realize that competitive advantage may best be achieved by adding product-related services, such as training and education, consultancy, hotline, remote monitoring and trouble-shooting also supports the synthesis perspective (Böhm, Eggert, & Thiesbrummel, 2017; Gebauer et al., 2008; Kindström & Kowalkowski, 2014; Matthyssens & Vandenbempt, 2008). Shifting from selling products to integrated product-service solutions is referred to as "servitization" (Baines, Lightfoot, Benedettini, & Kay, 2009; Martinez, Bastl, Kingston, & Evans, 2010; Valtakoski, 2017; Vandermerwe & Rada, 1988).

As a result of these trends, industrial firms now occupy varying positions on the products-to-services continuum as identified by Martin Jr. and Horne (1992):

1. pure products
2. core products with accompanying services
3. core services with accompanying products
4. pure services.

It is well recognized in the marketing literature that product and service marketing require different organizational capabilities (Fundin, Witell, & Gebauer, 2012; Kowalkowski, Windahl, Kindström, & Gebauer, 2015; Oliva & Kallenberg, 2003). Thus, both different positions on and transitions along this continuum may create organizational challenges to the firm's innovation approach. Because product-related services may be developed either during or after the product's development, firms need ways to synthesize product and service innovation.

All in all, the recent innovation literature seems to gravitate towards the perspective that the antecedents to successful new products and services are different (Storey et al., 2016), but remains largely silent on the nature of the innovation process that results in successful new services. At the same time, the literature recognizes that many B2B firms offer both products and services and therefore need to combine product and service innovation. This study provides insights into the innovation processes used by B2B manufacturers and service firms, how they manage them and their success in the marketplace, with the ingoing hypothesis, based on previous research, that B2B service firms manage innovation in a less sophisticated manner than do B2B products firms.

3. Research method

This study used the 2012 Comparative Performance Assessment Study (CPAS) data set, collected and made available for researchers by the Product Development and Management Association (PDMA, www.pdma.org). CPAS is a detailed benchmarking survey of 562 questions (Markham & Lee, 2013). An invitation to complete the survey was emailed to 3391 PDMA members and 21,588 PDMA contacts. In total, 835 respondents from 24 countries initiated participation. After eliminating incomplete and invalid responses, 453 firms remained: 198 North American, 149 Asian, 61 European and 45 firms in other parts of the world. The firms are active in industries ranging from capital goods and industrial services to health-care and fast-moving consumer goods. All questions from the CPAS survey used in this study are in the Appendix.

We used the respondents' answers about the firm's B2B/B2C sales mix to classify the firms as B2B, B2C or an equal mix of B2B/B2C. The firms with an equal mix were eliminated, resulting in a total sample of 378 firms (248 B2B and 130 B2C).

Next, we identified the extent to which the firms' offerings consisted of products and/or services. Unfortunately, the CPAS questionnaire does not unambiguously separate service providers from product manufacturers. However, the services literature emphasizes intangibility as a key service characteristic (Edgett & Parkinson, 1993; Moeller, 2010). Intangibility is generally interpreted as a continuous variable ranging from pure (tangible) products to pure (intangible) services (Shostack, 1977). Accordingly, we differentiate between product and service providers through their scores on three "intangibility" items: (a) ability to conduct a physical count of what we offer, (b) ability to store what we offer and (c) ability to display what we offer (1 = never, 3 = 50% of the time, 5 = virtually always). Four types of firms were identified based on their average scores for these three items:

- Products-dominant firms (169 firms): average score > 4 (offerings > 75% tangible);
- More-products firms (123 firms): average score > 3 and ≤ 4 (offerings > 50% and ≤ 75% tangible);
- More-services firms (85 firms): average score > 2 and ≤ 3: (offerings > 50% and ≤ 75% intangible);
- Services-dominant firms (61 firms): average score ≤ 2 (offerings ≥ 75% intangible).

Exploratory factor analysis of the items created one factor accounting for 73.3% of the variance in the data, with all items loading at > .66. Cronbach's α for the scale is .82, suggesting it is reliable. Of the 453 firms in the sample, 438 completed these items.

Next, we analyzed intangibility's distribution across our B2B and B2C samples. As Table 1 shows, there are no significant differences between how B2B versus B2C firms are distributed across the four product-service continuum categories. Therefore, our analyses focus on the differences between the four product-service categories for B2B firms. B2C firm findings are discussed only when there are significant differences for specific variables. At times, we refer to services- (or products-) focused firms in discussing the results. These labels denote that they consist of both the "-dominant" and "more-" categories for services (products).

Table 1 also includes demographic data for our B2B sample that shows that the average yearly revenues for firms across each category type are not statistically different, but that both products- and services-dominant B2B firms tend to be lower tech than do more-products or -services B2B firms.

To assess firm performance, the 1995, 2004 and 2012 PDMA studies (Barczak, Griffin, & Kahn, 2009; Griffin, 1997; Lee & Markham, 2016; Markham & Lee, 2013) all identically differentiate the Best innovation firms from the Rest. The Best firms are:

- above the sample mean for the average of four items associated with customer-based success;
- above the sample mean for the average of two items associated with

Table 1
B2B vs B2C firms.[a]

	Products dominant	More products	More services	Services dominant
All firms	14.0% (52)	16.1% (60)	28.8% (107)	41.1% (153)
B2B firms (243)	13/6% (33)	16.0% (39)	29.2% (71)	41.2% (100)
B2C firms (129)	14.7% (19)	16.3% (21)	27.9% (36)	41.1% (53)
More hightech	27.6%	34.4%	30.6%	7.4%
More lowtech	34.7%	26.7%	20.8%	17.7%
Firm sales	$ 9.9 B	$ 10.2 B	$ 10.5 B	$ 11.6 B

[a] The numbers in parentheses refer to the sample sizes.

Table 2
Innovation culture and strategy.[1]

	Products dominant	More products	More services	Services dominant
Has a risk accepting culture[2]	3.24 (67)	3.18 (91)	3.03 (60)	3.03 (33)
Actively manages a culture for innovation[2*]	3.16 (66)	3.14 (90)	2.84 (60)	2.43 (23)
*ANOVA: $p < .05$; products dominant and more products > services dominant				
Has a specific innovation management strategy:				
B2B				
B2C	56.1% (66)	61.3% (93)	56.7% (60)	39.1% (9)
	76.3% (38)	81.8% (44)	61.3% (31)	28.6% (4)
B2C: χ^2: $p < .05$; differs across categories (services-dominant less likely)				
Innovation strategy:				
Value being first and respond rapidly	31.8% (21)	39.6% (36)	24.1% (14)	26.1% (6)
Seldom first, but fast follower	40.9% (27)	27.5% (25)	37.9% (22)	26.1% (6)
Locate and maintain a niche in a stable area	24.2% (16)	25.3% (23)	25.9% (15)	30.4% (7)
Less aggressive, respond only when forced	3.0% (2)	7.7% (7)	7 (12.1%)	17.4% (4)
Has an innovation revenue growth target:	65.2% (66)	63.4% (93)	53.3% (60)	30.4% (23)
B2B				
B2C	74.4% (39)	77.3% (44)	67.7% (31)	21.4% (14)
B2B and B2C: χ^2: $p < .05$; increases from products dominant to services dominant				
Innovation revenue goal:				
As % of sales from products commercialized	22.9% (46)	27.7% (63)	21.3% (38)	8.7% (11)
During the last how many years	4.4 (46)	5.8 (63)	4.0 (38)	3.1 (11)

[1]All numbers refer to B2B firms only, unless indicated otherwise. The numbers in parentheses refer to the sample sizes. Curved arrows denote statically significant differences. Straight arrows denote data trends.
[2]1 = never; 3 = 50% of the time; 5 = virtually always.

success compared to their firm's program objectives; and
- in the top third compared to their competitors in their industry.

Of the firms providing intangibility item responses, only 214 (49.2%) provided responses for determining which were the Best and Rest. The Best constitute 34.6% of this reduced sample.

4. Results

We compare product-service and performance categories in terms of innovation culture and strategy, R&D spending and knowledge protection, innovation process and innovation performance. Due to missing data sample sizes vary, which are in parentheses in Tables 2-5.

a. Innovation Culture and Strategy

While B2B and B2C innovation cultures do not significantly differ, there are significant differences within the B2B sample. As shown in Table 2, all B2B firms have the same attitude towards risk, but services-dominant B2B firms are significantly less likely to actively manage a culture for innovation.

This limited emphasis on innovation in the corporate culture of

Table 3
R&D spending and knowledge protection.[1]

	Products dominant	More products	More services	Services dominant
% of sales spent on R&D	10.7% (67)	12.9% (93)	15.9% (60)	7.7% (23)
% of R&D spent on products	84.2% (62)	69.6% (80)	50.1% (55)	20.0% (21)
% of R&D spent on services	15.8% (62)	30.4% (80)	49.9% (55)	89.0% (21)
ANOVA: $p < .05$; post hoc Scheffé; no significant differences between products dominant and more products; all other differences are significant				
% of R&D spent on radical innovations	22.9% (61)	27.6% (79)	28.6% (51)	8.8% (20)
% of R&D spent on more innovative projects	37.7% (61)	35.3% (79)	33.6% (51)	24.5% (20)
% of R&D spent on incremental innovations	39.4% (61)	37.1% (79)	37.8% (51)	66.8% (20)
ANOVA: $p < .05$; post hoc Scheffé				
Use of intellectual property[2]	3.4 (63)	3.2 (91)	2.8 (57)	2.6 (23)
ANOVA: $p < .05$; post hoc Scheffé				

[1]All numbers refer to B2B firms only. The numbers in parentheses refer to the sample sizes. Curved arrows denote statically significant differences. Straight arrows denote data trends.
[2]1 = never; 3 = 50% of the time; 5 = virtually always.

Table 4
Innovation process.[1]

	Products dominant	More products	More services	Services dominant
No standard approach to innovation	4.5% (67)	7.6% (92)	11.7% (60)	26.1% (23)
No formal process, but clearly understood tasks	11.9% (67)	12.0% (92)	26.7% (60)	30.4% (23)
Formal sequential process, one function at a time	13.4% (67)	22.8% (92)	23.3% (60)	4.3% (23)
Formal process with cross-functional team	70.1% (67)	57.6% (92)	38.3% (23)	39.1% (23)

χ^2: $p < .05$; for 'no standard approach to innovation' increases from products dominant to services dominant; for the other three items the boxed categories are higher than the other two categories

B2B:				
% of ideas reached idea screening	77.6% (61)	69.6% (85)	70.1% (54)	78.2% (18)
% of ideas reached business analysis	50.9% (61)	46.8% (85)	45.8% (54)	55.0% (18)
% of ideas reached business development	38.4% (61)	34.1% (85)	30.8% (54)	42.4% (18)
% of ideas reached test and validation	32.0% (61)	26.7% (85)	22.9% (54)	30.7% (18)
% of ideas reached commercialization	27.0% (61)	19.9% (85)	15.8% (54)	24.7% (18)
B2C:				
% of ideas reached idea screening	64.3% (38)	59.9% (42)	53.5% (30)	68.5% (13)
% of ideas reached business analysis	43.0% (38)	43.8% (42)	40.6% (30)	38.8% (13)
% of ideas reached business development	31.4% (38)	34.8% (42)	30.1% (30)	25.8% (13)
% of ideas reached test and validation	25.1% (38)	24.6% (42)	23.9% (30)	18.0% (13)
% of ideas reached commercialization	20.6% (38)	18.2% (42)	17.2% (30)	10.4% (13)

[1]All numbers refer to B2B firms only, unless indicated otherwise. The numbers in parentheses refer to the sample sizes. Straight arrows denote data trends. Boxes denote equivalence of values.

services-dominant B2B firms also is reflected in the innovation strategy and objectives of services-focused firms. While most product-focused firms possess a specific innovation strategy that directs and integrates the entire innovation program, most services-focused firms lack such an innovation strategy. Within the B2C firms, services-dominant firms are significantly less likely to have a specific innovation strategy. Within the B2B sample the same pattern is present, but here the differences are not quite significant.

Looking at the total sample of 453 firms (i.e. the original sample before eliminating equally B2B/B2C firms) and their innovation strategies (Miles & Snow, 1978), a Prospector strategy (focused on being the first with new products, markets and technologies and responding rapidly to new market opportunities) is significantly more often used by products-focused firms than by service-focused firms. At the other (least innovative) end of the innovation strategy spectrum, a Reactor strategy is more common for services-focused firms than for product-focused firms. Within just the B2B firms the pattern remains, but the differences are not statistically significant.

That firms with more services are less likely to use a Prospector innovation strategy is also reflected in their limited use of explicit targets for new product or service goals. Only 30.4% of the services-dominant B2B firms have innovation revenue growth targets, compared to 65.2% of the products-dominant B2B firms. The same trend (the more services in the offering mix, the less likely it is that the firm will use explicit innovation revenue growth targets) is observed within the B2C sample. B2C services-dominant firms are particularly unlikely to use such innovation revenue growth targets.

Within the original sample of 453 firms, the services-dominant firms that do use an innovation revenue growth target have significantly less ambitious innovation revenue targets than firms with more products in their offering mixes. The B2B firms show the same pattern for both the size of their innovation revenue goals and the number of years that they have used them, but these differences are not statistically significant.

While each individual result above is not completely compelling, overall they indicate that both the culture and strategy of B2B services-focused firms are less supportive of innovation efforts than are the culture and strategy of products-focused firms.

4.1. R&D spending and knowledge protection

For the original total sample, both the products-dominant and services-dominant firms spend a significantly lower percentage of sales on R&D than the firms with just a bit more products or services in their offering mixes. This finding is not unexpected, as the "dominant" firms are slightly lower tech (Table 1). This pattern is again replicated within the B2B firms, but these differences are not significant (Table 3).

A closer look at what B2B firms spend their R&D budgets on reveals that products-focused firms do, as expected, spend on average 70–85% of their R&D budget on developing new products, while more-services firms spend half of their budget on developing new services and services-dominant firms spend nearly all (90%) of their budget on new services. This finding in part demonstrates the validity of our products versus services classification, but also illustrates that even firms classified as products- or services-dominant still offer a mix of both products and services, albeit with a strong emphasis on their currently dominant category.

There are significant differences between B2B product manufacturers and service providers in how innovatively they spend their R&D budgets (Table 3). Consistent with a less frequent use of proactive innovation strategies, services-dominant firms (> 75% intangibles) spend significantly less of their R&D budget on radical and more innovative projects and far more on developing incremental innovations. Interestingly, it is the more mixed categories of firms (more-products and more-services) who are spending the most on radical innovations.

The less frequent use of proactive innovation strategies by firms focusing on services, together with their more limited attention to radical innovation, also causes them to emphasize intellectual property far less. Both the services-dominant and more-services B2B firms make significantly less use of intellectual property as a key component of their innovation strategies than the products-dominant B2B firms.

4.2. The innovation process and time in development

Our analyses show that the innovation processes of B2B products-dominant firms differs markedly from those used by services-dominant

Table 5
Innovation cycle times.[1,2]

	Products dominant	More products	More services	Services dominant
Radical innovations				
Total cycle time	152.6 (35)	87.4 (57)	83.1 (28)	42.7 (7)
- Product line planning	13.8 (40)	6.2 (63)	4.6 (38)	2.6 (11)
- Project strategy development	11.2 (42)	5.0 (60)	5.2 (40)	3.5 (11)
- Idea/concept generation	10.1 (41)	5.6 (64)	5.6 (43)	3.5 (11)
- Idea screening	6.4 (42)	3.0 (63)	3.2 (40)	1.4 (11)
- Business analysis	12.2 (43)	4.1 (64)	4.4 (42)	3.9 (11)
- Design and development	43.9 (45)	24.1 (66)	23.7 (41)	9.0 (11)
- Test and validation	14.5 (46)	12.6 (66)	13.0 (38)	7.0 (10)
- Manufacturing development	19.0 (44)	12.2 (65)	13.7 (33)	3.6 (8)
- Commercialization	17.5 (43)	13.9 (65)	17.8 (38)	5.7 (11)
More innovative projects				
Total cycle time	124.3 (39)	71.2 (55)	82.6 (30)	50.8 (9)
- Product line planning	10.1 (47)	4.4 (65)	4.2 (39)	2.5 (13)
- Project strategy development	9.1 (46)	3.9 (64)	4.2 (42)	3.3 (13)
- Idea/concept generation	6.7 (46)	4.1 (67)	4.6 (43)	3.7 (16)
- Idea screening	5.2 (45)	3.0 (68)	3.1 (42)	1.6 (14)
- Business analysis	8.9 (50)	3.5 (69)	3.7 (44)	3.3 (15)
- Design and development	27.6 (51)	16.4 (71)	16.0 (42)	7.9 (16)
- Test and validation	11.7 (50)	8.6 (69)	9.4 (43)	6.6 (14)
- Manufacturing development	14.6 (49)	7.8 (69)	10.0 (36)	4.4 (11)
- Commercialization	12.2 (49)	8.7 (68)	12.3 (41)	5.3 (15)
Incremental innovations				
Total cycle time	67.5 (37)	38.3 (53)	43.9 (28)	46.6 (9)
- Product line planning	8.3 (45)	2.2 (60)	3.2 (38)	1.8 (14)
- Project strategy development	5.0 (46)	2.1 (62)	2.3 (41)	2.8 (16)
- Idea/concept generation	4.8 (46)	2.3 (66)	2.8 (42)	4.4 (16)
- Idea screening	3.4 (45)	1.9 (64)	1.5 (40)	3.0 (14)
- Business analysis	5.1 (51)	2.1 (68)	2.0 (42)	4.5 (17)
- Design and development	13.7 (53)	8.8 (71)	7.3 (42)	10.8 (18)
- Test and validation	6.8 (52)	5.0 (69)	4.6 (43)	11.4 (16)
- Manufacturing development	8.1 (52)	4.3 (68)	8.9 (37)	6.4 (11)
- Commercialization	9.2 (50)	5.7 (69)	8.2 (42)	7.3 (18)

[1]All numbers refer to B2B firms only. The numbers in parentheses refer to the sample sizes. Darker shades denote longer cycle times. Boxes denote equivalent cycle times.
[2]Number of weeks spent.

firms (Table 4). Perhaps because they tend to have a corporate culture less geared towards innovation and a less proactive innovation strategy, service-dominant firms also are much more likely to lack a standard innovation process (26.1%) or use an incompletely documented informal one (30.4%). In sharp contrast, 70.1% of the B2B products-dominant firms use a cross-functional, formally documented process, where management reviews the results and formally manages team progress. Only 39.1% of the services-dominant firms use more sophisticated innovation processes.

Taking a closer look at mortality curves, how innovations progress from idea to marketplace success, the differences between B2B firms and B2C firms are only significant during idea screening and business analysis, with B2C firms more rapidly eliminating less promising ideas. B2B firms are less effective at weeding out innovation projects during the early stages of development, resulting in wasted innovation dollars to get to a similar success endpoint compared to B2C firms. For both B2B firms and B2C firms, the mortality curves do not differ significantly across the four product-service categories.

While mortality curves are similar for B2B and B2C innovation pipelines (except for the early screening stages), development cycle times differ depending both on whether the innovation targets a B2B or B2C market, and its newness. For both radical innovations and more innovative projects, there are no significant differences between total cycle times for B2B versus B2C innovations, but for both levels of newness, the test and validation stage takes significantly longer for B2C than for B2B innovations. Radical B2C innovations need on average more than 20 weeks for testing and validation, while radical B2B innovations use less than 13 weeks (nearly 2 months shorter). Similarly, more innovative B2C projects require almost 15 weeks for testing and validation, and their more innovative B2B counterparts go through the same stage within 10 weeks (over a month shorter). These longer B2C testing and validation times may result from more extensive human use testing and perhaps even FDA approval requirements.

For incremental innovations the average total B2C cycle time is significantly longer than that of B2B projects: 48 weeks for B2B, 71 weeks for B2C (nearly 5½ months longer). B2C incremental innovation takes significantly more time across multiple stages, including idea generation, idea screening, design and development, test and validation and manufacturing development. In addition to not needing the human testing time, B2B incremental innovations may be developed more quickly because they are often responses to fairly specific requests from individual customers that can be rapidly implemented.

Table 5 contains B2B product development cycle times by week for each of the four product-service categories of firms, split out by three levels of product newness: radical, more innovative and incremental innovations. Radical and more innovative products follow similar cycle time patterns: product-dominant firms take the longest time, both overall and for each development stage; services-dominant firms take

the shortest, both overall and by stage; and both of the "more" category firm types take approximately the same amount of time, both by stage and overall, with that time being in between (but not necessarily equidistant between) the two dominant firm types. This overall pattern falls apart for incremental innovations: products-dominant firms still take more time both overall and by stage, but times for the other three categories are more equivalent – services-dominant projects do not take, on average less time by stage or overall.

Previous large-sample empirical research comparing products versus services cycle times has only looked at times for "a product" versus "a service" (Griffin, 2002). The findings above are consistent with previous research: developing a product takes significantly longer than developing a service. What is new in this research are the findings about how long it takes to develop hybrid product-service offerings and that they are similar in the time it takes, independent of whether the offering emphasizes the product or the service side more.

The other interesting aspect of these cycle time results are the overall times for each newness level, within B2B product-service category. Consistent with findings from previous research (Barczak et al., 2009; Markham & Lee, 2013), for both categories of product-focused firms, radical innovations take significantly longer than do more innovative products than do incremental innovation. However, the pattern differs for service-focused firms. For more-services firms, it takes about the same period of time for radical and more innovative projects, while incremental innovations take significantly less time. However, for services-dominant projects, there are no statistically significant differences in cycle time across newness categories: it takes as long to develop a B2B incremental service as it does to develop a radical service.

4.3. Innovation performance

The B2B firms in the CPAS sample overall show no significant differences in any of the standard PDMA performance measures compared to the B2C firms in the sample. Both types of firms average an overall success rate across four measures of about 45%, rate their average program performance (2-item scale) at about 6 (where a 4 rating is neutral between being the most (9) and least (1) successful compared to goals), perform equally well compared to their competitors, and finally, about 35% of each are among "The Best" in innovation.

Further, even though B2B services-dominant and/or focused firms are less likely to have a culture supporting innovation, an innovation-focused strategy and lower innovation revenue growth targets (Table 2), spend less money on radical and more innovative projects and more money on incremental innovations and depend less on intellectual property and its protection (Table 3), are less likely to use more sophisticated product development processes (Table 4), and are likely to take an equal amount of time to develop a product independent of whether it is a radical, more innovative or incremental new product (Table 5), our data show no statistically significant performance differences across the product-service categories: services-focused firms perform equally to products-focused firms.

5. Discussion

5.1. Theoretical contributions

An increasing number of firms, both service providers and firms offering combinations of products and services, are turning to the innovation literature for help in designing effective service innovation processes. Indeed, the "hybrid" product-service firms are perhaps the most interesting, since they represent both the current complexity of innovation in B2B firms and, as cited in the popular press, the future of B2B innovation. Indeed, this analysis shows that these hybrid firms are slightly more higher-tech, spend more on R&D and spend more on radical innovation, supporting these popular press contentions. This study produces six contributions to extant theory on product/service innovation, including demonstrating support to our overarching hypothesis that B2B service innovation is less sophisticated than B2B product innovation.

5.1.1. The current innovation practices of B2B firms and B2C firms are very similar

Our sample consisted of 243 B2B and 129 B2C firms. Their innovation practices are very similar in: innovation-supporting cultures (in both attitudes towards risk and actively managing for innovation), innovation strategies, innovation revenue goals (goal size and number of years), percentages of sales spent on R&D, R&D allocations across products and services and across radical, more innovative and incremental projects, innovation processes, and intellectual property protection. The only empirical differences between B2B and B2C firms are that B2B firms are less likely to have an innovation strategy or to use innovation revenue growth targets, and they are less efficient in eliminating less promising innovation projects during the early stages of idea screening and business analysis.

Finding that B2B and B2C firms are quite similar in their overall management of innovation is not new, nor is it unexpected. More than 30 years ago, Fern and Brown (1984) argued that managerial differences within B2B and B2C are much larger than the differences between B2B and B2C, suggesting that research should focus on the similarities between the two. This conclusion has been investigated and generally replicated by other researchers (Cova & Salle, 2007; Coviello & Brodie, 2001; Wilson, 2000). However, this is the first time that it has been empirically demonstrated in the specific context of innovation.

5.1.2. B2B product and service firms innovate differently

This large, global sample shows significant differences between how product manufacturers and service providers innovate, but also that not all factors create differences. For instance, the percentage of sales spent on R&D does not differ according to the firm's product-service mix. Furthermore, innovation mortality curves do not differ, suggesting that firms use similar project selection/continuation processes independent of product-service mix. However, other key characteristics of their innovation efforts, such as having and managing a culture for innovation, having a strategy for innovation management, using innovation revenue growth targets, and R&D spending on radical versus incremental innovations, differ significantly across the four types of firms.

5.1.3. B2B service innovation is less sophisticated than B2B product innovation

The above findings correspond with what is suggested by the demarcation perspective (Hipp & Grupp, 2005; Song et al., 2009): B2B service innovation differs from product innovation. Most importantly, they also confirm our central hypothesis that B2B service innovation is less sophisticated. One of the most telling results in support of this statement is that products-focused B2B firms are much more likely to use a formal, cross-functional innovation process, while services-focused firms are more likely to use an informal innovation process or no standard approach at all. Best practices research has long shown that more innovation-focused firms are more likely to use more formal and more sophisticated innovation processes (Barczak et al., 2009; Griffin, 1997).

In addition, compared to products-focused firms, services-focused firms manage less explicitly for innovation through both their culture and strategy, have lower innovation expectations, favor incremental innovation and, when they do initiate more innovative or radical projects, they spend less time taking them to market. These findings demonstrate a consistent pattern of B2B service firms managing innovation differently and being significantly less oriented to innovation than B2B product manufacturers. Service innovation is clearly less sophisticated than product innovation for B2B firms. This finding echoes the recent conclusion that service innovation is an immature, fragmented discipline that fails to provide managers with the tools required for

effective innovation (Biemans et al., 2016).

The findings also contribute to the debate about the maturity of service innovation (Biemans et al., 2016; Papastathopoulou & Hultink, 2012) by suggesting an additional explanation for service innovation being less sophisticated than product innovation: service firms favor incremental innovation and even their radical service innovations are less radical than the typical radical product innovations. Incremental service innovation typically does not require substantial investments and often occurs as a natural result of the human, interpersonal delivery system between service personnel and customers and thus arises more naturally than radical innovation (Den Hertog, 2000; Gallouj, 1998). Services can be easily and immediately modified based on specific customer requirements. Frontline service personnel consider this customization a natural part of a fluid service delivery process aimed at satisfying individual customers (Stock et al., 2017). Especially in knowledge-intensive services, unique solutions are co-created with individual customers to solve their specific problems (Gadrey & Gallouj, 1998). However, when service firms (a) fail to create environments that foster innovative behavior from frontline employees and (b) lack mechanisms to identify locally successful service innovations and then disseminate them across the firm, many new service ideas implemented for individual customers fail to become part of the firm's best practices.

5.1.4. B2B service innovation is no less successful than B2B product innovation

However, our results also present a seeming disconnect: if services-focused firms are less oriented to and sophisticated in innovation, why do they then have innovation outcomes that are equivalent to products-focused firms? We think the answer to this conundrum is two-fold: in the nature of services themselves, and in the nature of the measures used to compare innovation outcomes in this study.

By nature, services are more intangible and are co-created with customers, who have heterogeneous needs. Because of this it is difficult, if not nearly impossible, to create new service-enabling intellectual knowledge or property that is either protectable or radical. Because of customer co-creation in service delivery trade secrets are not possible, so other service providers rather easily can see the service, and likely copy it, especially as most processes are not patentable. Furthermore, changing customer behavior is extremely difficult, and thus service providers may need to move customers to a new offering in a more incremental rather than radical manner. Thus, what a service provider might call a “radical innovation”, likely is not truly radical as defined in the product innovation literature (Leifer et al., 2000). That service radical innovations likely are significantly less “radical” than product-based radical innovations is born out in the cycle time results for the different newness levels for services-dominant firms.

The success measures used here also may have attributed to the lack of performance differences between services- and products-dominant firms. Identifying “The Best” firms in innovation outcomes combines measures for customer and program performance and performance compared to the firm's competitors, all of which are perceptual, relative measures. A services-dominant firm may achieve its program and competitive performance goals just because they were modest and competitors have similar modest expectations for their innovation programs. Customer performance combines percentage of sales and profits attributable to new products and the percentage of new products that are successful in terms of sales and profits. Of these four items, the last two are again relative to expectations. Overall, most of the measures used consider innovation performance relative to expectations and competitors in the field and do not assess absolute performance of services-focused firms compared to products-focused firms.

5.1.5. For most B2B firms, the product innovation/service innovation dichotomy is obsolete

Despite the observed differences between B2B product manufacturers and service providers, this study's findings show that the product manufacturer/service provider dichotomy is rather artificial, and likely obsolete. “Pure” product manufacturers and “pure” service providers are the exception, rather than the rule; most firms offer both products and services, often in combination to the same customers. In our sample, 167 (44.9%) of the 372 firms were in the “more services” and “more products” categories. In addition, our findings show that services-dominant B2B firms still spend 20% of their R&D budget on products (Table 3) and products-dominant B2B firms still spend 15.8% of their R&D budget on services. Especially when products and services are part of integrated offerings, firms need to develop integrated innovation processes to effectively develop both types of innovations in tandem. This suggests that, for most B2B firms, a strict distinction between product and service innovation may not be useful, and for academics, research needs to be done from the “synthesis” perspective.

This confluence of product and service innovation is in sharp contrast to the ongoing debate about the differences between product and service innovation that permeates the innovation literature. For instance, Storey et al. (2016) identify the different antecedents of successful product versus service innovation, but it is only at the end of their article that they mention (in passing) that many manufacturers add services to their product offerings and that “As part of this servitization process, they need to adapt their innovation practices and capabilities to recognize the differences between services and products” (Storey et al., 2016: 545).

Research, however, shows that the managerial challenges of firms are not as simple as just recognizing the differences between products and services. Product-related services are not always developed independently and then sold in combination with the product; they are often developed simultaneously. This means that products and services are not developed in vacuums and suggests a complex integration is needed between product and service innovation, which in turn requires firms to deal with various organizational challenges, such as establishing a product-service culture, delivering integrated offerings and implementing various cross-functional competencies (Gebauer et al., 2008; Martinez et al., 2010; Paiola, Saccani, Perona, & Gebauer, 2013). Rapaccini, Saccani, Pezzotta, Burger, and Ganz (2013) describe how product manufacturers go through a series of capabilities-developing stages, each with its own characteristics and challenges, when they add product-services to their product mix.

5.1.6. Firms selling mixed product-service offerings focus on innovation

It is not just that the firms selling mixed product-service offerings are more ubiquitous; this study's findings also show that these firms are most committed to innovation. They spend about 50% more on R&D than firms at the extremes of the product-service spectrum, are almost twice as likely to use innovation revenue growth targets than services-dominant firms, and their innovation revenue goals (27.7% and 21.3% of sales) are 2.5 to 3 times higher than those of services-dominant firms (8.7%). For firms whose mixed offerings focus on products, innovation revenue targets are even higher than those of products-dominant firms (22.9%) (Table 2). The prevalence of firms offering mixed product-service offerings, together with their more ambitious approach to innovation, suggests that a successful synthesis of product and service innovation ultimately may have the highest potential for improving innovation performance in most firms. Unfortunately, the characteristics, challenges and benefits of such an integrated approach to product and service innovation represent uncharted territory and are in dire need of further research.

5.2. Managerial implications

Our findings als have several implications for managers in B2B firms. First, services-focused B2B firms may improve their innovation efforts by focusing more explicitly on innovation by using a proactive innovation strategy and establishing a culture that actively manages for innovation. The recent meta-analysis by Storey et al. (2016) identified

both an innovation strategy and innovation culture as two of the most influential antecedents of service innovation performance. Thus, more explicit management for innovation is expected to have a positive impact on innovation performance, both in terms of commercial success and strategic competitive advantage.

Second, all B2B firms may improve their innovation performance by implementing better screening methods to identify less promising innovation projects at early stages of the development process. These improved screening methods should be accompanied by the required procedures and discipline to implement them correctly and prevent internal social-political processes from tampering with these methods (Maute & Locander, 1994).

Third, B2B firms need to experiment with and develop approaches to simultaneously develop related new products and services (Kuijken, Gemser, & Wijnberg, 2017; Park, Geum, & Lee, 2012; Raja, Bourne, Goffin, Çakkol, & Martinez, 2013). In the absence of guidance from the innovation literature, B2B firms need to develop their own successful approaches and share best practices across their subsidiaries and divisions (Ulaga & Reinartz, 2011).

5.3. Limitations and future research

Certainly, the PDMA CPAS studies have inherent limitations in their methodology (Lee & Markham, 2016). The largest one, of course is that the performance measures are perceptual, not objective, and, for our purposes, relative to their own industry and objectives, which makes assessing the absolute performance of services- versus products-focused firms impossible.

In addition, there is another limitation in how the CPAS data were used here. The survey did not contain questions that allowed firms to self-select into different categories or levels of service/product provision or provide us with a direct numerical estimate (0–100%) of the proportion of products versus services they have commercialized. Thus, we used the average of three items associated with the overall intangibility of their offerings as an indirect proxy of their portfolio's service/product balance. But the intangibility of the firms' offerings is only a rough metric to characterize a firm's products/services mix for three reasons. First, although intangibility is considered to be the key defining characteristic of services (Wolak, Kalafatis, & Harris, 1998, Zeithaml et al., 1985), other characteristics can be used to distinguish products from services (Fisk et al., 1993; Moeller, 2010; Zeithaml et al., 1985). Second, there is no generally accepted scale available to measure the intangibility of an offering. Indeed, banks, hospitals and restaurants offer different combinations of tangible and intangible elements and the perception of their relative importance may depend on the context (Santos, 2002). Third, intangibility is a complex, multifaceted concept. For instance, Bebko (2000) argues that for services intangibility exists not only in the service output, but also in the service process. This suggests a need for more research into the multifaceted nature of intangibility and its effects on the innovation efforts of firms.

Another major direction for future research is based on our finding that nearly half of the B2B firms have offering streams dominated by neither products nor services. Because these firms focus on hybrid product-service-systems and represent the current complexity of many B2B firms, additional research addressing the synthesis of product and service innovation is warranted. While several authors have investigated the strategies and capabilities of firms moving along the products-services spectrum towards hybrid offerings (Gebauer et al., 2008; Martinez et al., 2010; Paiola et al., 2013; Rapaccini et al., 2013), it is not clear what this suggests for successful innovation. Research specifically investigating how firms may simultaneously develop integrated products and services is needed, which may initially require a qualitative research approach, as this is a complex phenomenon about which little is understood.

In addition, more research is also needed about “pure service” development. For instance, it remains unclear how the various service characteristics impact the service innovation process. Future research should focus on developing a comprehensive, streamlined, innovation process model specifically designed and optimized for a pure service development context. Researchers also need to investigate how such a baseline pure services innovation process model needs to be adapted to different service types. The current service innovation literature tends to lump all services together, even though significant differences exist between different types of services, such as financial, professional, customer, product and experiential services (Hipp & Grupp, 2005; Paswan, D'Souza, & Zolfagharian, 2009). While some services are more like products (financial services), or closely linked to products (remote monitoring of manufacturing equipment), others rely heavily on the expertise of highly-qualified personnel (consulting) or the total holistic customer experience (theater shows). Service innovation scholars need to investigate the differences between different service sectors, because innovation activities vary across service sectors (Kuester et al., 2013).

Finally, there is the issue of what constitutes a radical service innovation, or if there even is such a project type. Certainly from the cycle time data, it would seem that how services firms define radical innovation differs from the standard product-based definition (Leifer et al., 2000).

With scholars and practitioners working in tandem, both B2B service firms and firms selling mixed product-service offerings stand to benefit from developing new innovation tools and concepts, which will ultimately improve the sophistication of and returns to service innovation for both pure services and services that are part of integrated product-service offerings.

Appendix A. Questions used in this study[a]

Topic	Survey questions
B2B vs B2C classification	What is your business unit's mix in terms of selling to the consumer market and B2B market? (Virtually all consumer markets and little, if any, B2B; 75% consumer and 25% B2B; 50% consumer and 50% B2B; 25% consumer and 75% B2B; virtually all B2B and little, if any, consumer)
Products/services offering mix	Ability to conduct a physical count of what we offer[b] Ability to store what we offer[b] Ability to display what we offer[b]
Innovation culture	

	Has a risk accepting culture: Thinking about the culture within your business unit, what percent of time does your organization reflect these values • Open to the constructive conflict that occurs within the innovation process • Failure is understood to be a natural part of the innovation process • Both innovation and risk-taking are valued for career development **Actively manages a culture for innovation:** Thinking about the culture within your business unit, what percent of time does your organization reflect these values • Recruitment parameters include consideration for innovation potential • Managers establish objectives in the areas of innovation including training, measures and results • These established objectives are used in the performance review process • Our organization is a learning organization • Effectively communicates its innovation values internally
Innovation strategy	Does your business unit have a specific strategy for its new product activities that directs and integrates the entire new product program? Does your business unit target a certain portion of revenue growth to come from internal new product development? If yes, percentage of sales from products commercialized. Over the last how many years? Which of the following best describes your business unit's innovation strategy? • We value being first with new products, markets and technologies, even though not all efforts prove profitable. We respond rapidly to early signals concerning areas of opportunity • We are seldom first to market with new products. However, by carefully monitoring the actions of major competitors, we are frequently a fast follower, bringing a more cost-efficient or perhaps more innovative product into the market very rapidly • We attempt to locate and maintain a secure niche in a relatively stable product or service area. We try to protect our niche by offering higher quality, superior service, lower prices, etc. We ignore industry changes that have no direct influence on current areas of operations • We are usually not as aggressive in maintaining established products and markets as our competitors. Rather, we respond in those areas when forced to by environmental pressures
R&D spending	What percentage of total revenue is spent on R&D/new product development within your business unit? Percent of total new product development budget spent on products Percent of total new product development budget spent on services Percent of R&D dollars allocated to radical innovations Percent of R&D dollars allocated to more innovative projects Percent of R&D dollars allocated to incremental innovations
Intellectual property	Intellectual property is defined as patents, trademarks, trade secrets, and copyrights. How often do you use intellectual property as a major component of your business unit's new product strategy?
Innovation process	What most closely describes your business unit's product development process? • No standard approach to new product development • While no formally documented process is followed, we follow a clearly understood path of the tasks to be completed in product development • We have a formally documented process where one function completes a set of tasks, then passes the results on to the next function, which completes another set of tasks • We have a formally documented process where a cross-functional team completes a set of tasks; management reviews the results and gives the go-ahead for the team to complete the next set of cross-functional tasks What percent of your business unit's total new product ideas/concepts (100%) reach each stage of the development process below, whether you use this process formally or not: idea screening, business analysis, business development, test and validation, commercialization
Innovation cycle times	For a typical project, in each of the categories (radical innovations, more innovative projects, incremental innovations), please indicate the typical length of time (in weeks) spent on each of these activities. Please enter a zero if the activity is not performed: • Product line planning: Analyze the business unit's product portfolio vis-à-vis the competitive arena • Project strategy development: Determine this project's place in the product line, delineate the target market, determine market need and attractiveness • Idea/concept generation: Identify opportunities and initiate generation of possible solutions • Idea screening: Sort and rank solutions, eliminate unsuitable and unattractive options • Business analysis: Evaluate the concept financially, write business case, prepare protocol/development contract • Design and development: Convert concept into a working product • Test and validation: Product use, field, market and regulatory testing with customers • Manufacturing development: Develop and pilot the manufacturing process • Commercialization: Launch the new product or service into full-scale production and sales • Process review: Post-launch review and evaluation of the development process • Results Monitoring: Implement a process for ongoing measurement of selected outcomes

Innovation performance	Our new product program meets the performance objectives set out for it[c] Overall, our new product program is a success[c] Please mark the one phrase best describing your business unit's overall new product success as compared with your primary competitors over the past 5 years. Would you say you are..? • The most successful in our industry • In the top third of our industry • In the middle third of our industry • In the bottom third of our industry For new product programs, please provide estimates for the past five years of the following: • Total number of new products commercialized over last 5 years • Average new product sales as a % of total sales over last 5 years • Average new product profits as a % of total profits over last 5 years Based upon your business unit's definition of a successful new product, about what % of all the new products introduced into the market during the last 5 years were successful? And, what percentage would you estimate were successful in terms of their profitability to the business unit? • % on time, % on budget, % met technical objectives, % met market objectives, % successful, % successful in profitability

[a] Source: 2012 PDMA CPAS Questionnaire.
[b] 1 = never, 2 = about 25% of the time, 3 = about 50% of the time, 4 = about 75% of the time, 5 = virtually always.
[c] 1 = disagree, 4 = neutral, 7 = agree.

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