SMART SERVICES INITIATIVES IN PRODUCT-CENTRIC COMPANIES

Mario Rapaccini & Paolo Gaiardelli

ABSTRACT

Purpose: This paper investigates the linkages between servitization strategies and digital technologies, pointing out the characteristics of technology-enabled services (i.e. smart services) offered by manufacturing companies.

Design/methodology/approach: An extensive literature review is provided to build a theoretical framework linking servitization strategies and digital technologies.

Findings: Digital technologies have different role as they enable incremental, product-dominated servitization rather than radical, service-oriented/customer-centric servitization.

Originality/value: this paper represents the first attempt to shed light on the linkages among digital technologies and servitization strategies, building on interdisciplinary research on technology-driven service innovation, servitization of manufacturing companies and on studies from service dominant logic and service science.

Key words: technology-enabled services, servitization strategies, ICTs, digital technologies, smart services.

1. INTRODUCTION

Digital technologies are radically changing the way services are delivered (Ostrom et al. 2010, Davis et al. 2011) so that it is said that "the service revolution and the information revolution are two sides of the same coin" (Rust 2004, p. 24). Although innovation driven by new technologies is examined so far in service management research (Barret et al. 2015), scholars dealing with servitization of manufacturing firms have still "a limited awareness or appreciation of the use of information and communication technologies that are enabling many servitized manufacturers to deliver sophisticated product-centric service offerings" (Lightfoot et al. 2013, p. 1421). Despite previous research widely debated on servitization (Oliva & Kallenberg 2003, Neely 2008, Baines et al. 2009), few studies have focused on the role of digital technologies (Kowalkowski & Brehmer 2008, Kowalkowski et al. 2013, Grubic 2014). This paper aims at filling this gap as it investigates: 1) the linkages between servitization strategies and technology-enabled service-based offerings (hereafter, smart services); 2) the characteristics of smart services initiatives in B2B and B2C settings. The rest of the paper is, therefore, organised as follows. Section 2 introduces previous studies on servitization together with a brief review of the literature dealing with digital technologies in service innovation. Section 3 presents the research framework, which is discussed in Section 4, while Section 5 draws some conclusions and points out limitations and avenues of future research.

2. THEORETICAL BACKGROUND

This literature review is composed of two sub sections, which cover servitization strategies and digital technologies in servitization.

2.1 Servitization strategies

A wide range of internal and external factors can influence servitization strategies (Cook et al. 2006). Moreover, extent literature suggests that ideal trajectories to shift to a service-based business do not exist (Ulaga & Reinartz 2011, Kowalkowski 2014). Research also confirms that companies embarking upon a servitization journey move within a continuum, characterised by varying levels of product-service sophistication (Lay et al. 2010), in which multiple positions are possible at the same time. Many models, adopting different perspectives and combinations of descriptive characteristics,

have been suggested to illustrate how the change of product-service offering translates into differing levels of servitization (Oliva & Kallenberg 2003, Smith et al. 2012, Baines & Lightfoot 2013).

However the majority of accepted classifications focus mostly on customer support services provided to industrial equipment (i.e. in B2B settings). Another perspective - more general as it refers to both B2C and B2B settings - is taken by Tukker (2004), who clusters product-services in three main types, each one characterised by a specific value content and by different degrees of goods ownership, use and the decision making power. Product-oriented services enhance the utility that the ownership of the product delivers to the customer during the overall product life cycle (from pre-sales to dismantling). Use-oriented services that include leasing, renting and pooling schemes), do not entail a direct ownership of the product-service solution by the customer, who has the faculty to directly use the solution provided and owned by an external party. In case of result-oriented services the provider supplies a complete solution to fulfil a specific need of its customer, who does not use directly the solution, but takes advantage of its main outcome. In this paper, we adopt this latest model to classify the degree of servitization of a manufacturer.

2.2. ICTs and servitization

In general terms, digital technologies are claimed to be key in the servitization of manufacturing firms (Kindström & Kowalkowski 2009, Storbacka 2011). For instance, Raddats et al. (2015) affirms that a contribution to service success requires investments in information and communication technologies, while Ulaga & Reinartz (2011) state that advanced ICTs are crucial to develop capabilities to collect, analyse and interpret field data from installed bases. Digital technologies in servitizing firms include condition monitoring systems (Turunen & Finne 2014), mobile devices and appliances for employees and customers of service divisions (Fano & Gershman 2002), information systems that enable field operations (Kowakolsky et al. 2014), CRM and ERP systems (Storbacka 2011). Geum et al. (2011) and Park et al. (2012) agree that firms leverage technologies to integrate and combine product and services, in order to deliver higher value with relevant social and environmental benefits (Tukker 2004, 2013). In their shift to a service business, manufacturers focus firstly on technologies that increase the efficiency of service operations (Agnihothri et al. 2002,Kowalkowski & Brehmer 2008), due to the standardisation of the service delivery process (Brax & Jonsson 2009). Then, as service orientation becomes more intense, ICTs are used to differentiate, extend and complement the company's offering (Kindström & Kowalkowski 2009, Belvedere et al. 2013) and subsequently to get a competitive advantage. Harmon et al. (2011) show that firms can exploit technologies to design solutions that are radically new, in order to create breakthrough innovation and influence the forming and functioning of the entire service ecosystem (Lusch & Vargo 2014). The more the actors engaged in services shared data and information via digital technologies, the more knowledge generates and spreads across, thus favouring open innovation (Mustak 2014).

Another topic examined by scholars concerns the impact of technology on customer-provider interfaces (Kowalkowski & Brehmer 2008). Technology infusion, in fact, induces automation that, in turn, releases distance and opening hours constraints, thus favouring the raise of self-service and super-service options (Campbell et al. 2011). Subsequently, technology-facilitated services show reduced costs and higher efficiency due to fewer customer-provider interactions. However, the decrease in human contact can lead to noteworthy dissatisfaction as long as customers face negative experiences with the technological interfaces (Bitner et al. 2010).

Despite the conspicuous amount of researches dealing with technology-driven service innovation in service business, this argument remains largely unexplored in the domain of product-centric servitization. Remarkable exceptions are provided by Allmendinger & Lombreglia (2005), Antioco (2008), Baines & Lightfoot (2013), Kowalkowski et al. (2013), Belvedere et al. (2013). In particular Antioco (2008) and Kowalkowski et al. 2013 state that new technologies may impact differently on service orientation. While Services Supporting Products (SSPs) can be easily standardized to offer a

"digital version", Services Supporting Customers (SSCs) always show a big deal of variety due to people interactions and customer-specific situations. Thereby, "technology may not be appropriate in the context of an SSC business orientation given that these services are directed at the client and customized rather than to the product and standardized" (Antioco et al. 2008, p. 351). A similar duality appears in Wünderlich et al. (2013), who claim a lower customer acceptance of what is called "high-tech services" in comparison to "high-touch services". The first are fully or partly automated and can be delivered with few or no human contributions, such as smart self-services. The second are - conversely - smart interactive services in which customer and provider collaborate through a technological support. For instance, in case of collaborative remote maintenance of an industrial equipment, the field technician interacts with a remote specialist to diagnose and repair the machine. As shown by Rapaccini et al. (2014), there is growing interest for experimenting new technologies - such as Augmented Reality - in these applications. Another issue concerns the definition of smart services. Allmendinger & Lombreglia (2005) define smart those services that - due to product awareness and connectivity - are "fundamentally preemptive rather than reactive" (p. 2). As sensing technologies, connectivity and computers become integral to products, customer support is delivered on the basis of what products unveil about their status. As long as billions of data are collected, insights about how customers use products to create value are gained (Porter & Heppelmann 2014). Authors theorise that manufacturing firms can make a big deal of money exploiting these incredible knowledge (Evans & Annunziata 2012). For instance, GE uses these data to provide decision support services via a cloud platform that is expected to reach more than $1 billion revenues in 2015 (Iansiti & Lakhani 2014). Opresnik & Taisch (2015) suggest, therefore, the emergence of big data strategy in servitization. Up to now, however, prevailing applications of ubiquitous computing are finalised to develop diagnostic systems (Grubic et al. 2008, Grubic 2014), tele-maintenance (Jonsson et al. 2008) and support logistics (Dekker et al. 2013). In particular, solutions for remote condition monitoring of complex industrial equipment are remarkably spreading in UK (Grubic et al. 2011) as well as in US (Aberdeen 2014). This raises questions about what really customers expect from this kind of smart services (Paluch 2014, Grubic 2014), and in what cases these technologies are not accepted (Walker et al. 2002, Wünderlich et al. 2013). To the first concern, Baines and Lightfoot (2013) suggest that remote monitoring systems must monitor, transmit, store, analyse, and respond, this latter function establishing "any necessary actions that are required (e.g. repair, inform customer, arrange maintenance)" (p. 17).

3. RESEARCH FRAMEWORK AND DESIGN

3.1 Research framework

Building on the reviewed contributions, we structured the research framework to examine the role of ICTs in servitized firms [as shown in Table 1].

3.2 Research design

Since our research focuses on a how- and why- type question about a contemporary phenomenon not yet thoroughly researched, a case-based approach was selected as the most appropriate methodology (Yin 2009). First of all, we defined our conceptual framework, based on literature review (Voss, Tsikriktsis & Frohlich 2002). Then we selected our cases form a population of potential companies that have a well-known history of adopting servitization and smart services. Specifically, we selected five manufacturers that could bring an exhaustive description of the treated issues and thus allow a comprehensive vision of the investigated phenomenon in diverse industries. On the other hand, we chose companies that do not show any redundancy among them. During case studies, data were gathered in the field. The methods, instruments, procedures and general rules to be followed in carrying out the data collection were included in the case study protocol, obtained by synthesising the conceptual framework into semi-structured interviews, that were carried out by two of the authors in order to increase the reliability of the study, interviewing a number of

management personnel at all the case companies, e.g. CEO, CTO, Head of Strategic Innovation, Service Director. Supplementary methods of data gathering were also used to triangulate the data obtained from the interviews, also strengthening the construct validity of our study. The results were finally used to build and discuss the theoretical framework related to smart services for servitization. Because of space constraints, description of cases is not included in this paper.

Criteria	*Options*			
Degree of servitization	Product-oriented	Use-oriented		Result-oriented
Prevailing business logic	Good-dominant, technology-enabled innovation is company- and/or product-centric		Service-dominant, i.e. technology-enabled innovation is driven by customer, value network and ecosystems (open innovation)	
Type of innovation	Incremental and conservative, purposed to exploit state-of-the art service technologies in product-centric businesses		Radical and disruptive, purposed to create "blue ocean" market and to change the company's business model	
Type of technology	Enterprise information systems (ERP, CRM, service management systems, asset management systems, field force automation, contact centre/help desk technologies	Health management systems, remote condition monitoring, systems, diagnostic & prognostic		Mobile applications, smartphones - customer registering, demand for and access to services, ubiquitous/wearable computing
Technology is applied to/for	*Product* Detect incipient faults, prevent outages and improve recovery activities (due to early problem resolution)	*Logistic* Support service provider process, increase efficiency and save resources of field operations	*Delivery channels* Enable demand for services anytime - everywhere and access to the resources of the service system	*Value creation process* Support customer and contextually collect data about actual needs
Service options and level of automation	Automated service M2M high tech services *"the machine will do it for you"*	Super-service H2M high tech services *"I'll do it for you"*	Self-service M2H high tech services *"do it yourself"*	collaborative services H2H high touch services *"let' do it together"*
Data sources and types	Products, product status, operating conditions, incipient faults	Service process - technicians and work order status and availability, fieldwork programs, spares parts logistic	Customers - service requests, booking, notification of arrival, product usage, contracts, dynamic pricing, billing and invoicing	Environment/ecosystems, resource status and

Table 1: The role of ICTs in enabling servitization of manufacturing companies (morphology framework)

4. DISCUSSION

In this section we show how ICTs are actually used to support different levels of servitization. A first situation that was observed in our research refers to a kind of "digital servitization" that appears "product-dominated". In this case, the focus is on those technologies that can enable the development or improvement of technology-enabled product-oriented PSSs (Tukker 2004). In fact, a growing number of manufacturing companies - especially in B2B context (Grubic 2014) - use ICTs to become more responsive in providing base/intermediate services (Baines & Lightfoot 2013). By introducing sensors, connectivity and awareness into new products, as well as injecting latest technologies into the existing installed bases, firms can deliver smart services in the form of longer/better customer support super-services (Campbell et al. 2011). In such a situation, ICTs is leveraged to save resources and – at the same time - differentiate the quality of the company's offering. Thus, if adopted successfully, digital technologies can affect the orientation of the firm towards a service business (Kowalkowski et al. 2013). However, innovation of the company's offering is inherently incremental, as suggested by Oliva & Kallenberg (2003). In fact, introducing remote monitoring, diagnostic and health assessment, service logistics traceability, firms can deliver faster product recovery, achieve higher availability of products and spares, as well as a more efficient deployment of field-force. In these cases, the company's information system needs to be extended

and integrated to handle new kind of data, such as entitlements of service contracts, knowledge repositories for product troubleshooting, availability of technicians and spares across the field service network, etc.

In addition to the type of digital servitization described above, we observed other situations in which technology is introduced to address unexplored customer needs. Subsequently, radically new business models can be enabled. Sensors and connectivity embedded into products are used not only to monitor health conditions remotely, but also to record intensity of use, activate pay-per-use billing and enable automatic payment. In these cases, digital technologies facilitate the development of smart services initiatives that meet the characteristics of use-oriented PSS (Tukker 2004), in which products can thus be leased, rented, or even shared among multiple customers. Our research shows that these kinds of innovation are more common in – but not limited to - B2C settings, and require more active participation of customers as the whole service process is often delivered in the form of self-service (Campbell et al. 2011). In case these initiatives are based on shared products, customers use smartphone apps or smart cards to demand for and access to the offered services anytime/everywhere. On the supply side, ICTs are used to manage the ecosystem resources and preventively adapt capacity and match demand peaks. Capabilities of connecting customers – besides products –brings manifold opportunities for extending the service system boundaries, deliver services to every location where customers could move, and collect continuously data about their needs and their willingness to pay for new services. Therefore, this kind of digital servitization is undoubtedly driven by service-dominant logic approach. Last, it has been observed a third use of technology to deliver platform-based services, in which the provider leverages technologies to interconnect manifold resources – not only its products and it customers, and create a service-business ecosystem. Although less common, this kind of digital servitization allows to the platform provider to exploit data in order to offer advanced services such as remote configuration and process optimization, that are central to the development of outcome-base PSS offerings. Our research shows that these services are necessarily based on agreements between customer and provider about value expectations and outcomes, and usually require a combination of automation and interactivity (i.e. technology-enabled value co-creation).

5. CONCLUSIONS

By using digital technologies, manufacturing companies that are shifting to a service-based business can get more aware of their customers' true needs and develop more powerful channels to deliver smart services. This research shows that various technologies can be key for servitizing firms in respect to the kind of service-based offerings. Although more research is needed to confirm these findings, contribution of this paper is twofold: a) it clarifies concepts from interdisciplinary research that are crucial to examine technology-driven service innovation in servitizing firms, and puts in relation digital technologies to the kind of product-service offering; b) it shows the different characteristics of smart service initiatives by manufacturing companies. Main limitation of this study comes from not considering the generative power of digital technologies, that can facilitate combinatorial innovation by the actors engaged in the service system (Barret et al. 2015). This is also the first suggested avenue of future research.

REFERENCES

Aberdeen, 2014, 'Smart Machines Lead To Smarter Service: Remote Intelligence Drives Profitable Internet of Things', Available at: http://www.aberdeen.com/research/8610/RR-smart-machines-service.aspx/content.aspx#sthash.hM3vWWE0.dpuf, accessed on Feb, 26, 2015.

Agnihothri, S., Sivasubramaniam, N., & Simmons, D., 2002, 'Leveraging technology to improve field service', *International Journal of Service Industry Management*, 13(1), 47-68.

Akaka, M. A., & Vargo, S. L., 2014, 'Technology as an operant resource in service (eco) systems', *Information Systems and e-Business Management*, 12(3), 367-384.

Allmendinger, G., & Lombreglia, R., 2005, 'Four strategies for the age of smart services', *Harvard Business Review*, 83(10), 131.

Antioco, M., Moenaert, R. K., Lindgreen, A., & Wetzels, M. G., 2008, 'Organizational antecedents to and consequences of service business orientations in manufacturing companies', *Journal of the Academy of Marketing Science*, 36(3), 337-358.

Auramo, J., & Ala-Risku, T., 2005, 'Challenges for going downstream', *International Journal of Logistics: Research and Applications*, 8(4), 333-345.

Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M., 2009, 'The servitization of manufacturing: A review of literature and reflection on future challenges' *Journal of Manufacturing Technology Management*, 20(5), 547-567.

Baines, T., & Lightfoot, H. W., 2013, 'Servitization of the manufacturing firm: Exploring the operations practices and technologies that deliver advanced services' *International Journal of Operations & Production Management*, 34(1), 2-35

Barrett, M., Davidson, E., Prabhu, J., & Vargo, S. L., 2015, 'Service innovation in the digital age: key contributions and future directions' *MIS Quarterly*, 39(1), 135-154.

Belvedere, V., Grando, A., & Bielli, P., 2013, 'A quantitative investigation of the role of information and communication technologies in the implementation of a product-service system', *International Journal of Production Research*, 51(2), 410-426.

Bitner, M. J., Zeithaml, V. A., & Gremler, D. D., 2010, 'Technology's impact on the gaps model of service quality' In Handbook of service science. Springer, New York, 197-218.

Brax, S. A., & Jonsson, K., 2009, 'Developing integrated solution offerings for remote diagnostics: A comparative case study of two manufacturers', *International Journal of Operations & Production Management*, 29(5), 539-560

Campbell, C. S., Maglio, P. P., & Davis, M. M., 2011, 'From self-service to super-service: a resource mapping framework for co-creating value by shifting the boundary between provider and customer', *Information systems and e-business management*, 9(2), 173-191.

Cook, M. B., Bhamra, T. A., & Lemon, M., 2006, 'The transfer and application of Product Service Systems: from academia to UK manufacturing firms', *Journal of Cleaner Production*, 14(17), 1455-1465.

Davis, M. M., Spohrer, J. C., & Maglio, P. P., 2011, 'Guest editorial: How technology is changing the design and delivery of services', *Operations Management Research*, 4(1-2), 1-5.

Dekker, R., Pinçe, Ç., Zuidwijk, R., & Jalil, M. N., 2013, 'On the use of installed base information for spare parts logistics: A review of ideas and industry practice' *International Journal of Production Economics*, 143(2), 536-545.

Evans, P. C., & Annunziata, M., 2012, 'Industrial internet: Pushing the boundaries of minds and machines', General Electric, 21.

Fano, A., & Gershman, A., 2002, 'The future of business services in the age of ubiquitous computing', *Communications of the ACM*, 45(12), 83-87.

Geum, Y., Lee, S., Kang, D., & Park, Y., 2011, 'Technology roadmapping for technology-based product–service integration: A case study', *Journal of Engineering and Technology Management*, 28(3), 128-146.

Grubic, T., Redding, L., Baines, T., & Julien, D., 2011, 'The adoption and use of diagnostic and prognostic technology within UK-based manufacturers', *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 225(8), 1457-1470.

Grubic, T., 2014, 'Servitization and remote monitoring technology: A literature review and research agenda', *Journal of Manufacturing Technology Management*, 25(1), 100-124.

Jonsson, K., Westergren, U. H., & Holmström, J., 2008, 'Technologies for value creation: an exploration of remote diagnostics systems in the manufacturing industry', I*nformation Systems Journal*, 18(3), 227-245.

Kindström, D., & Kowalkowski, C., 2009, 'Development of industrial service offerings: a process framework', *Journal of Service Management*, 20(2), 156-172.

Kindström, D., & Kowalkowski, C., 2014, 'Service innovation in product-centric firms: a multidimensional business model perspective', *Journal of Business & Industrial Marketing*, 29(2), 96-111.

Kowalkowski, C., & Brehmer, P. O. , 2008, 'Technology as a driver for changing customer-provider interfaces: evidence from industrial service production', *Management research news*, 31(10), 746-757.

Kowalkowski, C., Kindström, D., & Gebauer, H., 2013, 'ICT as a catalyst for service business orientation', *Journal of Business & Industrial Marketing*, 28(6), 506-513.

Kowalkowski, C., Windahl, C., Kindström, D., & Gebauer, H., 2014, 'What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies', *Industrial Marketing Management*, doi: 10.1016/j.indmarman.2015.02.016, in press.

Harmon, R. R., Demirkan, H., & Chan, E., 2011, 'Redefining market opportunities through technology-oriented service innovation, In Technology Management in the Energy Smart World (PICMET), 2011 Proceedings of PICMET'11: (pp. 1-10). IEEE.

Helander, A., & Möller, K., 2007, 'System supplier's customer strategy', *Industrial Marketing Management*, 36(6), 719-730.

Iansiti, M., & Lakhani, K. R., 2014, 'Digital Ubiquity: How Connections, Sensors, and Data Are Revolutionizing Business (Digest Summary)', *Harvard Business Review*, 92(11), 91-99.

Lay, G., Copani, G., Jager, A., & Biege, S., 2010, 'The relevance of service in European manufacturing industries', *Journal of Services Marketing*, 21(5), 715-726.

Lightfoot, H. W., Baines, T., & Smart, P., 2011, 'Examining the information and communication technologies enabling servitized manufacture', *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture*, 225, 1-5.

Lightfoot, H. W., Baines, T., & Smart, P., 2013, 'The servitization of manufacturing: A systematic literature review of interdependent trends', *International Journal of Operations & Production Management*, 33(11/12), 1408-1434.

Lusch, R. F., & Vargo, S. L., 2014, 'Service-dominant logic: Premises, perspectives, possibilities', Cambridge University Press.

Maglio, P. P., & Spohrer, J., 2013, 'A service science perspective on business model innovation', *Industrial Marketing Management*, 42(5), 665-670.

Mustak, M., 2014, 'Service innovation in networks: a systematic review and implications for business-to-business service innovation research', *Journal of Business & Industrial Marketing*, 29(2), 151-163.

Neely, A., 2008, 'Exploring the financial consequences of the servitization of manufacturing', *Operations Management Research*, 1(2), 103-118.

Oliva, R., & Kallenberg, R., 2003, 'Managing the transition from products to services', *International Journal of Service Industry Management*, 14(2), 160-172.

Opresnik, D., & Taisch, M., 2015, 'The value of big data in servitization', *International Journal of Production Economic*s. Doi: 10.1016/j.ijpe.2014.12.036, in press.

Ostrom, A. L., Bitner, M. J., Brown, S. W. Burkhard, K. A., Goul, M., Smith-Daniels, V., Demirkan, H., & Rabinovich E. 2010, 'Moving forward and making a difference: research priorities for the science of service', *Journal of Service Research*, 13(1), 4-36.

Paluch, S., 2014, 'Customer expectations of remote maintenance services in the medical equipment industry', *Journal of Service Management*, 25(5), 639-653.

Park, Y., Geum, Y., & Lee, H., 2012, 'Toward integration of products and services: Taxonomy and typology', *Journal of Engineering and Technology Management*, 29(4), 528-545.

Penttinen, E. & Palmer, J., 2007, 'Improving firm positioning through enhanced offerings and buyer-seller relationships', *Industrial Marketing Management*, 36(5), 552-564.

Porter, M. E., & Heppelmann, J. E., 2014, 'How Smart, Connected Products Are Transforming Competition', *Harvard Business Review*, 92, 11-64.

Raddats, C., Burton, J., & Ashman, R., 2015, 'Resource configurations for services success in manufacturing companies', *Journal of Service Management*, 26(1).
Rapaccini, M., & Porcelli, I., 2013, 'How Advances of ICT will Impact on Service Systems and on the Delivering of Product-Related Services', In Advances in Production Management Systems. Sustainable Production and Service Supply Chains (pp. 57-64). Springer Berlin Heidelberg.
Rapaccini, M., Porcelli, I., Espíndola, D. B., & Pereira, C. E., 2014, 'Evaluating the use of mobile collaborative augmented reality within field service networks: the case of Océ Italia–Canon Group', *Production & Manufacturing Research*, 2(1), 738-755.
Rapaccini, M., 2015, 'Pricing strategies of service offerings in manufacturing companies: A literature review and an empirical investigation, *Production Planning & Control*, forthcoming.
Rust, R. T., 2004, 'If everything is service, why is this happening now, and what difference does it make', *Journal of Marketing*, 68(1), 23-24.
Smith, L., Ng, I., & Maull, R., 2012, 'The three value proposition cycles of equipment-based service', *Production Planning & Control,* 23(7), 553-570.
Storbacka, K., 2011, 'A solution business model: Capabilities and management practices for integrated solutions', *Industrial Marketing Management*, 40(5), 699-711.
Tukker, A., 2004, 'Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet', *Business strategy and the environment*, 13(4), 246-260.
Tukker, A., 2013, 'Product services for a resource-efficient and circular economy-a review', *Journal of Cleaner Production*, doi: 10.1016/j.jclepro.2013.11.049, in press.
Turunen, T., & Finne, M., 2014, 'The organisational environment's impact on the servitization of manufacturers', *European Management Journal*, 32(4), 603-615.
Ulaga, W., & Reinartz, W. J., 2011, 'Hybrid offerings: how manufacturing firms combine goods and services successfully', *Journal of Marketing*, 75(6), 5-23.
Voss, C.A., Tsikriktsis, N., & Frohlich, M., 2002, 'Case research in operations management', *International Journal of Operations & Production Management*, 22(2), 195-210.
Walker, R. H., Craig-Lees, M., Hecker, R., & Francis, H., 2002, 'Technology-enabled service delivery: An investigation of reasons affecting customer adoption and rejection', *International Journal of Service Industry Management*, 13(1), 91-106.
Windahl, C., Andersson, P., Berggren, C., & Nehler, C., 2004, 'Manufacturing firms and integrated solutions: characteristics and implications', *European Journal of Innovation Management*, 7(3), 218-228.
Wünderlich, N. V., Wangenheim, F. V., & Bitner, M. J., 2013, 'High Tech and High Touch A Framework for Understanding User Attitudes and Behaviors Related to Smart Interactive Services', *Journal of* Service Research, 16(1), 3-20.
Yin, R. K., 2009, *Case Study Research: Design and Methods*, Sage Publications, Thousand Oaks, CA.

ACKNOWLEDGMENTS

This paper has been inspired by research carried out at the ASAP Service Management Forum.

AUTHOR CONTACT DETAILS

Mario Rapaccini (mario.rapaccini@unifi.it)
IBIS Lab - Department of Industrial Engineering, University of Florence (Italy)
Paolo Gaiardelli (paolo.gaiardelli@unibg.it)
CELS - Department of Management Information and Production Engineering, University of Bergamo (Italy)