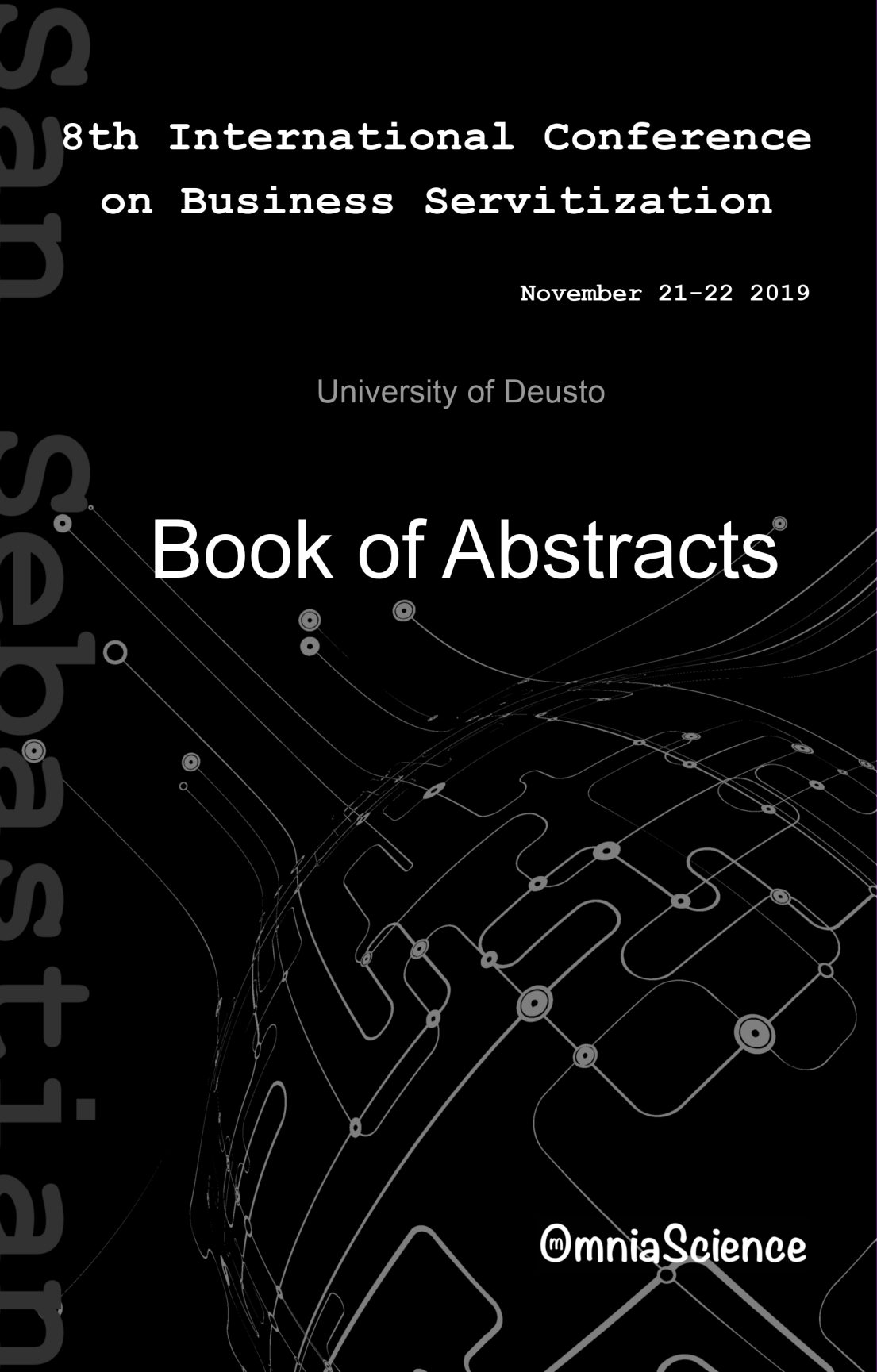
8th International Conference on Business Servitization

November 21-22 2019

University of Deusto

Book of Abstracts



OmniaScience

Book of Abstracts

8th International Conference on
Business Servitization

Deusto Business School, University of Deusto

San Sebastian, November 21-22, 2019

www.omniascience.com

DOI: https://doi.org/10.3926/serv2019

ISBN: 978-84-120643-4-6

Cover design: OmniaScience

Cover photo: © DouDou - Fotolia.com

Foreword

Welcome to 8th International Conference on Business Servitization

This book of abstracts summarizes the proceedings of the **8th International Conference on Business Servitization (ICBS 2019)**, held at Deusto Business School, university of Deusto, San Sebastian, Spain. On this edition, the conference places a special emphasis on the focal theme: New and Emergent approaches in servitization research.

The last three decades have seen a steady growth of interest in servitization – not only within manufacturers and service providers but also across the Management and Organizational literature. The study of servitization has evolved to become increasingly interdisciplinary, ranging from managerial aspects of strategy formulation and implementation to studies of the links between breakthrough technologies, business model innovation, and advanced service offerings. Thus, over the last decade, servitization has opened frontiers and expanded its scope to new fields, such as territorial competitiveness, engineering, ICT, Human resources, education, mobility, healthcare, innovation, sustainability, among others. Nowadays, servitization literature is well-established among the academic research and practitioner community, adding new

followers on an ongoing basis which expands the knowledge base and debate surrounding this field, provide new guidelines, and make servitization an increasingly competitive and attractive research topic.

Although servitization expands at a rapid pace, at this point, we consider a matter of the utmost importance to analyze what the future of servitization will be. In this way, we attempt to envisage the future lines of research, as well as, the main fields that will play a transcendental role in the future of servitization. To this aim, the present conference focuses on the following main premises:

How can interdisciplinary collaboration toward a common agenda be promoted and supported?

What are the future challenges of the servitization research field when considering the stock of accumulated academic knowledge and real-world trends? What will the research field look like in ten years?

How can the servitization community develop the domain further? Which are the alternative paths of advancing the field? What does each path involve and what the real implications for the field's development are in each case?

Does the domain have to develop following a single path? Alternatively, can the future development take many paths simultaneously?

This edition of the International Conference on Business Servitization (ICBS) aims at debating and shaping such critical questions for the future development of the field. Accordingly, the focus of this year is on multidisciplinary topics that may strengthen and consolidate emergent research perspectives, as well as, open new research directions in servitization literature. With more than 30 years as a field of research, servitization has grasped the attention of multiple management-related disciplines, becoming one of the most promising and integrative research themes emerged in the last few decades. This year's conference aims to discuss what are the future challenges of the servitization research field, and how can

the servitization community develop the domain further. To do so, we encourage academics in providing new and emergent theoretical lenses that can contribute to developing servitization-related research in the future.

The ICBS is a conference traditionally targeted to business professionals, policymakers and researchers. While the focus of this year's conference will be "New and Emergent approaches in servitization research", as in previous editions the organizers also endeavor to connect works related to other relevant issues linked with servitization such as business engineering, strategy, business models, international business, operations management, and supply chain management. The conference will engage current research on the emerging field of servitization, which focuses both on theoretical developments and on practical applications of the methods and techniques. The conference aims to provide a platform to the researchers and practitioners from both academia as well as industry to meet & share the cutting-edge developments in the field of servitization

In this 8th edition of the ICBS we have brought together 55 researchers from 30 Universities and Research Institutes located in 15 different countries across Europe and America. In summary, the conference is organized in twelve different parallel sessions that seek to fuel the academic debate around the different aspects of new and Emergent approaches in servitization research. Additionally, this year's conference welcomed two sessions of relevant keynote speakers. Day one session started with Prof. Vinit Parida (Luleå University of Technology) who delivered a presentation on "Digital business model innovation in industrial ecosystem". Day two session introduced Prof. Yipeng Liu (Henley Business School, University of Reading) who provided a presentation entitled "Servitization, collaborative partnerships and microfoundations". In the same line this year edition offered specialized sessions to

support pathways for publication to the community. On this occasion we counted with the participation of guest editors from highly ranked journals, such as: Technovation, International Journal of Operations & Production Management, and Sustainability.

Ferran Vendrell-Herrero, Director Scientific Committee
Lorea Narvaiza, Conference Chair
Marco Opazo, Conference Chair
Tontxu Campos, Conference Chair

Organizing Committee

Chairs of the Conference:

PhD. Lorea Narvaiza, University of Deusto
PhD. Marco Opazo, University of Deusto
PhD. Tontxu Campos, University of Deusto

Director Scientific Committee:

PhD. Ferran Vendrell-Herrero, University of Birmingham

Scientific Committee:

Prof. Yancy Vaillant, Toulouse Business School
Prof. Glenn Parry, University of Surrey
Prof. Andy Neely, University of Cambridge
Prof. Tim Baines, Aston University
Prof. Marko Kohtamäki, University of Vaasa
Prof. Yipeng Liu, Henley Business School
PhD. Oscar F. Bustinza, University of Granada
PhD. Emanuel Gomes, Nova SBE
Prof. Shlomo Tarba, University of Birmingham
Prof. Vinit Parida, Luleå University of Technology
PhD. Ivanka Visnjic, ESADE Business School
PhD. Esteban Lafuente, Universitat Politècnica de Catalunya
PhD. Bart Kamp, Orkestra-University of Deusto
PhD. Rodrigo Rabetino, University of Vaasa
PhD. Chris Raddats, University of Liverpool
PhD. Mª Luz Martín Peña, Rey Juan Carlos University

PhD. Esperanza Marcos, Rey Juan Carlos University

PhD. Marin Jovanovic, Copenhagen Business School

Organizing Committee:

PhD. Alberto de la Calle, University of Deusto

PhD. Aitor Garmendia, University of Deusto

PhD. Bart Kamp, Orkestra-Basque Institute of Competitiveness

PhD. Miguel Angel Larrinaga, University of Deusto

PhD. Meysam Moayery, University of Deusto

PhD. Eduardo Sisti, Orkestra-Basque Institute of Competitiveness

PhD. Kristina Zabala, University of Deusto

PhD. Arantza Zubiaurre, University of Deusto

Index

Parallel session 1

Managing Servitization in Distributor-Mediated Service Triads 19

The Impact of Service, Product and Process Innovation on Firm Performance: A Model of Interactions 25

Using the General Modular Systems Theory: Evidence from Servitization 33

Parallel session 2

Evaluating the Adoption of Integrated Project Teams as Strategic Form to Underpin PSI Systems in Servitizing Manufacturers 43

A Relational View on Industry 4.0: Governing Relationships in Digital Servitization 50

New Business Models in the Electricity Sector in the Framework of the Energy Transition Towards a Low Carbon Economy 58

IoT as Enabler for Smart Servitization in the Manufacturing Industry 62

Parallel session 3

Innovation in Servitization through Digital Technologies 71

Value Co-Creation Practices in Platform-Based PSI Systems: Cases from the Textile Sector in China 78

Servitization in Manufacturing SMEs: Exploring its Links with Industry 4.0 Implementation Drivers 90

Towards and Empirical Analysis of Relations between Territorial Servitization and Place Leadership 98

Parallel session 4

Treble Innovation Firms: Opening Innovation Frontiers in Manufacturing 107

Antecedents and Consequents of Service Innovation in Brazilian Medical Device Companies: The Moderating Effects of Digital Technologies 115

Data-driven Servitization of SMEs: Assessment of Success Factors based on a Multiple Case Study 120

Servitization of Manufacture and Spare Innovations: A Patent Citations Analysis 126

Applications of Internet of Things (IoT) and Blockchain for supply chain management in humanitarian Disasters 133

Parallel session 5

The Role of T-KIBS on the Innovation Performance of Manufacturing Firms: The Case of Mexico 137

Understanding the Service Market in an Era of Technological and Digital Disruption 142

Innovation Activities, Performance and Innovation Services in Manufacturing Firms from an Emerging Economy 149

Parallel session 6

Making it Practitioners-Friendly: A Service Design Toolkit for the Design of Advanced Services 159

Facilitate Value Capture by Creating an Understanding of Value Proposition Foundations 161

Requirement Design for Servitization 165

Parallel session 7

Challenges in the journey to services 169
Longitudinal Analysis of International Sales Growth of Highly Servitized Products: Best entry Strategies 176
The Relevance of Servitization for Ecoinnovation Activities among Manufacturing Firms 182
Servitization in Wind Power - a Complexity Perspective 186

Parallel session 8 Roundtable on business ecosystems

Parallel session 9

The Evolution of Digital Platforms: Exploring the Interplay between Digital Generativity and Solution Value Space 195
The Impact of Product-Service Innovation on Labor Productivity: Analysis of the Relevance of R&D Investments and Innovation-Driven Partnerships in Manufacturing Businesses 196
The Role of Service-oriented Technologies supported by KIBS in Enhancing Servitized Manufacturers' Performance 204
The Mediating Effect of Supply Chain Collaboration on the Relationship between Servitization and Firm's Innovation capability 209

Parallel session 10

Territorial servitization and the neighborhood coupling 217
Comparative Assessment of the Links between KIBS and Manufacturing Sectors in two Spanish Regions: Cataluña and Basque Country 222
Ecosystems as Coordination Mechanism for Value Creation in the Context of Servitizing SMEs 227

Parallel session 11

Understanding Innovation in Digital Product-Service Ecosystems – A Business Model Perspective 235

Applying a Transaction Cost Economics perspective to assess the commercial chances of machine tool builders to supply advanced services among their industrial clients 241

How are solutions co-produced in B2B? An investigation of servitizing manufacturing firms 245

Parallel session 12

Servitization: Allowing Better Solution Delivery and performance for Manufacturers of Longer Lifespan Products 255

Assessing the Role of KIBS Geographical Proximity in Firm's Servitization Capacity: A Basque Country Example 262

Hidden Services in the Lighting Industry – from Free to Fee 272

Alternative Financial Entities as Allies for Advanced Services Implementation: Lessons from B2B cases 278

Abstracts of Papers

Presented at

8th International Business Servitization conference

Parallel session 1

Product-Service Innovation System I

Chair: Yancy Vaillant

Managing Servitization in Distributor-Mediated Service Triads

Khadijeh Momeni

Miia Martinsuo

Tampere University, Department of Industrial Engineering and Management

Abstract

Servitization concerns manufacturing firms, their customers, and possible third parties in their supply chain. The involvement of third parties such as external service providers and distributors may generate challenges to servitization and needs to be managed well in the manufacturing firms' customer relationships. The purpose of this paper is to explore servitization in the supply chain in the relationship between manufacturing firms and distributors. A qualitative case study was implemented in a manufacturing firm that provides customized solutions to global customers and uses distributors in their supply chain. The findings show that the manufacturing firms need to support distributors in their servitization and develop required capabilities for the distributors. The research contributes an understanding about the dynamics of interactions in a service triad based on the complexity of the offering and the capabilities of the distributors. The paper shows how servitization can be managed on the supply chain level.

Keywords: Servitization, service supply chain, distributors, solutions

Introduction

Studies on servitization are moving from a dyadic interaction between a manufacturing firm and a customer to a triadic setting by acknowledging the role of intermediaries in service delivery (Karatzas et al., 2017). Service triad is a prominent research topic in the operations and supply chain management field and it explores the relationships between manufacturing firms, service suppliers or other intermediaries, and customers (Wynstra et al., 2015). This change in the level of analysis matches today's business environment - the centrality of a global network of materials, energy, information, money, and people as well as networks of interacting business and social actors (Barile et al., 2016). Previous studies have paid little attention to the characteristics of the offering and the types of intermediaries and their impacts on servitization in a service triad.

Manufacturing firms often provide both standard and customized offerings to their customers. The customized offerings are designed to fulfil specific needs of customers and include new or customized products and services, referred to as solutions (Davies et al., 2007). The solution offering is not limited to specific service components such as commissioning and handover, but the manufacturing firms may take long-term operational responsibility during the solution life cycle (Kujala et al., 2011), or use external service suppliers for that purpose. The uniqueness of the offering may create challenges for service suppliers, since they may not be able to provide services that require customization (Raja & Frandsen, 2017). This issue creates further questions: In case of customized solution offerings, is it possible to fully outsource service business to third-party service suppliers? How can service suppliers develop their capabilities to provide services for customized solution offering?

Servitization has so far been mainly studied from the manufacturing firm's viewpoint (Ayala et al., 2019), and service suppliers have usually been treated as pure service firms that already have the required capabilities for service delivery. Thus, servitization has not been studied sufficiently in the intermediary firms . However, distributors (of manufacturing firms' products) are potential service suppliers, and they are usually product-oriented firms that may not have the required capabilities to sell and deliver services (Momeni & Martinsuo, 2019). Therefore, there is a need to explore the implications of providing customized solutions to the relationship between manufacturing firms and their distributors as potential service suppliers.

This paper pursues increased knowledge on manufacturing firms' ways to manage servitization in their distributor-relationship and addresses the following research question:

How do manufacturing firms that provide customized solutions manage servitization in the presence of distributors in their supply chain?

Research method

To deepen the understanding of the triadic manufacturing firm-distributor-customer relationships, a qualitative case study based on interviews is conducted in one manufacturing firm. The firm offers various products, complex systems and services. It operates in the engineering and manufacturing sector, and its industrial offerings are tailored specifically for each customer and sold to other industrial firms globally. Service business has become an important part of the offering. The case was selected based on the extensive use of distributors to supply the customers with systems and services, and the firm's interest in developing the relationships with distributors and customers.

Discussion

The contribution of this study is twofold. The first contribution is related to the service triad literature. The findings show that the interaction in a triad has a dynamic nature and can vary based on the type of services and capabilities of the service suppliers. Manufacturing firms that provide customized solutions to their customers require specific capabilities from the intermediaries. These firms have more relationships in the downstream value chain compared to firms providing standard offerings. For example, the distributor may not necessarily have enough expertise to define customers' needs, commission the system or deliver services to the customers (Momeni & Martinsuo, 2019). Thus, the firm needs to have direct relationships with both the distributors and the customers. The manufacturing firm may experience different forms of triadic settings in respect to different distributors and/ or different products and services.

The second contribution is related to resource-based view and capability development in service supply chain. While this study confirms the importance of contract management (Broekhuis & Scholten, 2018), it reveals that the complexity and uniqueness of offerings force the manufacturing firm to go beyond monitoring the contracts and become a partner to develop the required capabilities in distributors to deliver the expectations. The findings of this study is in contrast with previous studies on capability development in service triads that have considered the service supplier as the source of knowledge and competences for new servitization capabilities (Raddats et al., 2017). This study shows that in case of offering customized solutions, the manufacturing firm has the active role in the dyad to transfer knowledge and develop required capabilities in the distributors.

In contrast with a triadic setting between a product supplier, system integrator, and customer (Finne & Holmström, 2013), this

study highlights that the distributors are not the firm's competitors in relationship with the customer. This characteristic leads to a situation where the manufacturing firm does not actively search for possible connections with the customers (as it is in the system integrator case, Finne & Holmström, 2013). Since the distributors are more product-oriented and prefer selling products, the manufacturing firm needs to support them in servitization through developing the required capabilities and use its own resources as the back-up plan for new or advanced products and services. This finding also lends support to previous studies on the impacts of the manufacturing firm's orientation on the interactions in a service triad (Ayala et al., 2019). The findings show that the firm with a stronger product orientation wants a stronger interaction between service suppliers and customers.

References

Ayala, N. F., Gerstlberger, W., &. Frank A. G. (2019). Managing servitization in product companies: the moderating role of service suppliers. *International Journal of Operations & Production Management*, 39(1), 43-74. https://doi.org/10.1108/IJOPM-08-2017-0484

Barile, S., Lusch R., Reynoso, J., Saviano, M., & Spohrer, J. (2016). Systems, networks, and ecosystems in service research. *Journal of Service Management*, 27(4), 652-674. https://doi.org/10.1108/JOSM-09-2015-0268

Broekhuis, M., & Scholten, K. (2018). Purchasing in service triads: the influence of contracting on contract management. *International Journal of Operations & Production Management*, 38(5), 1188-1204. https://doi.org/10.1108/IJOPM-12-2015-0754

Davies, A., Brady, T., & Hobday, M. (2007). Organizing for solutions: Systems seller vs. systems integrator. *Industrial Marketing Management*, 36(2), 183-193. https://doi.org/10.1016/j.indmarman.2006.04.009

Finne, M., & Holmström, J. (2013).A manufacturer moving upstream: triadic collaboration for service delivery, *Supply Chain Management: An International Journal*, 18(1), 21-33. https://doi.org/10.1108/13598541311293159

Karatzas, A., Johnson, M., &Bastl, M. (2017). Manufacturer-supplier relationships and service performance in service triads. *International Journal of Operations & Production Management*, 37(7), 950-960. https://doi.org/10.1108/IJOPM-11-2015-0719

Kujala, S., Kujala, J., Turkulainen, V., Artto, K., Aaltonen, P., & Wikström, K. (2011). Factors influencing the choice of solution-specific business models. *International Journal of Project Management,* 29(8), 960-970. https://doi.org/10.1016/j.ijproman.2011.01.009

Momeni, K. & Martinsuo, M. (2019). Going downstream in a project-based firm: Integration of distributors in the delivery of complex systems. *International Journal of Project Management*, 37(1), 27-42. https://doi.org/10.1016/j.ijproman.2018.09.007

Raddats, C., Zolkiewski, J., Story, V. M., Burton, J, Baines, T., & Bigdeli, A. Z. (2017). Interactively developed capabilities: evidence from dyadic servitization relationships. *International Journal of Operations & Production Management*, 37(3), 382-400. https://doi.org/10.1108/IJOPM-08-2015-0512

Raja, J. Z., & Frandsen T. (2017). Exploring servitization in China: Challenges of aligning motivation, opportunity and ability in coordinating an external service partner network. *International Journal of Operations & Production Management*, 37(11), 1654-1682. https://doi.org/10.1108/IJOPM-12-2015-0755

Wynstra, F., Spring, M., & Schoenherr, T. (2015). Service triads: A research agenda for buyer–supplier–customer triads in business services. *Journal of Operations Management*, 35, 1-20. https://doi.org/10.1016/j.jom.2014.10.002

The Impact of Service, Product and Process Innovation on Firm Performance: A Model of Interactions

María Luz Martín-Peña

José María Sánchez-López

Eloísa Díaz-Garrido

Elena Giménez-Fernández

Rey Juan Carlos University

Abstract

Manufacturing companies are introducing services to offer customized solutions to customers, and in this way, differentiate from competition through service innovation. At the same time, product and process innovation, which involves both internal and external R&D activities, is for many companies a way to differentiate. Both research domains, servitization of manufacturing and technological innovation, have been developed in isolation and recently the synergies between the two have been recognized, emerging from an open innovation approach. The relationship between both domains could be considered to achieve a competitive advantage. The aim of this paper is to analyze the interactions between internal technological innovation, technological collaboration (open innovation) and servitization, and its impact on firm performance. A theoretical model is proposed. An empirical analysis is developed in the Spanish chemical and pharmaceutical industry. The results show that internal R&D activities influence servitization; this relationship is moderated by open innovation, and servitization exerts a mediator effect between technological innovation and firm performance. This research advances in the

relations between service, technological innovation and firm performance in the manufacturing companies. Internal and external R&D intensity should be taken into consideration when the innovation strategy of the firm is defined. This innovation strategy should be linked to an increase in servitization activities and should boost an open-service strategy.

Keywords: Technological innovation, servitization, open innovation, firm performance

Introduction

Nowadays, the increase in global competition has led to the search of customized solutions by manufacturing firms. Getting the highest customer satisfaction, besides increasing income, has meant the shift towards integrated solutions, focused on customers' needs (Tuli et al., 2007; Storbacka, 2011; Kohtamäki et al., 2013). This process is known as servitization. In this way, advanced services are added to the internal value chain (Rabetino et al., 2018; Visnjic et al., 2018). Servitization can be understood as the innovation of an organization's capabilities and processes to better create mutual value through a shift from selling products to selling product-service systems (Baines et al., 2009; Neely, 2008; Cusumano et al. 2015). On this basis, Bustinza et al. (2019) conceptualise servitization as a continuum that determines the innovation level. The two dimensions of this continuum are, on the one hand, product innovation and updated product lifecycle; and, on the other hand, product-service alignment and service feedback and analytics.

Product and process innovation is usually pursued by R&D intensity. Technological knowledge for innovation and R&D activities might come from the firm itself or from external partners. Given the complexity of the innovation process, firms increasingly collaborate with other stakeholders, such as customers, suppliers or even competitors. Literature has analysed customers and suppliers

collaboration in manufacturing firms (Chesbrough, 2011) and in service firms (Mina et al., 2014), but it would be interesting to extend the analysis to the case of servitized firms since it is yet an understudied area of research.

Both research domains, servitization and technological innovation, have been developed in isolation and recently the synergies between the two have been recognized, promoting its research from an open innovation approach (Mina et al., 2014; Bustinza et al., 2019). However, many firms still servitize through internal development (Bustinza et al., 2015) because lack of open innovations processes (Keupp and Gassman, 2009). Roos (2015) and Santamaria et al. (2012) base the need to analyse service, product and process innovations together in order to understand the innovation processes of servitized manufacturing firms.

Prior research had different perspectives on the relationship between technological innovations and servitization (Santamaria et al., 2012; Hwang and Hsu, 2017). Some argued that servitization exerts the innovative convergence of products and services; therefore, the possession of innovation capacity through product and production process innovations for a manufacturing firm is critical to the success of servitization (Hong et al., 2015). Servitization is linked to technological innovation in the way that changes that are required for its display imply innovation decisions (Santamaria et al., 2012). Some scholars suggest product-service innovation is conductive to higher innovation levels (Tongur and Engwall, 2014; Visnjic et al., 2018; Bustinza et al., 2019). In contrast, other scholars contended that the development of services is not comparable to the development of new technical products, hence, the knowledge gained from developing technological innovations cannot be applied to the new challenge of initiating servitization (Lerch, 2014).

Indeed, innovation is essential for firms to get a competitive advantage (Danneels, 2002; Katila and Ahuja, 2002; Teece et al., 1997; Wang and Ahmed, 2007; Zobel, 2013). Over time, firms have constantly been searching for ways to transform and advance their innovation strategies to generate a superior firm performance (Zobel, 2013), and one way to enhance the firm performance is adding value to products through servitization. It is needed to understand the links between technological innovation, open innovation and servitization, and their influence on firm performance.

In order to advance in this gap, the aim of this paper is to analyse the interaction between technological effort (internal R&D), technological collaboration (open innovation) and servitization, and their impact on firm performance. A theoretical model is proposed to establish the interactions between the analysed variables.

This research is carried out in the chemical and pharmaceutical Spanish sector, featured by its intense innovative activity with an above average servitization level (Ruizalba et al., 2016; De la Calle et al., 2016). Indeed, chemical and pharmaceutical firms have traditionally made an extensive use of technological collaborations to support their new product and process development (Das and Brunet, 2016).

Regarding technological innovation and servitization, results show that the relationship between technological effort and servitization is positive, and this relationship is moderated by the collaboration with other agents (customers, suppliers, competitors), highlighting the importance of that collaboration for the introduction of new services in manufacturing firms. This finding extends the open-service innovation research line by evidencing that technological collaboration is moderating the relationship between internal R&D and servitization, meaning that firms that combine

internal and external R&D activities will boost their servitization level.

Related to the level of servitization and firm performance, it is supported a positive relationship between the variables. As novelty, it is demonstrated that servitization exerts a mediator role on the relationship between technological innovation and firm performance. In other words, the internal R&D effort, which is used to improve the servitization level, is translated into an increase in the value generated by the firm. This result is in line with previous literature that argued that technological innovation can improve the efficiency and effectiveness of processes through the creation of value for customers (Bustinza et al., 2019), so it generates new opportunities for rent generation (Visnjic et al. 2012).

All in all, the paper has important implications for both theory and practice. From a theoretical point of view, our research advances on the relationship between technological innovation and servitization from an open innovation perspective. We also open the black box to the complex interrelations between servitization and firm performance. From a practical point of view, it highlights the importance of collaboration with other agents and the mediator role of servitization on innovation to improve firm performance. If managers pursue to increase firm performance, they should boost an open-service strategy.

References

Baines, T., 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), 47-567. https://doi.org/10.1108/17410380910960984

Bustinza, O. F., Bigdeli, A. Z., Baines, T, & Elliot, C. (2015). Servitization and competitive advantage: the importance of organizational structure and value chain position. *Research-Technology Management*, 58(5), 53-60. https://doi.org/10.5437/08956308X5805354

Bustinza, O.F., Gomes, E., Vendrell−Herrero, F., & Baines, T. (2019). Product–service innovation and performance: the role of collaborative partnerships and R&D intensity. *R&D Management*, 49(1), 33-45. https://doi.org/10.1111/radm.12269

Chesbrough, H.W. (2011). Bringing Open Innovation to Services. *MIT Sloan Management Review*; 52(2), 85-90.

Cusumano, M.A., Kahl, S.J., & Suarez, F.F. (2015). Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal*, 36(4), 559-575. https://doi.org/10.1002/smj.2235

Danneels, E. (2002). The dynamics of product innovation and firm competences. *Strategic Management Journal,* 3(12), 1095-1121. https://doi.org/10.1002/smj.275

Das, S.,& Brunet, I. (2016). *Innovation Policy of European Chemical companies*. Publicaciones Universidad Rovira i Virgili. Tarragona. https://doi.org/10.17345/9788484244806

De La Calle, A., & Freije, I. (2016). Is servitization really profitable? Two decades of evidence from Spanish manufacturing companies. *Universia Business Review*, 49, 54-95.

Hong, Y.-P., Kim, Y., & Cin, B.C. (2015). Product-Service System and Firm Performance: The Mediating Role of Product and Process Technological Innovation. *Emerging Markets Finance and Trade*, 51(5), 975-984. https://doi.org/10.1080/1540496X.2015.1061388

Hwang, B.N; & Hsu, M.Y. (2017). The Impacts of Technological Innovations upon Servitization in Taiwan- Evidence from a Large-Scale Industrial Database. *Proceedings of the Seventh European Academic Research Conference on Global Business, Economics, Finance and Banking Zurich*, Switzerland. Paper ID: Z719

Katila, R., & Ahuja, G. (2002). Something Old, Something New: A Longitudinal Study of Search Behavior and New Product Introduction. *Academy of Management Journal,* 45(6), 1183-1194. ttps://doi.org/10.2307/3069433

Keupp, M. M., & Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management,* 39(4), 331-341. https://doi.org/10.1111/j.1467-9310.2009.00563.x

Kohtamäki, M., Partanen, J., Parida, V., & Wincent, J. (2013). Non-linear relationship between industrial service offering and sales growth: the moderating role of network capabilities. *Industrial Marketing Management,* 42(8), 1374-1385. https://doi.org/10.1016/j.indmarman.2013.07.018

Lerch, C. (2014). Servitization as an Innovation Process: Identifying the Needs for Change. *Servitization in Industry, Springer*, Cham, 179-189. https://doi.org/10.1007/978-3-319-06935-7_11

Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy,* 43, 853-66. https://doi.org/10.1016/j.respol.2013.07.004

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research,* 1(2), 103-118. https://doi.org/10.1007/s12063-009-0015-5

Rabetino, R., Harmsen, W., Kohtamäki, M, & Sihvonen, J. (2018). Structuring servitization-relted research. *International Journal of Production Economics*, 38(2), 3502-371. https://doi.org/10.1108/IJOPM-03-2017-0175

Roos, G. (2015). Servitization as innovation in manufacturing—a review of the literature. In *The handbook of service innovation* (pp. 403-435). Springer, London. https://doi.org/10.1007/978-1-4471-6590-3_19

Ruiz-Alba, J.L; Morales, J., & Soares, A. (2016). Servitization and co-opetition in the pharmaceutical distribution: Back to Basics?. *Universia Business Review*, 49, 96-115.

Santamaría, L., Nieto, M. J., & Miles, I. (2012). Service innovation in manufacturing firms: Evidence from Spain. *Technovation*, 32(2), 144-155. https://doi.org/10.1016/j.technovation.2011.08.006

Storbacka, K. (2011). A solution business model: Capabilities and management practices for integrated solutions. *Industrial Marketing Management*, 40(5), 699-711. https://doi.org/10.1016/j.indmarman.2011.05.003

Teece, D.J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal,* 18(7), 509-533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7<509::AID-SMJ882>3.0.CO;2-Z

Tongur, S., & Engwall, M. (2014). The business model dilemma of technology shifts. *Technovation*, 34(9), 525-535. https://doi.org/10.1016/j.technovation.2014.02.006

Tuli, K. R., Kohli, A. K., & Bharadwaj, S. G. (2007). Rethinking customer solutions: From product bundles to relational processes. *Journal of Marketing*, 71(3), 1-17. https://doi.org/10.1509/jmkg.71.3.001

Visnjic, I., Neely, A., & Jovanovic, M. (2018). The path to outcome delivery: Interplay of service market strategy and open business models. *Technovation*, 72-73, 46-59. https://doi.org/10.1016/j.technovation.2018.02.003

Wang, C.L., & Ahmed, P.K. (2007). Dynamic capabilities: A review and research agenda. *International Journal of Management Reviews*, 9(1), 31-51. https://doi.org/10.1111/j.1468-2370.2007.00201.x

Zobel, A.-K. (2013). *Open Innovation: A Dynamic Capabilities Perspective*. Maastricht University, Maastricht.

Using the General Modular Systems Theory: Evidence from Servitization

Philip Davies

Henley Business School, University of Reading

Glenn Parry

University of Surrey

Kyle Alves

University of the West of England

Abstract

This paper examines innovation in product-service systems. Using the lens of the general modular systems theory (Schilling, 2000), the research examines the factors that influence whether a product-service system would benefit from an increasingly modular, or an increasingly synergistic specific (or integrated) state in a servitized context. The paper presents results from an in-depth case study of an OEM of military vehicles. The OEM provided design services to reconfigure military vehicles based on the requirements of the end-user (military personnel), and were based on real-time need from active overseas engagements. The research design uses a mixed-methods approach. Given modularity is a directly observable configuration of structure, design structure matrices (DSMs) were used to inspect the modular structure of vehicles each time a customer-requested design change was integrated. To supplement the DSMs, thematic analysis was conducted on 29 in-depth interviews with the organisation's employees, as well as on texts,

documents and secondary data. In applying the general modular systems theory to the context of an outcome-based product-service system, the research finds four additional factors that push a system toward or away from modularity. These factors arise from the diversity of the customers' use-contexts that were not included in the original Schilling (2000) framework. These factors include requirements based on contextual variety, emergence, actor agency, urgency in use. The paper contributes to the innovation management and service modularity literature by updating and refining the general modular systems theory, and provides guidance to managers when designing and innovating outcome-based product-service systems.

Keywords: Servitization; modular systems theory; modularity; product-service systems.

Purpose

This paper examines innovation in product-service systems. Specifically, the research examines the factors that influence whether a system would benefit from, and therefore move toward, an increasingly modular or increasingly synergistic specific (or integrated) state in a servitized context using the lens of the general modular systems theory (Schilling, 2000). Schilling's (2000) modular systems theory explains why a system moves toward, or away from, a modular state. Within her theoretical framework, movements between states are linked to factors including: heterogeneity of inputs, heterogeneity of demands, urgency of competition, and urgency of technological change (Schilling & Paparone, 2005). Figure 1 presents Schilling's (2000) original theoretical framework.

Within Figure 1, block arrows show direct effects whilst dashed arrows show reinforcement effects. The theory predicts that as both input and demand heterogeneity increase, the system will be pushed toward and benefit from a more modular state. This push is

reinforced by urgency when competition is high and technological change is high (i.e., technological change is fast in the industry). Whilst Schilling (2000) argues the theory is applicable to most systems, she specifically explains it within the context of product design. However, a number of scholars have questioned the simple transition of theories explained in the context of manufacturing to services (Ng et al., 2009; 2012; Maglio et al., 2015; Green et al., 2017). Brax et al. (2017) calls for further research of the theoretical foundations of modularity in a service context. The testing of Schilling's (2000) theory is therefore important in the development of modular systems theory for services. We examine the theoretical framework presented by Schilling (2000) within the context of product centric servitization of a manufacturer of military vehicles (Baines et al., 2009).

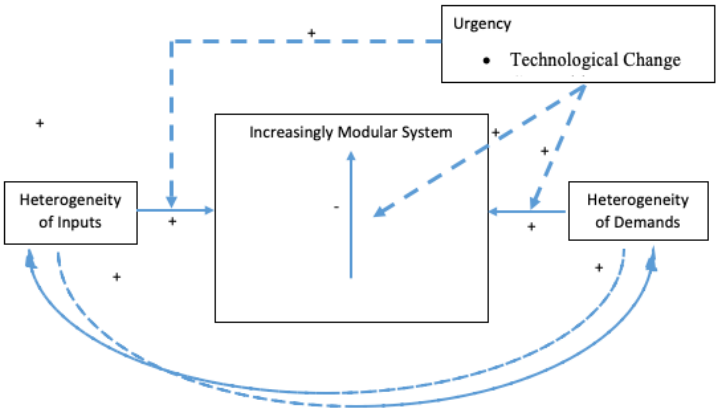


Figure 1. General Modular Systems Theory (Schilling, 2000)

Methods

This paper presents the results of an in-depth case study of an OEM of military vehicles. The Research uses observations from the

company within the defence industry during the years 2001-2014 The focal company provided design services to reconfigure military vehicles based on the requirements of the end-user (military personnel) requested during active engagements overseas. The research design uses a mixed-methods approach to better align with the mixed nature of the research setting. Modularity can be objectively observed through the inspection of structure (Baldwin & Clark, 2000). Based on this, design structure matrices (DSMs) were used to inspect the modular structure of vehicles each time a design change was integrated (Browning, 2001). To supplement the DSMs, we collected 29 in-depth interviews with the organisation's employees, and analysed these interviews as well as texts, documents and secondary data using a thematic analysis (Braun & Clark, 2006).

Findings

In applying the Schilling (2000) framework to the context of an outcome-based product-service system, the research finds four additional factors brought about by the diversity of the customers' use-contexts that were not included in the original framework. These factors include requirements based on:

- contextual variety
- emergence
- actor agency
- urgency-in-use.

Contextual variety is defined as the number of different states in which a single product can be used. Emergence occurs when the character of the system cannot be determined by an analytical or reductive specification of its components. Actor agency is defined as the actor's ability to initiate change in a given context. Finally, urgency-in-use requirements are defined as the speed at which the user requires new functionality to be integrated to achieve their

outcomes. As in the theoretical framework presented by Schilling (2000) (Figure 1), we find both direct and reinforcement effects occur between the factors within our modified framework. These are shown in Figure 2.

When any of these factors are high, the system moves away from the designed modular state. This is because high variety demand creates complexity that cannot be absorbed within the restricted parameters of the modular system. The data further reveals that a delivery system facing increased urgency from customer requirements is more likely to fail to meet set architectural and performance standards. Making urgent changes to systems with modular design creates additional time-based complexity in product support, upgrades, and use which require a different organisational capability to deliver. More broadly, these findings contribute to the theoretical development of the general modular systems theory.

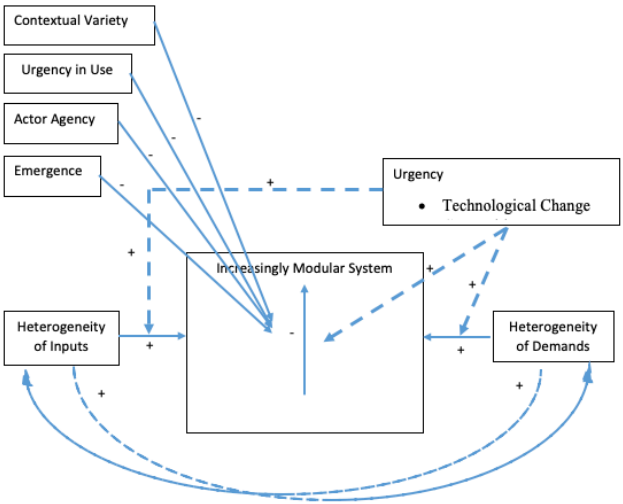


Figure 2. Modified General Modular Systems Theory

Limitations

There are a number of limitations that need to be acknowledged. First, this study is a single case. Whilst the findings provide insights to update and refine the modular general systems theory, the results cannot be generalized beyond the context of this study. The findings appear to have wider potential application across capital goods markets, but we cannot confidently say that the results apply outside of this context. It is therefore necessary to verify the results in other industries to confirm their wider applicability; in, for example, the consumer goods market. Second, this study draws on conducted interviews with the focal provider organisation. Additional insight would be gained through interviews with individuals from the customer's organisation, which would better explore the customers' context. Future studies should therefore seek to validate or refine the results using the views of both the provider and customer.

Managerial Implications

This research provides empirical evidence that innovation in product-service systems is more complex than traditional product design. In applying the general modular systems theory, four additional factors were identified that influence the configuration of a system with respect to their degree of modularity and integrality. These included emergence, contextual variety, actor agency and urgency in use. In identifying these factors, the research highlights a number of additional factors that need to be accounted for in the design and innovation process of a product-service system where the value proposition is product-centric.

Originality/Value

The paper contributes to the innovation management literature by updating and refining the general modular systems theory (Schilling, 2000). The findings are supported by empirical evidence from the defence industry where the manufacturing organisation, engaged in additional services post production of the asset, modifies their product's functionality beyond the original specification. These modifications stem from the contextual requirements of the end-user. The modified modular systems theory brings to the fore a number of factors necessary for manufacturing organisations to understand, design for-, and manage during the provision of advanced services.

References

Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E., & Swink, M., (2009). Towards an operations strategy for product–centric servitization. *International Journal of Operations & Production Management*, 29(5), 494-519. https://doi.org/10.1108/01443570910953603

Baldwin, C.Y., & Clark, K.B. (2000). *Design Rules.* MIT Press, Cambridge, MA. https://doi.org/10.7551/mitpress/2366.001.0001

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Brax, S.A., Bask, A., Hsuan, J., & Voss, C. (2017). Service modularity and architecture – an overview and research agenda, *International Journal of Operations & Production Management,* 37(6), 686-702. https://doi.org/10.1108/IJOPM-03-2017-0191

Browning, T.R. (2001). Applying the design structure matrix to system decomposition and integration problems: a review and new directions, *IEEE Transactions on Engineering Management*, 48(3), 292-306. https://doi.org/10.1109/17.946528

Green, M., Davies, P., & Ng, I. (2017). Two strands of servitization: A thematic analysis of traditional and customer co-created servitization and future research directions, *International Journal of Production Economics*, 192(October),40-53. https://doi.org/10.1016/j.ijpe.2017.01.009

Maglio, P., Kwan, S., & Spohrer, J. (2015). Commentary—Toward a Research Agenda for Human-Centered Service System Innovation. *Service Science*, 7(1), 1-10. https://doi.org/10.1287/serv.2015.0091

Ng, I. C. L., Maull, R., & Yip, N. (2009). Outcome-based contracts as a driver for systems thinking and service-dominant logic in service science: Evidence from the defence industry. *European Management Journal*, 27, 377-387. https://doi.org/10.1016/j.emj.2009.05.002

Ng, I., Badinelli, R., Polese, F., Di Nauta, P., Löbler, H., & Halliday, S. (2012). S-D logic research directions and opportunities: The perspective of systems, complexity, and engineering. *Marketing Theory*, 12(2), 213-217. https://doi.org/10.1177/1470593111429519

Schilling, M. A. (2000). Toward a general modular systems theory and its application to interfirm product modularity, *Academy of Management Review,* 25(1), 312-334. https://doi.org/10.5465/amr.2000.3312918

Schilling, M. & Paparone, C. (2005). *Modularity: An application of general systems theory to military force development*. US Military Report. https://doi.org/10.21236/ADA441764

Parallel session 2

Service Business Models

Chair: David Sjödin

Evaluating the Adoption of Integrated Project Teams as Strategic Form to Underpin PSI Systems in Servitizing Manufacturers

Carlos Galera Zarco

Coventry University

Abstract

In the search of competitiveness in the knowledge-based economy, developing a successful Product-Service Innovation (PSI) becomes crucial for many manufacturers. In this context, the different configurations that PSI systems may adopt is being object of intense debate. Under this environmental uncertainty about the most accurate configuration, manufacturers make different strategic choices ranging from in-house development to outsourcing, different types of alliances or even mergers & acquisitions. Lately, some manufactures are deploying a recent configuration by adopting project integrated teams as a new way to develop PSI. Following a multiple case-study approach, we expect to assess four main factors surrounding PSI systems configured by manufacturers through creation of projects integrated teams: 1) degree of technological innovation and complexity of PSI; 2) degree of servitization in their business model; 3) Organizational barriers to advanced services introduction; 4) benefits and competitive advantages arising from the implementation of a project- based operation. In the final discussion and conclusion derived from our research we will delve into the study of PSI in project-based context by providing new knowledge to illustrate this operational change and how it influences value creation and business model configuration in servitizing manufacturers.

Keywords: PSI systems, Advanced Services, Organizational Design, Integrated Project Teams.

Introduction

The introduction of services to business models in manufacturing businesses to create value has been widely defined as servitization phenomenon (Baines & Lightfoot, 2013; Bustinza, Vendrell-Herrero, & Baines, 2017) With the sustained development of servitization in recent years, manufacturers are in a continuous search of competitiveness through the implementation of successful PSI systems (Bustinza et al., 2019; Cusumano et al., 2015; Rabetino et al., 2018). PSI can be understood as the offering of new services, based on the use of innovative technological developments, which are able to generate adding-value throughout lifespan of products (Bustinza et al. 2018; Vendrell-Herrero et al., 2017). As a particular type of innovation, PSI implies deep organisational changes to adapt business to external environment and be able to provide market-oriented solutions (Bustinza et al., 2019; Pleiss, 2007).

Previous research suggests that to structure for PSI systems, organizations have to explore organizational design decisions to be successful (Raja et al., 2018, Rubalcaba et al. 2010, Santamaria, Nieto & Miles, 2012). Among the many complexities to achieve success in the servitization process, understanding what makes a PSI system configuration being successful and profitable, emerges as a key factor (Bustinza, Vendrell-Herrero & Gomes, 2019). Recent studies delve into how in-house PSI leads the development of internal innovation capabilities (Cusumano et al., 2015; Kindström & Kowalkowski, 2014). But also, other authors have showed that many manufacturers are not able to develop these capabilities internally, and embrace different types of intern-firm collaborations, including

partnerships, mergers & acquisitions or alliances (Schroeder et al., 2016; Bustinza et al., 2019; Lafuente et al. 2017).

Therefore, literature remarks these strategic choices to develop PSI internally or externally as a decisive sucessful factor (Raddats et al., 2017; Lafuente, Vaillant & Serarols, 2010; Vendrell-Herrero et al. 2014). There is however in-between a third way, whose exploration, will be the aim of this study. Integrated project team is a system of collaborative working which have acquired increasing popularity in engineering sector (Park et al., 2011; Roehrich et al., 2019). These configurations include team members from different actors of the value chain (manufacturers, suppliers, client) working together and cooperating to achieve a shared aim (Kent & Gerber, 2010; Raja et al., 2018).

In this paper, by analysing this new type of configuration applied on PSI system, we will address the lack of theorizing of how IPT configuration could influence strategic choices at organisational level for manufacturers offering advanced services. Further, we contribute to extend the knowledge on how innovation processes take place in that case. Likewise, we will try to study external and internal factors that potentially may make this configuration choice successful and ultimately collaborate to offer servitizing manufacturers new insight into new strategic forms.

Methodology

We adopt a qualitative approach through a multiple-case study of servitizing manufacturers implementing integrated project teams as organisational configuration for PSI. Our selected companies are being analysed to find out critical information about benefits and drawbacks of this configuration by analysing: 1) degree of technological innovation and complexity of PSI; 2) how servitized the business models are; 3) Pre-existing organizational barriers to

deploy PSI; 4) benefits and competitive advantages derived from this configuration in the servitization context.

Findings

Our preliminary findings bring new knowledge to illustrate the operational change influencing innovation management, value creation and business model design in manufacturers by adopting IPT configuration. These new strategic form increases the capability of involved organizations to co-innovate and strengthen competitive advantages thanks to a more collaboratively intensive relationship between involved actors. Also, lateral communication and speed of decision making seems to be common advantages in this type of PSI systems. On the other hand, the required high level of coordination and trust arise as main barrier to success in such configuration. Regarding limitations, we are aware about difficulties to generalize results because of the multiple-case study approach.

References

Baines, T., & Lightfoot, H. (2013). Made to serve: *How manufacturers can compete through servitization and product service systems*. Hoboken, NJ: John Wiley & Sons. https://doi.org/10.1002/9781119207955

Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2017). Service implementation in manufacturing: An organisational transformation perspective. *International Journal of Production Economics*, 192, 1-8. https://doi.org/10.1016/j.ijpe.2017.08.017

Bustinza, O.F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research*, in press. https://doi.org/10.1016/j.jbusres.2019.01.035

Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Baines, T. (2019). Product–service innovation and performance: the role of collaborative

partnerships and R&D intensity. *R&D Management, 49*(1), 33-45. https://doi.org/10.1111/radm.12269

Bustinza, O. F., Vendrell-Herrero, F., & Gomes, E. (2019). Unpacking the effect of strategic ambidexterity on performance: A cross-country comparison of MMNEs developing product-service innovation. *International Business Review.* https://doi.org/10.1016/j.ibusrev.2019.01.004

Cusumano, M.A., Kahl, S.J., & Suarez, F.F. (2015). Services, industry evolution, and the competitive strategies of product firm. *Strategic Management Journal, 36*(4), 559-575. https://doi.org/10.1002/smj.2235

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. https://doi.org/10.1108/JBIM-08-2013-0165

Lafuente, E., Vaillant, Y., & Serarols, C. (2010). Location decisions of knowledge-based entrepreneurs: why some Catalan KISAs choose to be rural? *Technovation,* 30, 590-600. https://doi.org/10.1016/j.technovation.2010.07.004

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial Servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics, 192*, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Park, H., Han, S. H., Rojas, E. M., Son, J.W., & Jung, W. (2011). Social network analysis of collaborative ventures for overseas construction projects. *J. Constr. Eng. Manage.*, 10.1061 /(ASCE) CO .1943-7862 . 0000301, 344-355. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000301

Plessis, M.D. (2007). The role of knowledge management in innovation. *Journal of Knowledge Management, 11*(4), 20-29. https://doi.org/10.1108/13673270710762684

Raddats, C., Zolkiewski, J., Story, V. M., Burton, J., Baines, T., & Ziaee Bigdeli, A. (2017). Interactively developed capabilities: evidence from dyadic servitization relationships. *International Journal of Operations & Production Management, 37*(3), 382-400. https://doi.org/10.1108/IJOPM-08-2015-0512

Raja, J. Z., Chakkol, M., Johnson, M., & Beltagui, A. (2018). Organizing for servitization: examining front-and back-end design configurations. *International Journal of Operations & Production Management,* 38(1), 249-271. https://doi.org/10.1108/IJOPM-03-2016-0139

Roehrich, J. K., Davies, A., Frederiksen, L., & Sergeeeva, N. (2019). Management innovation in complex products and systems: The case of integrated project teams. *Industrial Marketing Management*, 79, 84-93. https://doi.org/10.1016/j.indmarman.2018.10.006

Rubalcaba, L., Gago, D., & Gallego, J. (2010). On the differences between goods and service innovation. *Journal of Innovation Economics* 5, 17-40. https://doi.org/10.3917/jie.005.0017

Santamaría, L., Nieto, M.J., & Miles, I. (2012). Service innovation in manufacturing firms: Evidence from Spain. *Technovation*, 32, 144-155. https://doi.org/10.1016/j.technovation.2011.08.006

Schroeder, A., Galera Zarco, C., Baines, T., & Bigdeli, A. (2016). Barriers to capturing the value of advanced services and digitisation in the road transport industry. IN: *Spring Servitization Conference SSC2016*. 2016-05-16 - 2016-05-17.

Vendrell−Herrero, F., Parry, G., Bustinza, O. F., & O'Regan, N. (2014). Servitization as a driver for organizational change. *Strategic Change*, *23*(5-6), 279-285. https://doi.org/10.1002/jsc.1976

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management, 60*, 69-81. https://doi.org/10.1016/j.indmarman.2016.06.013

Vendrell-Herrero, F., Gomes, E., Bustinza, O. F., & Mellahi, K. (2018). Uncovering the role of cross-border strategic alliances and expertise decision centralization in enhancing product-service innovation in MMNEs. *International Business Review, 27*(4), 814-825. https://doi.org/10.1016/j.ibusrev.2018.01.005

A Relational View on Industry 4.0: Governing Relationships in Digital Servitization

Anmar Kamalaldin

Lina Sundén

David Sjödin

Vinit Parida

Luleå University

Abstract

In the light of industry 4.0, providers are increasingly offering their industrial customers more advanced services enabled by digital technologies such as the internet of things, remote monitoring, and artificial intelligence. This trend is referred to as digital servitization, and it is enabling significant changes in how value is created and captured in industrial relationships. In order to fully benefit from digital servitization, providers and customers need to transform their relationships. However, there is limited knowledge on how a provider and a customer govern their relationship in the context of digital servitization. To address this gap, this paper applies the relational view theory as a lens for studying how dyad relationships in digital servitization can be successfully governed and transformed. To that end, research was conducted based on multiple case study of four dyadic relationships between providers and customers. In total, 40 respondents from both sides were interviewed, and data was analyzed based on thematic analysis approach to identify relevant themes and patterns. The results identify four components –complementary digitalization capabilities, relation-specific digital assets, digitally enabled knowledge-sharing routines, and partnership governance– that enable providers and customers to profit from digital servitization. The main contribution

is the development of a relational governance framework for digital servitization. In doing so, we provide contribute to the servitization literature, as we advance understanding of the central role of relationship governance in digital servitization, and provide insights into the transformation of provider-customer relationships.

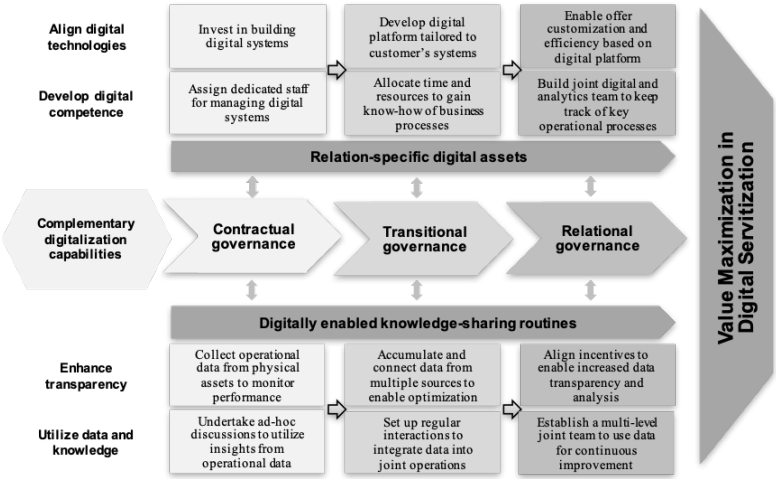
Keywords: Digital Servitization, Industry 4.0, Governance, Relational View.

Introduction

Digital technologies induced by industry 4.0, such as the internet of things, remote monitoring, and artificial intelligence, are enabling the transformation of manufacturing companies from being a product provider to a solution provider. This trend is referred to as 'digital servitization', which is defined as the provision of digital services embedded in a physical product (Holmström & Partanen, 2014; Vendrell-Herrero & Wilson, 2017). A key challenge is to transform provider-customer relationship in order to fully realize the potential benefits (Pagoropoulos et al., 2017; Lerch & Gotsch, 2015). It needs a transition from transactional to relational interaction, but this encounters many difficulties, including balancing risk and reward (Reim et al., 2018), finding the right level of customization, and ensuring transparent information sharing (Coreynen et al., 2017). The provider and customer should understand how to govern their relationship to deal with these challenges.

However, knowledge on this area remains limited. Previous studies on digital servitization have widely focused on provider perspective, with limited insights on how customers' companies interact with providers, and how their relationship transforms over time. There is a need for finer appreciation of how partners can develop their relationship if they are to successfully leverage their complementary resources and capabilities, make joint relation-

specific investments, and develop knowledge-sharing routines.



Moreover,
research gaps exist in understanding the relational governance strategies (Poppo & Zenger, 2002; Dyer et al., 2018) that are appropriate to ensure the successful implementation of digital servitization. To address these gaps, this study adopts the relational view (Dyer & Singh, 1998; Dyer et al., 2018) as a lens to study *how providers and customers govern and transform their relationships within digital servitization*.

Methods

The study is based on exploratory multiple case study of four dyadic B2B relationships between Swedish providers and customers in various industries (telecom, forestry, energy, and mining). Data was collected through semi-structured interviews, and we interviewed a total of 40 respondents from providers' and customers' sides. Respondents have various functional roles, including procurement managers, R&D managers, project managers,

and production managers. This enabled an understanding of the cases from different perceptions. Interviews were recorded and transcribed, and data was coded and analyzed through thematic analysis approach to find relevant themes and patterns (Braun & Clarke, 2006). The identified categories were then clustered into second-order themes, and then converged into aggregate dimensions (Gioia et al., 2013). As data was aligned with the theoretical framework of the relational view, its four determinants of relational rent (complementary resources and capabilities, relation-specific assets, knowledge-sharing routines, and effective governance) were the basis for developing the aggregate dimensions.

Results

Figure 1. A relational governance framework for digital servitization

Complementary digitalization capabilities: Complementarity is found to be the trigger for initiating and preserving the relationship. A company would establish a relationship if the potential partner has the digitalization capabilities that the company lacks. Therefore, partners should assess the potential benefits of combining provider's expertise and customer's business knowledge. This evaluation continues throughout the relationship, as partners continue to monitor the evolution of these capabilities and reassess complementarity. This is especially true due to the rapid development of digital technologies.

Relation-specific digital assets: When complementarity exists, partners invest in relation-specific digital assets. Results show two perspectives with this regard. The first is investment in aligning digital technologies. This tends to start with developing digital systems for operations, and with time, it evolves to developing a

digital platform that can lead to further efficiency and offer customization. The second aspect is investment in the development of digital competences. This is enabled by assigning dedicated staff for the management of digital systems, but partners need to continue allocating required resources for further developing their know-how. This is likely to lead to building a joint team for analytics in order to keep track of processes and exploit new business opportunities.

Digitally enabled knowledge-sharing routines: Setting up knowledge-sharing routines is key for success. These routines are digitally enabled and data driven, as data is collected, analyzed and transformed into knowledge through digital means. Our findings show two aspects in this regard. The first is developing routines to boost transparent knowledge-sharing, and this is done through data collection from physical assets, so performance can be monitored. As the relationship develops, partners connect data from multiple sources to further enhance transparency and analysis, but this requires continuous alignment of incentives. The second aspect is developing routines for knowledge utilization, as knowledge has no value if not acted upon. At an early stage of the relationship, this tends to be undertaken through ad-hoc discussions, but then partners set up regular meetings to integrate data and utilize knowledge. When the relationship develops even further, a useful practice is forming a joint team for utilizing knowledge for continuous improvement.

Partnership governance: Agreeing on governance mechanisms is vital for benefiting from relation-specific digital assets and digitally enabled knowledge-sharing routines. The findings show that the balance between control and flexibility get adjusted over time as mutual trust develops. The relationship usually begins with a highly *contractual governance* approach, with a high level of control in order to safeguard partners' interests. When trust grows, *transitional*

governance approach is taken, where partners revise their contract to be more efficient. At a more mature stage, partners apply *relational governance* approach that is highly based on trust with no rigid control.

Conclusion

The study contributes to digital servitization literature by highlighting how the relationship transformation unfolds, as previous studies have widely focused on the provider's transformation journey rather than the entire provider-customer relationship. The study also stresses the vital role of governance mechanisms, which need to be progressively developed over time.

In terms of managerial implications, the study provides insights for managers involved in servitization efforts in manufacturing companies, in addition to managers in companies procuring digital services. The study guides provider and customer to transform their relationship for maximizing the benefits of digital servitization, and helps them make informed decisions to prioritize resources. It also guides managers to gradually develop governance approaches at different maturity levels of the relationship.

References

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101. https://doi.org/10.1191/1478088706qp063oa

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, *60*, 42-53. https://doi.org/10.1016/j.indmarman.2016.04.012

Dyer, J. H., & Singh, H. (1998). The relational view: Cooperative strategy and sources of interorganizational competitive advantage. *Academy*

of Management Review, 23(4), 660-679. https://doi.org/10.5465/amr.1998.1255632

Dyer, J. H., Singh, H., & Hesterly, W. S. (2018). The relational view revisited: A dynamic perspective on value creation and value capture. *Strategic Management Journal*. https://doi.org/10.1002/smj.2785

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, 16(1), 15-31. https://doi.org/10.1177/1094428112452151

Holmström, J., & Partanen, J. (2014). Digital manufacturing-driven transformations of service supply chains for complex products. *Supply Chain Management: An International Journal*, 19(4), 421-430. https://doi.org/10.1108/SCM-10-2013-0387

Lerch, C., & Gotsch, M. (2015). Digitalized Product–Service Systems in manufacturing firms: A case study analysis. *Research-Technology Management*, 58(5), 45-52. https://doi.org/10.5437/08956308X5805357

Pagoropoulos, A., Maier, A., & McAloone, T. C. (2017). Assessing transformational change from institutionalising digital capabilities on implementation and development of Product-Service Systems: Learnings from the maritime industry. *Journal of Cleaner Production,* 166, 369-380. https://doi.org/10.1016/j.jclepro.2017.08.019

Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or complements? *Strategic Management Journal*, 23(8), 707-725. https://doi.org/10.1002/smj.249

Reim, W., Sjödin, D., & Parida, V. (2018). Mitigating adverse customer behaviour for product-service system provision: An agency theory perspective. *Industrial Marketing Management*, 74, 150-161. https://doi.org/10.1016/j.indmarman.2018.04.004

Vendrell-Herrero, F., and Wilson James, R. (2017) "Servitization for territorial competitiveness: taxonomy and research agenda", *Competitiveness*

Review: An International Business Journal, 27(1), 2-11. https://doi.org/10.1108/CR-02-2016-0005

New Business Models in the Electricity Sector in the Framework of the Energy Transition Towards a Low Carbon Economy[1]

Macarena Larrea Basterra, Maider Bilbao Ozámiz

Orkestra, Universidad de Deusto

Abstract

The energy sector is changing. There are several main trends that can be highlighted, among them are decarbonization (as a consequence to the international commitments against climate change), electrification (electricity is turning into the main energy vector even in transport as electric vehicles and batteries are becoming a key element for the transition), and decentralization. In addition to these, there are other trends such as the development of digital technologies (artificial intelligence, internet of things, cloud and blockchain), which can bring about the development of new business or business models, the appearance of new players in the sector and the improvements in the performance levels of existing companies (Wei, Sanbron & Slaughter, 2019).

As a consequence, the business model of traditional electricity companies is in the process of being transformed. This is mainly due to the growth in: the development of distributed generation, which includes solar photovoltaic and other renewable energies, the storage of electrical and thermal energy, as well as more active electricity demand management, which is pushing these companies to organize their activity around electricity as a provision of services and not as the supply of a product as it has been in the past (Hamwi & Lizarralde, 2017). Similarly, in this context, different business

[1] We would like our paper to be included in the "Technovation special sessions".

models are emerging, whose design will have an impact on their economic performance.

Developing a new business model implies the need to have an in-deep knowledge of the needs of customers, the achievement or failure that competitors result with the objective and the technological and organizational trajectory.

Taking into consideration this framework, business models in the electricity sector are organized under a specific legal, policy and regulatory framework; which can even determine a part of the income and, to a certain extent, the viability of these models. In this manner, and as an example, in recent years, different mechanisms have been proposed to support the development and implementation of low carbon emissions electricity generation technologies, such as photovoltaic solar, as well as associated technologies such as the storage of electrical energy in batteries and the software that monitors physical parts in virtual. Hence, the electricity sector is changing, from the management of a product to the management of a service as will be explained next. This work aims to shed some light on the ways that these developments are taking place.

In order to do so, the academic literature on business models in the electrical field will be reviewed first. Some authors consider that the literature on this topic is scarce (Burger & Luke, 2017), and the existing tends to associate these models with a particular technology (for instance solar photovoltaic or blockchain).

Therefore, there are different classifications of business models. In this sense, the service offered, the market segment to whom it is directed, the income flow (Burger & Luke, 2017) or the positioning in the value chain of the traditional electricity sector can be taken as an element for classification (Abella et al., 2015). From this perspective, business models tend to be grouped into three broad categories: distributed electricity generation, electricity demand management and zonal aggregate systems (as a combination of the first two categories).

Other sources refer to the transformation of the business model of traditional utilities, such as (PWC global power & utilities, 2016) and (Bryant, Straker & Wrigley, 2018). In this sense, a possible classification raises the development of the business models of

these companies to face the challenges that the new framework is bringing. This can be accomplished under two parameters: the degree of disintegration and the degree to which the business model focuses on a product or service.

In this sense, energy has been understood as a product up until now and the whole electricity value chain was organised around utilities in order to help them offer this essential product. In this regard, a transition to alternative sources has a particular focus, developing a wider range of business models based on services.

Other classifications collected in the literature distinguish between three major business models: those in which assets belong to consumers, services offered by third parties and energy communities (Hamwi & Lizarralde, 2017). There are other approaches such as Wei et al. (2019) or Burger and Luke (2017).

Other authors, in the exercise of analyzing the new business models have identified two fundamental types, those that give greater weight to the consumer (aggregators, peer-to-peer electricity exchange and energy as a service) and the facilitators of renewable energy supply (models of community property and payment as consumed [pay-as-you-go]).

There is also literature related to business models that, in relation to distributed generation, can be developed in developing countries with low rates of electrification of the population or in isolated areas of the electricity grid (Couture, Pelz, Cader & Blechinger, 2019).

On the basis of this bibliography, a review of the new business models will be carried out in order to detect new trends. Therefore, the authors will develop a new scheme that will try to offer a more complete vision than the partial one that is detected in the references.

In addition, companies from different contexts will be identified, and how are positioning themselves in these business models. This will lead to an understanding of the main business trends. This document will not focus on the business models that have emerged in developing territories, although it is likely that some of the models detected will be replicated in those countries.

Keywords: Electricity sector, distributed resources, business models.

References

Abella, A., Álvarez, E., Argüeso, J., Bozon, A., Castro, U., López, D., & Martén, I. (2015). *Smart Energy: nuevas aplicaciones y modelos de negocio*. Bilbao: Orkestra. Retrieved from https://www.orkestra.deusto.es/es/investigacion/publicaciones/cuadernos-orkestra/203-smart-energy-nuevas-aplicaciones-modelos-negocio

Bryant, S., Straker, K., & Wrigley, C. (2018). The typologies of power: Energy utility business models in an increasingly renewable sector. *Journal of Cleaner Production.* 1032. Retrieved from https://www.sciencedirect.com/science/article/pii/S0959652618315804 https://doi.org/10.1016/j.jclepro.2018.05.233

Burger, S. P., & Luke, M. (2017). Business models for distributed energy resources: A review and empirical analysis. *Energy Policy,* 109, 230-248. https://doi.org/10.1016/j.enpol.2017.07.007

Couture, T., Pelz, S., Cader, C., & Blechinger, P. (2019). Off-grid prosumers: Electrifying the next billion with PAYGO solar. In F. P. Sioshansi (Ed.), *Consumer, prosumer, prosumager* (pp. 311) Elsevier Inc. https://doi.org/10.1016/B978-0-12-816835-6.00014-0

Hamwi, M., & Lizarralde, I. (2017). A review of business models towards service-oriented electricity systems. *The 9th CIRP IPSS Conference: Circular Perspectives Son product/service-Systems,* 64, 109. Retrieved from https://www.sciencedirect.com/science/article/pii/S2212827117301762 https://doi.org/10.1016/j.procir.2017.03.032

PWC global power & utilities (2016). *The road ahead. gaining momentum from energy transformation* Retrieved from https://www.pwc.com/ca/en/industries/power-utilities/publications/gaining-momentum-energy-transformation.html

Wei, J., Sanbron, S., & Slaughter, A. (2019). *Digital innovation. creating the utility of the future* Deloitte Insights. Retrieved from https://www2.deloitte.com/insights/us/en/industry/power-and-utilities/digital-transformation-utility-of-the-future.html

IoT as Enabler for Smart Servitization in the Manufacturing Industry

Elisabeth A.M. van de Kar

Fontys International Business School, Fontys University of Applied Sciences, The Netherlands

Lisa Bakir, Lambert J.M. Nieuwenhuis

Department of Industrial Engineering and Business Information Systems, University of Twente, The Netherlands

Abstract

We are now at the beginning of the fourth industrial revolution. An important development is the Internet of Things (IoT). In smart industry, manufacturing companies use more and more sensors to measure such dimensions as temperature, humidity, pressure, water quality, gases and chemicals, smoke, infrared, fluid levels, images, and movement and acceleration.

Internet of Things (IoT) make a significant reshaping of industry possible (Porter & Heppelmann, 2015). This may materialize through service enhanced products and new business models (Friess & Riemenschneider, 2015). Hence, IoT allows for more efficient production and higher customization levels offering promising opportunities of its application in many industries. Indeed, research recognizes the potential of IoT for manufacturers as they are moving from product-oriented companies to service-oriented ones (de Senzi Zancul et al., 2018; Georgakopoulos, Jayaraman & Georgakopoulos, 2016).

This research attempts to deepen the understanding of potential benefits and challenges of adopting IoT technologies, in the pursuit of offering value-added services. We seek this aim by assessing industry's readiness to adopt IoT technologies. The context of this

research is confined to Small and Medium sized Enterprises (SMEs) in the manufacturing industry. This research responds to calls on further exploring the possibilities of digitization and servitization (Coreynen, Matthyssens & Bockhaven, 2016; Raddats, Kowalkowski, Benedettini, Burton & Gebauer, 2019; Rymaszewska, Helo & Gunasekaran, 2017; Vendrell-Herrero, Bustinza, Parry & Georgantzis, 2016) and the limited consideration of servitization research in the SME domain (Kowalkowski, Windahl, Kindström & Gebauer, 2015).

Research method and findings

We are working on a large-scale empirical investigation in SMEs in the Province of Limburg in the Netherlands. We investigated manufacturers operating in several industries who e.g., make brewery machines, solar panels, cheese cutting machines, vegetable washing machines, garage doors. The research is guided by an IoT readiness framework based on the Capability Maturity Model (CMM -see appendix; Paulk, Curtis, Chrissis & Weber, 1993). The framework determines companies' IoT readiness by measuring five dimensions which are: organization, data intelligence, production process, service process and customer. Our approach is divided into three phases:

1. Literature review and initial survey (pilot) among three companies;

2. 20 SMEs participated in the following 5 steps within half a year (1) online survey; (2) knowledge session; (3) in-depth interviews; (4) reports to individual companies; and (5) a meet and match session with IT or knowledge parties.

3. Longitudinal study on implementation processes of IoT and the success and failure experiences. This phase will take place in 2019 and 2020.

The results of Phase 2 are visualized in a radar chart as shown in figure 1. Each dimension comprised of ten to twenty items. The

online survey served as a baseline as companies had to assess their own IoT readiness. Results were further explored by in-depth interviews leading to a more objective outsider view on the status quo.

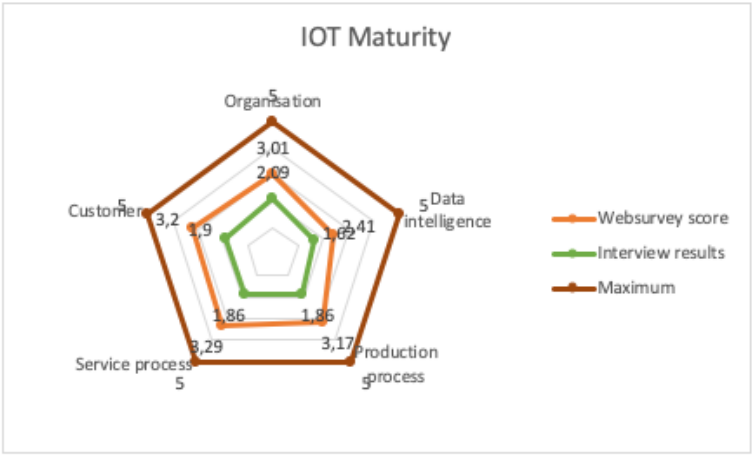


Figure 1. IoT Maturity matrix average for 20 SME's in manufacturing industry

The average of the 20 companies was used to benchmark the results of each individual company with the average scores. Some of the striking findings are:

- *Companies overvalue their own performances.* Self-reported scores by the survey were higher than the scores measured in the interviews.
- *The dimension 'Data Intelligence' scored lowest,* in the online survey as well as in the interviews. On this dimension, companies reported concerns about skilled personnel and security.
- *The dimension 'Service Process' scored highest.* The item 'IoT offers opportunities for our After Sales Services' was highly ranked and often mentioned in the interviews.

Discussion and future research

The experiences of these 20 companies with IoT implementation vary from none, to just starting, and to having experience. Therefor the average in Figure 1 is not very interesting as such. In Phase 3 we will compare the results of companies with companies who in the same phase of implementation.

The aim of the research is to understand the IoT readiness of SMEs in the region over a period of time. One of the preliminary conclusions is that there are big differences between companies and that traditional manufacturing companies are still wondering if and how they should implement IoT. Therefor we want to develop a framework in which we link the characteristics of the SMEs to success and failure factors of implementing IoT. This will be part of the design approach we are developing for companies who consider implementing IoT.

References

Coreynen, W., Matthyssens, P., & Bockhaven, W. Van. (2016). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, 60, 42-53. https://doi.org/10.1016/j.indmarman.2016.04.012

De Senzi Zancul, E., Takey, S. M., Paula Bezerra Barquet, A., Heiji Kuwabara, L., Cauchick Miguel, P. A., & Rozenfeld, H. (2018). Business Process Management Journal Business process support for IoT based product-service systems (PSS). *Business Process Management Journal Business Process Management Journal Iss.*

Georgakopoulos, D., Prakash Jayaraman, P., & Dimitrios Georgakopoulos, B. (2016). Internet of things: from internet scale sensing to smart services. *Computing*, *98*, 1041-1058. https://doi.org/10.1007/s00607-016-0510-0

Green, M. H., Davies, P., & Ng, I. C. L. L. (2017). Two strands of servitization: A thematic analysis of traditional and customer co-created servitization and future research directions. *International Journal of Production Economics*, *192*(January), 40-53. https://doi.org/10.1016/j.ijpe.2017.01.009

Kowalkowski, C., Windahl, C., Kindström, D., & Gebauer, H. (2015). What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. *Industrial Marketing Management*, 45(1), 59-69. https://doi.org/10.1016/j.indmarman.2015.02.016

Paulk, M., Curtis, B., Chrissis, M., Weber, C., (1993). *Capability Maturity Model for software, Version 1.1. CMU/SEI-93-TR-24.* Software Engineering Institute, USA. https://doi.org/10.21236/ADA263403

Porter, M. E., & Heppelmann, J. E. (2015). How Smart, Connected Products Are Transforming Competition. *Harvard Business Review*, (October), 1-38.

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*. https://doi.org/10.1016/j.indmarman.2019.03.015

Rymaszewska, A., Helo, P., & Gunasekaran, A. (2017). IoT powered servitization of manufacturing – an exploratory case study. *International Journal of Production Economics*, 192, 92-105. https://doi.org/10.1016/j.ijpe.2017.02.016

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2016). Servitization, digitization and supply chain interdependency. https://doi.org/10.1016/j.indmarman.2016.06.013

Appendix


MATURITY LEVEL 5
Optimizing
Stable and flexible. Organization is focused on continuous improvement and is built to pivot and respond to opportunity and change. The organization's stability provides a platform for agility and innovation.
5
MATURITY LEVEL 4
Quantitatively Managed
Measured and controlled. Organization is data-driven with quantitative performance improvement objectives that are predictable and align to meet the needs of internal and external stakeholders.
4
MATURITY LEVEL 3
Defined
Proactive, rather than reactive. Organization-wide standards provide guidance across projects, programs and portfolios.
3
MATURITY LEVEL 2
Managed
Managed on the project level. Projects are planned, performed, measured, and controlled.
2
MATURITY LEVEL 1
Initial
Unpredictable and reactive. Work gets completed but is often delayed and over budget.
1

Parallel session 3

Product-Service Innovation System II

Chair: Esteban Lafuente

Innovation in Servitization through Digital Technologies

Chris Raddats

University of Liverpool

Vicky Story

Loughborough University

YJamie Burton, Judy Zolkiewski

University of Manchester

Abstract

The application of digital technologies within servitization is an emerging phenomenon. Research to date has identified the use of different digital technologies by manufacturers to enhance their servitization efforts, such as the Internet of Things, cloud computing and big data. However, the application of these technologies within the servitization domain has had limited attention using an innovation lens. This is despite digital technologies often resulting in improved or extended service offerings (e.g., remote diagnostics to enhance an existing maintenance service), new service offerings (e.g., an availability offering) or even new service business models (i.e., replacement of a product business model with a service business model). The current study aims to investigate different types of service innovation modes, from incremental through intermediate to radical, with a particular focus on the latter, which is often seen as most important for improving manufacturers' performance but remains elusive in

practice. Due to the limited extent of existing work in this area, case studies are used to investigate the phenomenon, as they facilitate the collection of rich data sets enabling development of academic and practical insights.

Keywords: Digital technologies, Servitization, Radical and incremental innovation.

Introduction

There is growing interest from academics and practitioners about how digital technologies can enhance manufacturers' servitization efforts. For example, lift manufacturer Otis is using big data and predictive analytics to improve the performance of its traditional maintenance business. The application of these technologies has mainly been considered with regards to their impact on manufacturers' service offerings, either improving or extending the way in which current offerings are delivered or facilitating creation of new service offerings (Lerch & Gotsch, 2015). Some research also suggests that manufacturers may be able to use digital technologies such as cloud computing to transform their traditional product-centric business models towards service-centric models, where services (provision of computing) replace products (sale of computers) (Barrett et al., 2015).

While new digital technologies, such as big data, are often considered innovative per se, research to date has tended to not use a service innovation lens to consider how manufacturers use digital technologies as part of servitization. This is despite the likelihood that an innovation lens, aligned to incremental and radical innovation modes, could help to explain how manufacturers deploy digital technologies and the opportunities and risks of doing so. Thus, the purpose of this study is to investigate, within the servitization domain, different innovation modes using digital technologies. In particular, occurrences of radical service

innovations will be purposively sampled and explored as work in this area is scarce despite servitization literature often calling for it.

Literature Review

A number of digital technologies are potentially applicable in the servitization domain; for example, the Internet of Things (IoT), cloud computing and predictive analytics (Ardolino et al., 2018). Equally, large complex data sets (often termed 'big data') can now be converted into valuable information to enhance competitive advantage (Opresnik & Taisch, 2015). For example, digitised 'smart' product-service systems (PSS) are developed through networking and management of connected devices (Allmendinger & Lombreglia, 2005).

Service innovations are often categorised as radical or incremental (Ordanini & Parasuraman, 2011). Service offerings with minor changes to existing characteristics are categorised as incremental service innovation while ones with a new set of characteristics are categorised as radical service innovation (Gallouj & Weinstein, 1997). While innovation is often presented as a dichotomy, it is more likely to be a spectrum, with varying degrees of innovativeness (Story et al., 2014), with incremental and radical modes at extreme ends and intermediate modes in-between. However, innovation level is a relative concept, determined to some extent by the actor concerned, with one company's incremental innovation being another's intermediate or maybe even radical innovation.

Within manufacturers, different service innovation modes are apparent. For example, collecting and analysing operational data to enhance maintenance services for forklift trucks (Ulaga & Reinartz, 2011) *(incremental service innovation)*. Engine manufacturer Rolls Royce utilising digital analytics and the IoT to create their 'power by the

hour' service offering (Barrett et al., 2015) *(intermediate service innovation)*. A shoe insole manufacturer developing digital products to disrupt existing provider/customer relations (Coreynen et al., 2017) *(radical service innovation)*. As previously highlighted, specifying the innovation mode can be problematic since it could be argued that Rolls Royce's 'power by the hour' concept is a radical innovation as the company was the first that offered engine availability as a managed service. Yet, it has not fundamentally changed how the company views itself, which is described as one of world's leading industrial technology companies (Rolls Royce, 2019); that is, it is still essentially a product company.

Despite the importance of radical service innovation for affecting manufacturer performance (Johansson et al., 2019), there are relatively few documented examples of this being successfully undertaken (Raddats et al., 2019). The exception to this is IBM's historic switch from a computer manufacturer to services and solution provider. Indeed, more recent examples such as General Electric's Predix platform (used to collect and analyse big data) demonstrate the difficulties for manufacturers of monetising digital technologies as part of radical innovations (Sklyar et al., 2019). Manufacturers may have greater difficulties than service companies developing radical innovations since it is not easy for them to 'break free' from their traditional product businesses (Burton et al., 2017), thus limiting the extent to which digital technologies can disrupt existing operations.

Methodology and Potential Contribution

A qualitative case study methodology is proposed to investigate how manufacturers are deploying digital technologies as part of service innovation. This approach is suitable since there are unclear boundaries between the phenomenon under investigation and the

context of the study (Yin, 2017). A number of purposively sampled case studies will be developed highlighting how digital technologies help manufacturers to develop service innovations, using different innovation modes: 1) improve or extend existing service offerings (incremental mode); 2) develop new service offerings (intermediate mode); 3) change the company's business model (radical mode). One case study will be presented at the conference.

The potential contribution of the work rests on a better understanding of how digital technologies can be deployed in a servitization context. By using an innovation lens, the study will present a novel interpretation of this emerging phenomenon aligned to different service innovation modes. The prevalence of radical service innovations through digital technologies will, in particular, be considered (through having multiple case studies), since these are promised to provide greatest benefits to manufacturers yet remain scarce in practice.

References

Allmendinger, G., & Lombreglia, R. (2005). Four strategies for the age of smart services, *Harvard Business Review,* 83, 131-145.

Ardolino, M., Rapaccini, M., Saccani, N., Gaiardelli, P., Crespi, G., and Ruggeri, C. (2018). The role of digital technologies for the service transformation of industrial companies. *International Journal of Production Research*, 56(6), 2116-2132. https://doi.org/10.1080/00207543.2017.1324224

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. https://doi.org/10.25300/MISQ/2015/39:1.03

Burton, J., Story, V., Raddats, C., & Zolkiewski, J. (2017). Overcoming the challenges that hinder new service development by manufacturers with diverse services strategies, *International Journal of Production Economics*, 192, 29-49. https://doi.org/10.1016/j.ijpe.2017.01.013

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management,* 60, 42-53. https://doi.org/10.1016/j.indmarman.2016.04.012

Gallouj, F., & Weinstein, O. (1997). Innovation in services. *Research Policy*, 26(4-5), 537-556. https://doi.org/10.1016/S0048-7333(97)00030-9

Johansson, E., Raddats, C., & Witell, L. (2019). Developing customer knowledge for incremental and radical service innovation in manufacturers, *Journal of Business Research*, 98*,* 328-338. https://doi.org/10.1016/j.jbusres.2019.02.019

Lerch, C., & Gotsch, M. (2015). Digitalized product-service systems in manufacturing firms: A case study analysis. *Research-Technology Management*, 58(5), 45-52. https://doi.org/10.5437/08956308X5805357

Opresnik, D., & Taisch, M. (2015). The value of big data in servitization. *International Journal of Production Economics,* 165, 174-184. https://doi.org/10.1016/j.ijpe.2014.12.036

Ordanini, A., & Parasuraman, A. (2011). Service innovation viewed through a service-dominant logic lens: A conceptual framework and empirical analysis. *Journal of Service Research*, 14(1), 3-23. https://doi.org/10.1177/1094670510385332

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams, *Industrial Marketing Management,* available at: https://doi.org/10.1016/j.indmarman.2019.03.015

Rolls-Royce.com. (2019). *About*. [online] Available at: https://www.rolls-royce.com/about.aspx [Accessed 12 June 2019].

Rymaszewska, A., Helo, P., and Gunasekaran, A. (2017). IoT powered servitization of manufacturing–an exploratory case study. *International Journal of Production Economics*, 192, 92-105. https://doi.org/10.1016/j.ijpe.2017.02.016

Sklyar, A., Kowalkowski, C., Tronvoll, B., and Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research*, available at: https://doi.org/10.1016/j.jbusres.2019.02.012 [Accessed 12 June 2019].

Story, V.M., Daniels, K., Zolkiewski, J., & Dainty, A.R. (2014). The barriers and consequences of radical innovations: Introduction to the issue. *Industrial Marketing Management,* 43(8), 1271-1277. https://doi.org/10.1016/j.indmarman.2014.09.001

Ulaga, W., & Reinartz, W. J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *Journal of Marketing,* 75, 5-23. https://doi.org/10.1509/jm.09.0395

Yin, R. K. (2017). *Case study research and applications: Design and methods*. Sage publications.

Value Co-Creation Practices in Platform-Based PSI Systems: Cases from the Textile Sector in China

Jiamian Tian, Lei Shen

Donghua University

Paul Matthyssens

Antwerp Management School, University of Antwerp

Wim Coreynen

Antwerp Management School, Jheronimus Academy of Data Science

Abstract

Industry 4.0 and the IIoT (Industry Internet of Things) are prevailing trends that influence nearly all industries, including the 'low-tech' textile industry. The purpose of this article is to explore what co-creation practices manufacturers use to exploit the opportunity of platforms in an Industry 4.0/IIoT context. It also intends to identify the trajectories of changes in companies' platform strategies for product-service offerings. Using an interpretive methodology, we observe four cases of Chinese textile manufacturers transforming to a platform-based business model, thereby upgrading value co-creation (VCC) in an enhanced product-service innovation (PSI) system. Based on the cross-case analysis, the starting point and three distinct transition routes are identified: 1) Starting from offering standard products; 2) plus customer-centric offerings; 3) plus value-adding services; and 4) plus integrated personalized solutions. This study contributes to the

servitization research by linking the recent focus of the VCC theory and the recent strategic management insights on platforms. This research constructs the basis for a theory that extends the servitization trajectory model in a platform leverage lens.

Keywords: Servitization, product-service innovation, value co-creation practice, platform leverage logic.

Introduction

Confronted with the present challenges of Industry 4.0 / IIoT, manufacturers are forced to transform themselves from traditionally a relatively independent part in the value chain to an interactive actor in an integrated network enabled by platforms (Ardolino et al., 2018; Frank, Dalenogare & Ayala, 2019). The use of platforms leads to new ways of doing manufacturing businesses (Bustinza, Vendrell-Herrero & Baines, 2017; Tao & Qi, 2017) and enables product-service innovation (PSI) (Sánchez-Montesinos et al., 2018; Martín-Peña, Díaz-Garrido, & Sánchez-López, 2018).

Building on a platform typology, we describe platforms as IIOT-enabled environments containing dynamic relations of technologies, interactions, processes and humans, which act as a foundation where platform providers stimulate value co-creation (VCC) with their network of complementors and gain competitive advantages by orchestrating resources and leveraging network effects (Perks et al, 2017; Ramaswamy & Ozcan, 2018). Platform strategies aim at strengthening companies' product-service offerings (Cenamor, Sjödin & Parida, 2017; Jagstedt & Persson, 2019). Research has recognized the potential of platforms for traditional manufacturers transforming to novel digitalized product-service business models (Vendrell-Herrero et al., 2018).

Exploiting new and often uncertain opportunities from a platform-based PSI system requires a better understanding of the co-creation logic between internal and external actors (Ostrom et al.,

2015; Li & Found, 2017; Lenka, Parida & Wincent, 2017). Prior studies have identified how the manufacturing industry struggles with service-based innovation, indicating pathways to boost servitization (Visnjic, Wiengarten & Neely, 2016; Coreynen, Matthyssens & Van Bockhaven, 2017; Jovanovic et al., 2019). The PSI literature has recently stressed the need for an external root (e.g., knowledge intensive business services) which can definitely be beneficial to manufacturers lacking the necessary capabilities to strengthen their service offerings (Bustinza et al., 2019a; Bustinza et al., 2019b).

This research focuses on exploring the VCC practices enabled by platforms in the IIoT context. The article contributes to the network research and the servitization literature by exploring (i) how companies co-create value through Industry 4.0/ IIoT platforms, and (ii) how do companies evolve to reach the potential set of platform-based business models.

Research methodology

Interpretive multiple case study was conducted because the topic of platform leverage is new and scarcely explored, and the interpretive methodology uncovers new relationships among key dimensions of over relatively unstructured, dynamic market strategy (Matthyssens & Vandenbempt, 2003). For detailed analysis of the phenomenon and for comparison across cases, a comparative multiple-case design as advanced by Eisenhardt (1989) and Yin (1994) was selected.

Our empirical database consists of data on four Chinese textile companies located in a specific area of east China that represents an industrial cluster specialized in textile products. All companies are pioneers selected from '2017 China smart manufacturing pilot demonstration project in the textile industry'. Two of them are fiber

manufacturers (i.e., Co. Huaxing and Co. Huading) and the other two are apparel manufacturers (i.e., Co. KuteSmart and Co. Ruyi). According to Strozzi et al., (2017, p. 6579), 'China is leading the development of the enabling technologies of the Smart Factory'. The textile industry is one of the key sectors of China's industrial reform called 'Made in China (MiC) 2025 plan' (Li, 2018). We look behind the co-creation practices of the Chinese textile industry to uncover how Chinese textile manufacturers develop their platform strategies and what VCC practices they apply.

As empirical fieldwork, a variety of data gathering methods was used, ensuring construct validity through triangulation of data (Beverland & Lindgreen, 2010). First, we consulted with industry experts about the cases and why they are considered best-practice examples within the Chinese textile sector. Second, prior to interviewing the cases, we collected secondary information on them by reading their websites, promotion materials and consulting other available information. Third, we conducted a series of semi-structured, in-depth interviews with the cases' top management, the marketing (or the front-end) department and the production (or the back-end) department. This provided an understanding of the drivers, inhibitors, steps and practices of companies' platform strategies.

Findings and discussion

Building on the radical and incremental nature of technological innovations (Dewar & Dutton, 1986), this study extends the architectural leverage logic (Thomas, Autio, & Gann, 2014) into a platform leverage framework, containing two dimensions (i.e., the incremental & radical innovation, and the transaction & production leverage), resulting in four categories: transaction-incremental (TI),

transaction-radical (TR), production-incremental (PI), and production-radical (PR) innovations (Figure 1).

The selected companies have strong symptoms of platform-type operations and demonstrate characteristics of platform strategies. They have responded to the call of MiC 2025 initiative and gradually restructured their PSI system towards smart factory business models. Table 1. demonstrates how the selected case companies developed their platform strategies and what VCC practices they applied.

All case companies look for ways to open new business opportunities and add value for their customers by leveraging platforms. We display the case companies' trajectories in the platform leverage framework (Figure 1). Based on the cross-case analysis, the starting point and three distinct transition routes across the platform leverage logics are identified: (1) Starting from offering standard products; (2) plus customer-centric offerings; (3) plus value-adding services; and (4) plus integrated personalized solutions.

As such, this study constructs a framework for understanding VCC practices in platform-based PSI systems in the context of Industry 4.0 / IIoT. This research constructs the basis for a theory that extends the servitization trajectory model (Visnjic, Wiengarten & Neely, 2016) in a platform leverage lens. We respond to Kohtamäki and Rajala's (2016) call for research on how digitalization impact on the practice of VCC, and Frow, Mccall-Kennedy and Payne's (2016) call for additional studies on VCC practices in platform-related settings.

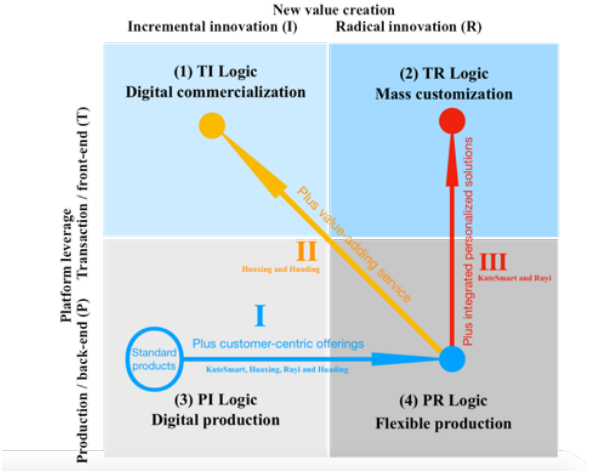


Figure 1. Case companies' evolution in platform leverage framework

Step 1			
Co. KuteSmart	Co. Huaxing	Co. Ruyi	Co. Huading
Incident: Developing a digital suit production line • Motive: For improved production efficiency • Key VCC practice: Co-designing the distributed production line with engineers and designers; RFID-facilitated Human-Machine co-manufacturing • Key stage: Materializing • Platform logic: PI	Incident: Building a digital spinning factory • Motive: For enhanced efficiency and productivity, and reduced labor usage and operation cost • Key VCC practice: Co-designing with hardware suppliers; Co-launching with government and third parties • Key stage: Materializing • Platform logic: PI	Incident: Employing digitally advanced production facilities • Motive: For reduced lead time and more stabilized product quality • Key VCC practice: Co-designing with suppliers in the digital dyeing and printing business • Key stage: Materializing • Platform logic: PI	Incident: Launching a digital factory producing nylon filament • Motive: For reduced lead time and more stabilized product quality • Key VCC practice: Co-designing with suppliers in the digital dyeing and printing business • Key stage: Materializing • Platform logic: PI

Step 2			
Incident: Building a Cloud-based manufacturing platform • Motive: For achieving flexible production • Key VCC practice: Promoting co-ideation based on research centers, universities and institutions; Setting rules to control the innovation network • Key stage: 1. Linking, 2. Institutionalizing • Platform logic: PR	Incident: Developing an integrated Cyber-Physical System • Motive: For collaborations across the production process • Key VCC practice: Co-designing with software suppliers and industry experts • Key stage: Linking • Platform logic: PR	Incident: Developing a web-based distributed manufacturing system • Motive: For improved machine utilization and more flexibility in production • Key VCC practice: Building the "talent network" program; Setting rules; Co-designing with firm partners; Co-launching with a government partner • Key stage: 1. Linking, 2. Institutionalizing • Platform logic: PR	Incident: Developing an integrated operating system • Motive: For collaborations in a networked manufacturing setting • Key VCC practice: Establishing a research department and encouraging internal co-innovation • Key stage: Linking • Platform logic: PR
Step 3			
Incident: Establishing a mass customization platform • Motive: For suiting clients' individualized needs • Key VCC practice: Linking material and accessary suppliers to the "Co-innovation hub"; Analyzing data collected in "Customization Big Data Center"; Enabling real-time communication to co-design with clients • Key stage: 1. Linking, 2. Materializing • Platform logic: TR	Incident: Developing a B2B e-commerce platform • Motive: For creating connections with customers and reducing time to market • Key VCC practice: Interacting with customers; Listening to their requirements and comments; Mutual adaptation; Nurturing cooperative culture within the platform • Key stage: 1. Materializing, 2. Institutionalizing • Platform logic: TI	Incident: Building a mass customization platform • Motive: For satisfying clients' individualized expectations • Key VCC practice: Connecting designers and IT suppliers for ideas on the customization system; Transferring Ruyi's offline clients into the platform; Continuously developing the key technology • Key stage: 1. Linking, 2. Institutionalizing • Platform logic: TR	Incident: Developing cross-border e-commerce • Motive: For the quick response to market request • Key VCC practice: Interacting with customers; Collecting and analyzing customer data; Turning their wishes into product features and quality requirements • Key stage: Materializing • Platform logic: TI

Step 4			
Incident: Building a solution platform for manufacturers • Motive: For serving customers in other industries and creating more sources of revenue • Key VCC practice: Cooperating with the national IT ministry and jointly establishing a practice base for manufacturers • Key stage: Materializing • Platform logic: TR		Incident: Developing a high-end smart retail platform • Motive: For meeting the individual needs of high-end customers • Key VCC practice: Collaborating with the world's only listed luxury e-commerce company Secoo in the fields of smart retail and develop the marketing model of M2B2C • Key stage: Materializing • Platform logic: TR	

Table 1. The four companies' key VCC practices in platforms

References

Ardolino, M., Rapaccini, M., Saccani, N., Gaiardelli, P., Crespi, G., & Ruggeri, C. (2018). The role of digital technologies for the service transformation of industrial companies. *International Journal of Production Research*, 56(6), 2116-2132. https://doi.org/10.1080/00207543.2017.1324224

Beverland, M., & Lindgreen, A. (2010). What makes a good case study? A positivist review of qualitative case research published in Industrial Marketing Management, 1971–2006. *Industrial Marketing Management*, 39(1), 56-63. https://doi.org/10.1016/j.indmarman.2008.09.005

Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2017). Service implementation in manufacturing: An organisational transformation perspective. *International Journal of Production Economics*, 192, 1-8. https://doi.org/10.1016/j.ijpe.2017.08.017

Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Baines, T. (2019a). Product–service innovation and performance: the role of collaborative partnerships and R&D intensity. *R&D Management*, 49(1), 33-45. https://doi.org/10.1111/radm.12269

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019b). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research*, in Press. https://doi.org/10.1016/j.jbusres.2019.01.035

Cenamor, J., Sjödin, D. R., & Parida, V. (2017). Adopting a platform approach in servitization: Leveraging the value of digitalization. *International Journal of Production Economics*, 192, 54-65.

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, 60, 42-53. https://doi.org/10.1016/j.indmarman.2016.04.012

Dewar, R. D., & Dutton, J. E. (1986). The adoption of radical and incremental innovations: An empirical analysis. *Management science,* 32(11), 1422-1433. https://doi.org/10.1287/mnsc.32.11.1422

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of management review*, 14(4), 532-550. https://doi.org/10.5465/amr.1989.4308385

Frank, A. G., Dalenogare, L. S., & Ayala, N. F. (2019). Industry 4.0 technologies: Implementation patterns in manufacturing companies. *International Journal of Production Economics*, 210, 15-26. https://doi.org/10.1016/j.ijpe.2019.01.004

Frow, P., McColl-Kennedy, J. R., & Payne, A. (2016). Co-creation practices: Their role in shaping a health care ecosystem. *Industrial Marketing Management*, 56, 24-39. https://doi.org/10.1016/j.indmarman.2016.03.007

Jagstedt, S., & Persson, M. (2019). Using Platform Strategies In The Development Of Integrated Product-Service Solutions. *International Journal of Innovation Management,* 23(04), 1950034. https://doi.org/10.1142/9781786347602_0011

Jovanovic, M., Raja, J. Z., Visnjic, I., & Wiengarten, F. (2019). Paths to service capability development for servitization: Examining an internal service ecosystem. *Journal of Business Research*, in Press. https://doi.org/10.1016/j.jbusres.2019.05.015

Kohtamäki, M., & Rajala, R. (2016). Theory and practice of value co-creation in B2B systems. *Industrial Marketing Management,* 56, 4-13. https://doi.org/10.1016/j.indmarman.2016.05.027

Lenka, S., Parida, V., & Wincent, J. (2017). Digitalization capabilities as enablers of value co−creation in servitizing firms. *Psychology & Marketing*, 34(1), 92-100. https://doi.org/10.1002/mar.20975

Li, L. (2018). China's manufacturing locus in 2025: With a comparison of "Made-in-China 2025" and "Industry 4.0". *Technological Forecasting and Social Change*, 135, 66-74. https://doi.org/10.1016/j.techfore.2017.05.028

Li, A. Q., & Found, P. (2017). Towards sustainability: PSS, digital technology and value co-creation. *Procedia CIRP*, 64, 79-84. https://doi.org/10.1016/j.procir.2017.05.002

Martín-Peña, M. L., Díaz-Garrido, E., & Sánchez-López, J. M. (2018). The digitalization and servitization of manufacturing: A review on digital business models. *Strategic Change*, 27(2), 91-99. https://doi.org/10.1002/jsc.2184

Matthyssens, P., & Vandenbempt, K. (2003). Cognition-in-context: reorienting research in business market strategy. *Journal of Business & Industrial Marketing*, 18(6/7), 595-606. https://doi.org/10.1108/08858620310492446

Ostrom, A. L., Parasuraman, A., Bowen, D. E., Patrício, L., & Voss, C. A. (2015). Service research priorities in a rapidly changing context. *Journal of Service Research*, 18(2), 127-159. https://doi.org/10.1177/1094670515576315

Perks, H., Kowalkowski, C., Witell, L., & Gustafsson, A. (2017). Network orchestration for value platform development. *Industrial Marketing Management*, 67, 106-121. https://doi.org/10.1016/j.indmarman.2017.08.002

Ramaswamy, V., & Ozcan, K. (2018). What is co-creation? An interactional creation framework and its implications for value creation. *Journal of Business Research*, 84, 196-205. https://doi.org/10.1016/j.jbusres.2017.11.027

Sánchez−Montesinos, F., Opazo Basáez, M., Arias Aranda, D., & Bustinza, O. F. (2018). Creating isolating mechanisms through digital servitization: The case of Covirán. *Strategic Change*, 27(2), 121-128. https://doi.org/10.1002/jsc.2187

Strozzi, F., Colicchia, C., Creazza, A., & Noè, C. (2017). Literature review on the 'Smart Factory'concept using bibliometric tools. *International Journal of Production Research*, 55(22), 6572-6591. https://doi.org/10.1080/00207543.2017.1326643

Tao, F., & Qi, Q. (2017). New IT driven service-oriented smart manufacturing: framework and characteristics. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 99, 1-11.

Thomas, L. D., Autio, E., & Gann, D. M. (2014). Architectural leverage: putting platforms in context. *Academy of management perspectives,* 28(2), 198-219. https://doi.org/10.5465/amp.2011.0105

Vendrell−Herrero, F., Parry, G., Bustinza, O. F., & Gomes, E. (2018). Digital business models: Taxonomy and future research avenues. *Strategic Change*, 27(2), 87-90. https://doi.org/10.1002/jsc.2183

Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of Product Innovation Management*, 33(1), 36-52. https://doi.org/10.1111/jpim.12254

Yin, R.K., (1994). *Case Study Research*. Thousands Oaks.CA.: Sage Publications.

Servitization in Manufacturing SMEs: Exploring its Links with Industry 4.0 Implementation Drivers

Eduardo Sisti, Miren Estensoro, Miren Larrea

Orkestra-Basque Institute of Competitiveness and Deusto Business School

Abstract

The implementation of Industry 4.0 relates to gains in productivity and the generation of new sources of income (BCG, 2016). One of the most important (and synergetic) new avenues is the development of servitization (Kamp et al., 2016) which has critical implications for territories (Lafuente, Vaillant &Vendrell-Herrero, 2017). This is especially important for the Basque Country that stands out for its manufacturing tradition and its composition based on SMEs. This paper focuses on how manufacturing SMEs approach servitization in order to be part of the Industry 4.0. transition paradigm and it makes two main contributions. First, through a regression analysis conducted on 174 manufacturing SMEs from Gipuzkoa (Basque Country, Spain) we identify the drivers for servitization in manufacturing SMEs, which include strategic, operational and social drivers. Preliminary results show that social drivers and specifically the cooperation culture of the firm are critical for SME servitization. Complementary, the qualitative data gathered through interviews make possible to go deeper in the understanding about the challenges for SMEs in the servitization processes. Second, when discussing the findings and deriving managerial implications for SMEs, a special focus is done on lessons for policy makers. At this matter, the need of SMEs for external assistance by integrating proximity agents like county development agencies or the importance of adapting to specific

territorial conditions contribute to the discussion for overtaking the micro-level approach in servitization research.

Keywords: Servitization, SMEs, manufacturing industry, drivers, inclusiveness.

Theory and hypotheses

The conceptual approach of the paper focuses on the interaction (& synergies) between three topics of interest. First, the development of industrial servitization related to strategic, operational, and social drivers at firm-level (Gebauer et al., 2005; Cook et al., 2006; Kowalkowski et al., 2012; Lay, 2014; Parida et al., 2014; Li et al., 2015; Kiel et al., 2017; Vendrell-Herrero et al., 2017; Raddats, et al., 2019; Sklyar et al., 2019). Second, Industry 4.0 refers to the effects and adoption of new technological advances (i.e. connectivity in the factory) in the flexibility and productive efficiency; and at the same time, it has business models changes such as the new opportunities for the provision of services (Navarro & Sabalza, 2016; Frank et al., 2019; BCG, 2015). Third, the small scale of firms is usually related to a less capacity to support the development of services (Neely, 2008; Li et al., 2015; Chalal et al., 2015) as well as the transition to the Industry 4.0 (Muller & Voigt, 2017; Schumacher, Erol & Sihn, 2016; Faller & Fedmuller, 2015). To sum up, the exploration of the influence identifying the transition drivers for servitization is a challenging issue for SMEs. Therefore, the following hypotheses are proposed:

H1. The strategic sophistication (& pressures) is positively related to SMEs' servitization.

H2. Higher operational capabilities are positively related with SMEs' servitization propensity

H3. Greater collaboration culture of the firm is positively related to SME's servitization

Methods

Research process

The research process behind this paper has been developed through seven bimonthly workshops inspired by action research methodologies (Karlsen & Larrea, 2014; Larrea et al., 2018). Researchers, facilitators (county development agencies) and policy makers (provincial council) participated in these workshops. The shared goal was to analyze the situation of SMEs and to help them to step into the Industry 4.0 transition path. One distinct outcome for this transition is servitization. Then, some other conditions are classified according to the drivers mentioned before (Table 1).

Type	Driver	Description
Strategic	Strategic thinking	Degree of top management involvement and a holistic approach
	Market acceptance	Assesses to what extent the market/sector where the SME operates is one in which there is pressure or possibilities to advance within Industry 4.0 transition
	Competitors' behaviour	Identifies where in the value chain the SME is positioned and how its relationship with other (often bigger and client but also competitor) firms in the chain
Operational	Financial resources	The potential of the SME to make new investments
	Profitability and efficiency	The potential of profitability and efficiency of new investments for Industry 4.0
	Qualified staff	Assessment of the qualification of staff, and the possibilities to increase their skills
	Infrastructures	Availability of high-speed networks in their industrial area or town
Social	Alliances and cooperation in the innovation system	Assesses the development of cooperation with other SMES, customers, and suppliers or through alliances with actors from the innovation system
	Organizational model and resilience	Assesses whether the managerial and organizational models are adapted to context changes

Table 1. Drivers for Industry 4.0 implementation

The empirical analysis is executed through a mixed-method approach (Creswell, 2003). First, the quantitative analysis is carried out by means of an econometric estimation which helps to identify the relative importance of the drivers. Second, the qualitative analysis is made trough 8 semi-structured interviews to inquire deeper on the understanding of drivers' effects.

Sample and data collection

The sample of analysis contains 174 manufacturing SMEs with between 20 and 99 employees from Gipuzkoa province (Basque Country, Spain). Data was collected by the staff of the county development agencies from Dec-2017 to May-2018. Semi-structured interviews are conducted by authors.

Variables

Dependent variable. Servitization is measured using a 4-point Likert scale. Also, it is transformed into a binary variable (Agree=1; disagree=0) to test it in a logit model.

Independent variables. Nine conditions for Industry 4.0 transition are collected using a 4-point Likert scale. Due to the high correlation between them, groupings have been carried out by means of a factor analysis.

Control variables. Firm-level size (logarithm of sales), age (calculated using the year of creation from the SABI-Informa database), and sector technological intensity (using dummy variables) are included to control.

Preliminary results

The first general issue to note is the low degree of servitization development among the surveyed firms. This is complemented by

qualitative information stressing their lack of knowledge on the concept and priority towards servitization. On the other hand, the preliminary results of the econometric estimation highlight the statistical significance of the development of alliances in the field of Industry 4.0; then, it seems that collaboration increase the probability of servitization. This confirms the implications of the importance of having a territorial ecosystem for innovation that fosters cooperation and collaboration between companies, KIBS, and other actors in the innovation system (Lafuente et al., 2017).

References

BCG (2015). *Industry 4.0: The future of productivity and growth in manufacturing industries*. Boston Consulting Goup Perspectives.

Chalal, M., Boucher, X., & Marques, G. (2015). Decision support system for servitization of industrial SMEs: a modelling and simulation approach. *Journal of Decision Systems*, 24(4), 355-382. https://doi.org/10.1080/12460125.2015.1074836

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. https://doi.org/10.1016/j.jclepro.2006.01.018

Faller, C. y Feldmüller, D. (2015). Industry 4.0 Learning Factory for regional SMEs. *The 5th Conference on Learning Factories 2015. Procedia CIRP*, 32, 88-91. https://doi.org/10.1016/j.procir.2015.02.117

Frank, A.G., Mendes, G.H.S., Ayala, N.F., & Ghezzi, A. (2019). Servitization and Industry 4.0 convergence in the digital transformation of product firms: a business model innovation perspective. *Technological Forecasting and Social Change*, in press. https://doi.org/10.1016/j.techfore.2019.01.014

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal*, 23(1), 14-26. https://doi.org/10.1016/j.emj.2004.12.006

Karlsen, J. & Larrea, M. (2014) (Eds.). *Territorial Development and Action Research: Innovation Through Dialogue.* Gower, Farnhman, UK..

Kamp, B., Ochoa, A., & Díaz, J. (2016). Smart servitization within the context of industrial user-supplier relationships: contingencies according to a machine tool manufacturer. *International Journal of Interactive Design and Manufacturing*, 11(3), 651-663. https://doi.org/10.1007/s12008-016-0345-0

Kiel, D., Arnold, C., & Voigt, K.-I. (2017). The Influence of the Industrial Internet of Things on Business Models of Established Manufacturing Companies-A Business Level Perspective, *Technovation,* 68, 4-19. https://doi.org/10.1016/j.technovation.2017.09.003

Kowalkowski, C., Kindström, D., Alejandro, T.B., Brege, S., & Biggemann, S. (2012). Service infusion as agile incrementalismin action. *Journal of Business Research*, 65(6), 765-772. https://doi.org/10.1016/j.jbusres.2010.12.014

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Larrea, M., Estensoro, M., & Sisti, E. (2018). The contribution of action research to Industry 4.0 policies: bringing empowerment and democracy to the economic efficiency arena, *International Journal of Action Research*, 14(2-3), 164-180. https://doi.org/10.3224/ijar.v14i2-3.07

Lay, G. (Ed.) (2014) *Servitization in industry.* Heidelberg: Springer Verlag. https://doi.org/10.1007/978-3-319-06935-7

Li, J., Lin, L., Chen, D., & Ma, L. (2015). An empirical study of servitization paradox in China. *The Journal of High Technology Management Research*, 26(1), 66-76. https://doi.org/10.1016/j.hitech.2015.04.007

Müller, J. y Voigt, K. (2017). Industry 4.0 - Integration strategies for SMEs. *International Association for Management of Technology IAMOT 2017 Conference Proceedings*.

Müller, J., Kiel, D. y Voigt, K. (2018). What Drives the Implementation of Industry 4.0? The Role of Opportunities and Challenges in the Context of Sustainability. *Sustainability*, 10(1), 247-271. https://doi.org/10.3390/su10010247

Müller, J., Buliga, O., & Voigt, K. (2018). Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0. *Technological Forecasting and Social Change*, 132, 2-17. https://doi.org/10.1016/j.techfore.2017.12.019

Navarro-Arancegui, M., & Sabalza-Laskurain, X. (2016). Reflexiones sobre la Industria 4.0 desde el caso vasco. *Ekonomiaz*, 89(1), 143-173.

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research*, 1(2), 103-118. https://doi.org/10.1007/s12063-009-0015-5

Parida, V., Sjödin, D.R., Wincent, J., & Kohtamäki, M. (2014). A survey study of the transitioning towards high-value industrial product-services. *Procedia CIRP*, 16, 176-180. https://doi.org/10.1016/j.procir.2014.01.019

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J. & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*. Available at https://doi.org/10.1016/j.indmarman.2019.03.015

Schumacher, A., Erol, S., & Sihn, W. (2016). A Maturity Model for Assessing Industry 4.0 Readiness and Maturity of Manufacturing Enterprises. *Procedia CIRP*, 52, 161-166. https://doi.org/10.1016/j.procir.2016.07.040

Sklyar, A., Kowalkowski, C., Tronvoll, B., & Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research*. Available at https://doi.org/10.1016/j.jbusres.2019.02.012

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60, 69-81. https://doi.org/10.1016/j.indmarman.2016.06.013

Vendrell-Herrero, F., & Wilson, J. R. (2016). Servitization for territorial competitiveness: Taxonomy and research agenda, *Competitiveness Review*, 26(5).

Towards and Empirical Analysis of Relations between Territorial Servitization and Place Leadership

Marco Bellandi

University of Florence

Silvia Lombardi

ISTAT

Erica Santini

University of Trento

Abstract

The introduction of digital-based services and technologies within production processes and products challenges local productive systems with traditional specializations in manufacturing. Territorial servitization is a potentially feasible solution, since it is compatible with the place-based division of labour and decentralized organization featuring many such systems in old industrialized countries. However, it asks for a coordinated set of structural factors underpinned by specific systemic conditions. An appropriate place leadership (PL) plays an important role in regulating the coordination of systemic conditions. However, if either structural factors are weak or place leadership is based on a closed club of private interests, TS trajectories may be entrapped by inertia or even deliberate resistance to change. This paper aims to pave the way for an empirical analysis of such phenomena. We build on a previous work on the relations between local manufacturing configurations,

specialization in service activities, and systemic performances in contemporary Italian local productive systems. The results indicated the possible presence of TS trajectories only when specific knowledge intensive services are localized in the manufacturing area. We propose a variation that allows a first control of PL's possible impacts.

Keywords: Territorial servitization; place-leadership; local productive systems; empirical analysis.

Introduction

We build here on two recent papers that touch upon, respectively, conceptual and empirical sides of a line of research on territorial servitization (TS) in local productive systems featuring a manufacturing specialization driven by SMEs. The first paper (Bellandi and Santini, 2019) presents a novel conceptual frame to explore how types of place leadership (**PL**) could combine with structural patterns impinging on territorial servitization (**TS**) trajectories of different strength. Here, PL might help or obstruct rerouting of a manufacturing Local Productive System (**LPS**) towards a product-service system specialization (**PSS**). The second paper (Bellandi et al., 2019) presents an empirical analysis on Italian cases, and aims at shedding light on the roles played by different classes of knowledge intensive business services (KIBSs). KIBSs enter manufacturing processes and have different impacts on both TS and performances of different types of LPS.

After recalling the main results of the two papers above, we discuss the problem of identifying statistical variables related to PL in LPS. According to the first paper, we propose some possible proxies of PL to combine them with the frame of the second paper and implement a comprehensive empirical analysis.

Place leadership in emerging product-service systems: A conceptual frame

Since TS is a systemic and place-based trajectory (Lafuente et al., 2017), its strength and stability depend on an appropriate combination of specific structural factors innervating a place (Gomes et al., 2018). LPS present different patterns of local entrepreneurial, institutional structures, and embedded specialised competences. Bellandi & Santini (2019) recall a specification of such factors in terms relevant to TS trajectories: I. a multiplicity of specialized competences within and around the manufacturing value chain, which represents a potential demand for highly specific KIBS; II. an institutional context of local and multi-scalar governance that lowers local transaction costs and fosters collaborations between manufacturing SMEs and KIBS providers; III. an entrepreneurial drive that expands the experimentation of new business models and new institutional mechanisms. The level and quality of the three factors trigger different types of TS trajectories, from Strong TS (STS) to Mild, Weak, or even Unstable TS. STS trajectories are related to patterns of high levels in all three factors. LPS manufacturing firms systematically exchange knowledge with new local or localized KIBS. Advanced services combine with manufacturing processes and product functionalities, playing a role as innovation bridges. STS trajectories allow the convergence to PSS. In case of weaker patterns in one or more factors, feasible TS trajectories have a lower strength and may be conducive at best to the surfacing of some niches of product-service solutions within the traditional manufacturing system.

The strength of the three factors depends on the availability of a set of specifically adapted systemic conditions, such as training structures for digital-aware skills and business culture, digital infrastructure and intermediary platforms (online marketplaces, social media and creative content outlets, application distribution

platforms, price comparison websites and collaborative economy platforms). Influencing, building or adapting systemic conditions imply the exercise of high-level strategic (Schumpeterian) functions within the institutional and business context. Bellandi and Santini (2019) relate such strategic functions to the concept of PL (Sotarauta & Beer, 2017). The same PL may be stronger or weaker, being more or less able to have an impact on structural factors. In some cases, a contestable and composite leadership is constituted on the capability to mobilize a large part of the local endowment, mediate conflictual views and interests, and support positively the factors of stronger TS trajectories. In other cases, systemic conditions are driven by few actors enjoying entrenched positions of local economic and political power, and they may express a deliberate resistance to change if solutions reconciling rents for the élite and rerouting are not found.

Agglomerative patterns of manufacturing and service activities

The empirical analysis in Bellandi et al. (2019) presents two parts. The first is aimed at detecting localization patterns of service activities in Italian LPS in the last decade, distinguishing knowledge intensive services (KIS) for the business sector (KIBS). It focusses on the classification proposed by Cusumano et al. (2015): knowledge-intensive financial services are related to the smoothing services, which do not alter the product functionality; knowledge intensive market services and other knowledge intensive services are identified with adapting services that expand the product functionality and trigger processes of reconfiguration in the local system; high-tech knowledge intensive services correspond to the substituting services that increase the capability of firms to offer alternative service solutions to buyers.

The second part of the analysis focuses on a subset of manufacturing LPS, and exploits the service localization patterns detected in the first part of the analysis. The aim is to assess association patterns between service localization and socio-economic LMA characteristics. Therefore, an additional set of variables of performance and competitiveness (ISTAT, 2015d) is taken into account, as well as socio-demographic and industrial organization features available for the year 2011-2013. A Multiple Correspondence Analysis detects significant statistical associations among such variables, and a Cluster Analysis highlights groups of local systems featured by the same characteristics.

The results highlight a strong association between high-performing manufacturing LPSs, both IDs and large-enterprises LPSs, and specific categories of KIS: Knowledge intensive market services and Knowledge intensive financial services. However, only the cases where manufacturing activities are highly associated with adapting and substituting services appear to be candidates to host strong TS trajectories. Instead, smoothing services supporting local manufacturers in a traditional way still dominate. Here, there is a high risk to maintain the system's path stuck to weaker TS trajectories.

LPSs with weaker or even bad performances are associated to Other KIS or Low KIS. An important issue concerns Other KIS. They include for example basic training activities that, *per se*, are necessary to the regeneration of human capital and therefore to support the enhancement of the local multiplicity of specialized competencies towards TS. On the other hand, a relatively high presence of such services may signal just an excessive role played by public employment, and this seems not conducive to stronger TS trajectories.

Two further steps for an empirical analysis

We propose eventually two further steps towards an empirical analysis of the relations between TS, structural factors and PL in LPS featured by a traditional manufacturing specialization. The first concerns the empirical identification of the variables in the conceptual frame above. Multiplicity can be related to longitudinal measures of number and concentration of employment within and without the main specializations of the LPS; the quality of the institutional context to measures of social capital; the strenght of the entrepreneurial drive to measures of firms' demography, i.e. of entrepreneurship capital. PL is identified, within the related specialized literature, by means of surveys on case-studies or the analysis of meta-data on limited sets of local systems or regions. Direct proxies are difficult to find in general statistical datasets. Indirect proxies may concern higher or lower concentration of employment in larger plants, higher or lower concentration of innovation sources (patents or other), higher or lower indexes of open government or vice-versa or corruption in local PA, broader or narrower diffusion of cultural activities, higher or lower rate of participation to local elections, etc. The second step concerns the interaction of some variables related to PL with the clusters of LPS identified by the empirical analysis on Italy recalled above. The aim is to test if stronger (weaker) TS and/or performance are confirmed by signals of stronger (or weaker) structural factors and PL. This will be just an exploratory analysis, since at the moment very few sets of data are available at the appropriate territorial level for the proxies we are looking for. We work here just on data related to multiplicity and to concentration of local employment and diffusion of cultural activities, and present related results.

References

Bellandi, M., & Santini, E. (2019). Place leadership in emerging product-service systems. Forthcoming in *International Journal of Business Environment*.

Bellandi, M., Lombardi, S, & Santini, E. (2019). Traditional manufacturing areas and the emergence of product-service systems: the case of Italy. Forthcoming in *Economia e politica industriale – Journal of Industrial and Business Economics*. https://doi.org/10.1007/s40812-019-00140-y

Cusumano, M. A., Kahl, S. J., & Suarez, F. F. (2015). Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal*, 36(4), 559-575. https://doi.org/10.1002/smj.2235

Gomes, E., Bustinza, O. F., Tarba, S., Khan, Z., & Ahammad, M. (2018). Antecedents and implications of territorial servitization. *Regional Studies*, 53(3),410-423. https://doi.org/10.1080/00343404.2018.1468076

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Sotarauta, M., & Beer, A. (2017). Governance, agency and place leadership: lessons from a cross-national analysis. *Regional Studies*, 51(2), 210-223. https://doi.org/10.1080/00343404.2015.1119265

Parallel session 4

Service Innovation Strategies

Chair: Oscar F. Bustinza

Treble Innovation Firms: Opening Innovation Frontiers in Manufacturing

Ferran Vendrell-Herrero

University of Birmingham

Oscar F. Bustinza

University of Granada

Marco Opazo Basáez

University of Deusto

Abstract

Manufacturing firms can develop three forms of innovation: product, process, and service. Previous research has mostly analysed service innovation in isolation, whilst this study aims at comparing profit position of firms adopting simultaneously all technological innovations (treble innovation firms). Based on the Resource-Based View (RBV) premises, we argue that treble innovation firms can build on innovation cross-fertilization to develop valuable, rare and inimitable resources that translates in to a higher profitability. Furthermore, consistently with RBV, we also expect treble innovation firms to benefit more from open innovation because they can save considerably more in internal R&D development whilst keeping a differentiated offer. We test our hypotheses on a random and representative survey to 423 Spanish manufacturing firms, for which 22% are treble innovators. Our results support our hypotheses. Hence, we find causal evidence supporting that treble innovation firms obtain supernormal profits. Our results also confirm that open innovation positively moderates the relationship

between treble innovation firms and performance, but this moderation is significant only when internal R&D expenditures are low.

Keywords: Open Innovation, Service Innovation, Resource-Based View, Manufacturing firms, Returns on Sales.

Extended Summary

Product companies are using emergent technologies from the digital world to offer a wide range of innovations and obtain greater value from the product throughout its lifespan (Vendrell-Herrero et al., 2017; Opazo-Basáez et al., 2018). Such innovations do not only entail product and process innovations, but also service innovations that lend the firm considerable extra capacity to create value (Bustinza et al., 2018). An illustrative example of this is the case of Apple. The firm's strategy can now no longer be simply summarised as one that optimises to the utmost the manufacture of products and processes with its emblematic slogan "Designed by Apple in California, Assembled in China". Rather, it is developing a whole range of cloud-based services that not only enable there to be greater interactivity with the customer, but that these in turn relaunch the intrinsic value of its products. Recent data refers to the fact that the division of services is the only thing that is keeping the level of company sales afloat[2].

The example of Apple merely illustrates the move on the part of manufacturers towards a broader outlook on innovation by simultaneously incorporating process, product and service innovations. This paper contributes to innovation management literature by identifying these types of firm and classifying them as treble innovation firms.

---

2 Apple shifts focus to services business. Available at https://www.ft.com/content/68e80a44-9b28-11e6-b8c6-568a43813464

On an increasingly competitive and globalised market, these firms are becoming more and more common —in a representative sample of Spanish manufacturers, we found that approximately one in every five medium-sized enterprises may be classified as treble innovation firms. The growing popularity of these types of firm is significant because it reinforces the notion that these different types of innovation complement each other— something that has been studied with only two types of innovation (i.e. Visnjic et al., 2016), albeit not one that has been taken into consideration in the case of three simultaneous innovations. Hence, this study constitutes a response to the call for those that combine the synchronised adoption of technological and innovation management (Alexiev et al., 2018).

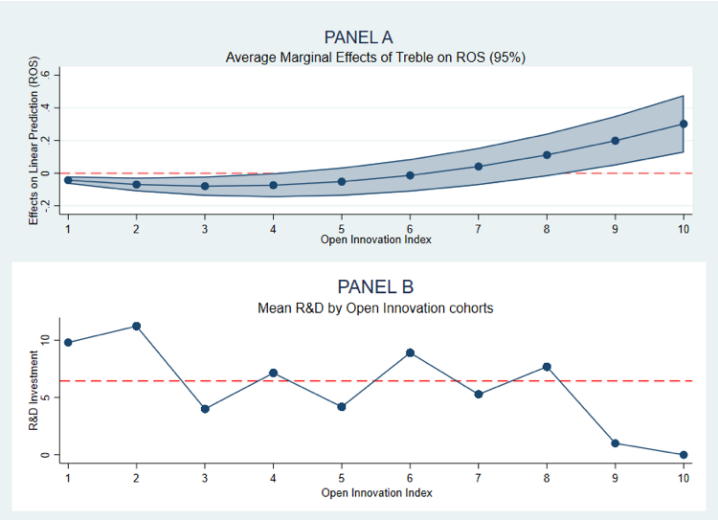
This study uses the Resource-Based View (RBV) of the firm as a theoretical framework –this theory determines the fact that the firm needs to control and exploit limited, inimitable and valuable resources in order to increase its competitive advantage (Teece, 2006). Accordingly, pursuing this theory and evolutionary view of innovation in which intangible resources are deemed complementary to each other (Hannola et al., 2018), we hypothesize that treble innovation firms are more profitable than firms that already have product and process innovations, in an attempt to evaluate the marginal benefit of the most recent evolutionary step in the innovation process in manufacturing industries. In accordance with our estimations using matching techniques, manufacturers with product, process and service innovations at their disposal retain approximately eleven out of every hundred Euros gained in turnover, whereas firms featuring product and process innovation may retain only around five out of every hundred Euros. This six Euro difference per every hundred Euros is both statistically significant and robust in terms of various specifications, including doubly robust estimations.

However, the fact should be taken into account that medium-sized firms have limited resources at their disposal (De Massis et al., 2018), and it is therefore difficult to envisage how they might simultaneously develop the three types of innovation internally. In this respect, we argue that such firms somehow need to gain knowledge from external organisations belonging to the same production chain as is the case with suppliers, competitors and customers (Tsinopoulos et al., 2018). In other words, treble innovation firms have greater incentive to implement open innovation systems that may enable them to access such knowledge (Mowery, 2009).

At first glance, there would appear to be an inconsistency in using RBV while at the same time maintaining that open innovation is necessary to ensure that treble innovation firms may be profitable. When all is said and done, this theory argues that the firm needs to maintain control over its most valuable resources (Barney, 1991). Despite this apparent inconsistency, a recent formal model developed by Alexy et al. (2018) has enabled these two theoretical views to find some common ground. The conceptual model suggests that two open innovation systems will be profitable while at the same time remain in keeping with the theory based on resources and capacities only under two conditions: (i) when this entails a significant saving in terms of developing internal innovation, or (ii) when this enables those intangible resources that remain protected in the organisation to be systematically exploited. As per Figure 1 this paper is the first to validate the predictions made by Alexy et al. (2018), as it not only shows that firms with multiple resources are the ones that benefit most from open innovation, but also show that benefit is apparent only when there is a significant saving in R&D investment.

Within predictions about the theory of resources and capacities, we find that strategic resources need to complemented so as to thus

be able to increase channels for creating and gaining business value (Teece, 2006). And within this conceptual framework, the core hypothesis put forward in this work is that firms with an extensive, varied innovation portfolio may gain greater financial returns. By using an evolutionary view of innovation in manufacturing industries (Bustinza et al., 2019; Visnjic et al., 2019), this research



Note: To calculate Open innovation our survey collects binary information on whether the firm uses different types of external knowledge sources when developing product, process and/or service innovation. Our open innovation index equals the sum of all sources of innovation plus one (∑IS+1). In that way the index has a minimum of 1 (no sources of external innovation) and a maximum of 10 (all possible sources of external innovation). The dependent variable in the analysis is Returns on Sales (ROS). The red line in Panel B denotes the mean R&D investment for treble innovation firms (6.4%).

Figure 1. The moderation role of open innovation and the relationship with R&D investment.

finds substantial, robust evidence to suggest that resources that are innovatory in nature are indeed complementary. This result makes a contribution to previous evidence that compared the complementary nature of having two simultaneous innovation results in the firm (i.e. Najafi-Tavani et al. (2018) for product and process; Visnjic et al. (2016) for product and service; or Alexiev et al. (2018) for service and management), because it adds the possibility of extending up to three types of innovation result: product, process and service, and in this respect, the results are clear.

References

Alexiev, A. S., M. Janssen, and P. den Hertog. (2018). The moderating role of tangibility in synchronous innovation in services. *Journal of Product Innovation Management,* 35(5), 682-700. https://doi.org/10.1111/jpim.12459

Alexy, O., West, J., Klapper, H., & Reitzig, M. (2018). Surrendering control to gain advantage: Reconciling openness and the resource−based view of the firm. *Strategic Management Journal*, 39(6), 1704-1727. https://doi.org/10.1002/smj.2706

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120. https://doi.org/10.1177/014920639101700108

Bustinza, O., Vendrell Herrero, F., Gomes, E., Lafuente González, E. M., Opazo-Basáez, M., Rabetino, R., & Vaillant, Y. (2018). Product-service innovation and performance: unveiling the complexities. *International Journal of Business Environment*, 10(2), 95-111. https://doi.org/10.1504/IJBE.2018.095819

Bustinza, O. F., Gomes, E., Vendrell−Herrero, F., & Baines, T. (2019). Product–service innovation and performance: the role of collaborative partnerships and R&D intensity. *R&D Management*, 49(1), 33-45. https://doi.org/10.1111/radm.12269

De Massis, A., Audretsch, D., Uhlaner, L. & Kammerlander, N. (2018). Innovation with limited resources: Management lessons from the German Mittelstand. *Journal of Product Innovation Management,* 35(1), 125-46. https://doi.org/10.1111/jpim.12373

Hannola, L., Richter, A., Richter, S. & Stocker, A. (2018). Empowering production workers with digitally facilitated knowledge processes–a conceptual framework. *International Journal of Production Research,* 56(14), 4729-43. https://doi.org/10.1080/00207543.2018.1445877

Mowery, D. C. (2009). Plus ca change: Industrial R&D in the "third industrial revolution". *Industrial and Corporate Change,* 18(1), 1-50. https://doi.org/10.1093/icc/dtn049

Najafi-Tavani, S., Najafi-Tavani, Z., Naudé, P., Oghazi, P., & Zeynaloo, E. (2018). How collaborative innovation networks affect new product performance: Product innovation capability, process innovation capability, and absorptive capacity. *Industrial Marketing Management,* 73, 193-205. https://doi.org/10.1016/j.indmarman.2018.02.009

Opazo-Basáez, M., Vendrell-Herrero, F., & Bustinza, O. (2018). Uncovering productivity gains of digital and green servitization: implications from the automotive industry. Sustainability, 10(5), 1524. https://doi.org/10.3390/su10051524

Teece, D. J. (2006). Reflections on "profiting from innovation". *Research Policy*, 35(8), 1131-46. https://doi.org/10.1016/j.respol.2006.09.009

Tsinopoulos, C., Sousa, C. M., & Yan, J. (2018). Process innovation: Open innovation and the moderating role of the motivation to achieve legitimacy. *Journal of Product Innovation Management*, 35(1), 27-48. https://doi.org/10.1111/jpim.12374

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60, 69-81. https://doi.org/10.1016/j.indmarman.2016.06.013

Visnjic, I., Ringov, D., & Arts, S. (2019). Which service? How industry conditions shape firms' service-type choices. *Journal of Product Innovation Management*. In Press. https://doi.org/10.1111/jpim.12483

Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of Product Innovation Management*, 33(1), 36-52. https://doi.org/10.1111/jpim.12254

Antecedents and Consequents of Service Innovation in Brazilian Medical Device Companies: The Moderating Effects of Digital Technologies

Guilherme Sales Smania, Glauco Henrique de Sousa Mendes, Camila Favoretto, Fabiane Letícia Lizarelli

Federal University of São Carlos

Abstract

Servitization has been widely considered as a strategy of product firms to create long-term competitive advantage. Building on the service innovation literature, this study explores the antecedents and consequents of service innovation in Brazilian medical device manufacturing companies. Moreover, the article tests how the use of digital technologies moderates service innovation performance. To validate the proposed conceptual model, a survey was conducted with 68 Brazilian medical device servitized companies. Structural equation modelling was used to investigate the investigated constructs and their relations. The results validated the tested hypotheses: i) service strategy directly influences the culture and climate, leadership and technology; ii) culture and leadership directly influence co-creation; iii) co-creation and technology directly act as mediators and influence on service innovation; iv) service innovation has positive impact on the financial and non-financial performances and; v) digital technologies positive impact the service innovation performance. The results provide new insights about service innovation in medical device manufacturing companies.

Keywords: Servitization; Service Innovation, Digital Technologies, Firm Performance and Medical Device Companies.

Introduction

Servitization is as a competitive strategy for product firms, contributing to increase their competitiveness, turnover and market power (Kowalkowski et al., 2017). To varying degrees, servitization might involve the reconfiguration of a company's business model (Baines et al., 2017; Fliess & Lexutt, 2017). Servitized companies seek to provide services (Santamaria et al., 2012; Storey et al., 2016), but the number of studies that investigate how product firms might excel in their service innovation are relatively scarce (Valtakoski & Witell, 2018). In the service innovation literature, several studies cite key antecedents of service innovation performance, including internal organizational factors, such as proficient operations and delivery systems, a strong innovation culture and appropriate organizational design practices (Santamaria et al., 2012; Storey et al., 2016; Mendes et al., 2017). In this article, a conceptual model was developed considering antecedent constructs such as service strategy, culture and climate, leadership, co-creation and technology. The consequent constructs of service innovation were financial performance and non-financial performance.

Research Method

Primary data was collected from a survey with 68 Brazilian servitized medical device companies. The questionnaire was addressed to managers involved with product and service innovation of these companies and it was administrated using face-to-face interviews. The analysis was carried out through a descriptive exploratory research. Partial Least Squares - Structural Equation Modelling (PLS-SEM) was also used to analyze the collected data, assess the model and test the hypotheses. Before that, the sample bias was tested using Harman's single-factor test (Podsakoff et al., 2003) and the results showed that common

method bias was not a problem in the sample. Moreover, all the validity and reliability measures were satisfied, indicating that the fit of our conceptual model.

Findings

To test the predictive power of our structural model, the explained variance in the endogenous constructs was verified by means of R2 values (Hair et al., 2014). In this sense, the R2 values suggest great adequacy of the model since they range from 0.194 (Financial performance) to 0.656 (Culture and climate). Furthermore, the results support all the proposed hypotheses. In particular, we highlight the following relations: i) service strategy directly influences the culture and climate, leadership and technology; ii) culture and leadership directly influence co-creation; iii) co-creation and technology act as mediators and; iv) service innovation has positive impact financial and non-financial performances. Regarding the control variables, the results did not show statistical significance between both large and small/medium companies. Lastly, the results, suggest that use of digital technologies (e.g, internet of things, big data and cloud computing) have a positive relationship or moderation effect on the service strategy and technology relationship. These results shed lights on the antecedents and consequents of service innovation in Brazilian servitized medical device companies. Consequently, they provide management implications to servitized product firms that want to increase their financial and non-financial impact through the enhancement of service innovation.

Acknowledgments

This research has been financially supported by São Paulo Research Foundation – FAPESP.

References

Baines, T., Ziaee Bigdeli, A., Bustinza, O. F., Shi, V. G., Baldwin, J., & Ridgway, K. (2017). Servitization: revisiting the state-of-the-art and research priorities. *International Journal of Operations & Production Management*, 37(2), 256-278. https://doi.org/10.1108/IJOPM-06-2015-0312

Fliess, S., & Lexutt, E. (2017). How to be successful with servitization - Guidelines for research and management. *Industrial Marketing Management.*

Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2014). A primer on partial least squares structural equation modeling (PLS-SEM). Sage publications.

Kowalkowski, C., Gebauer, H., Kamp, B., & Parry, G. (2017). Servitization and deservitization: Overview, concepts, and definitions. *Industrial Marketing Management*, 60, 4-10. https://doi.org/10.1016/j.indmarman.2016.12.007

Mendes, G. H., Oliveira, M. G., Gomide, E. H., & Nantes, J. F. D. (2017). Uncovering the structures and maturity of the new service development research field through a bibliometric study (1984-2014). *Journal of Service Management*, 28(1), 182-223. https://doi.org/10.1108/JOSM-07-2015-0230

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, 88(5), 879. https://doi.org/10.1037/0021-9010.88.5.879

Santamaría, L.; Nieto, M. J. & Miles, I. (2012). Service innovation in manufacturing firms: Evidence from Spain. *Technovation*, 32(2), 144-155. https://doi.org/10.1016/j.technovation.2011.08.006

Storey, C., Cankurtaran, P., Papastathopoulou, P., & Hultink, E. J. (2016). Success factors for service innovation: A meta‐analysis. *Journal of Product Innovation Management*, 33(5), 527-548. https://doi.org/10.1111/jpim.12307

Valtakoski, A., & Witell, L. (2018). Service capabilities and servitized SME performance: contingency on firm age. *International Journal of Operations & Production Management*, 38(4), 1144-1164. https://doi.org/10.1108/IJOPM-06-2016-0328

Data-driven Servitization of SMEs: Assessment of Success Factors based on a Multiple Case Study

Lukas Schweiger, Jürg Meierhofer

Zurich University of Applied Sciences

Abstract

It is challenging for small and medium-sized enterprises (SMEs) to successfully adopt the concepts of servitization of manufacturing. This is because many of the concepts and approaches of servitization have been designed for larger companies (Hewitt-Dundas, 2006). It is considerably more demanding for SMEs to develop the necessary resources (Neely, 2008) in the area of data capabilities for services (Meierhofer et al., 2019). The lack of consideration of servitization research in the SME area is discussed in (Kowalkowski et al., 2015). This paper discusses the hurdles that SMEs face in data-driven servitization by means of a multiple case study. For the creation of the cases, data-driven servitization approaches for different types of manufacturing SMEs were developed based on the key question: How can SMEs undertake first steps in the development of data-driven services against the background of their limited resources and capabilities?

Keywords: Smart services, data-driven servitization, SMEs, multiple case study.

Research Motivation

The transition from products to services is considered essential in general and specifically for SMEs. On the transition from products to services, the focus moves from the concept of "Goods-

Dominant Logic" (GDL) to "Service-Dominant Logic" (SDL). In SDL, service is considered the fundamental purpose of economic exchange (Vargo & Lusch, 2008). It is provided in networks of actors, which are called "manufacturing service ecosystems" (Opresnik & Taisch, 2015). The concept of industrial companies as service providers has emerged (Lay, 2014). The value creation is moved from the manufacturer processes to the co-creation between the manufacturer and the customer (Vargo & Lusch, 2008). For advanced services, the provider guarantees the customer an agreed performance at an agreed pricing scheme. Hence, assessing and quantifying the fluctuations and risks inherent to the output performance as well as to the production costs for achieving this performance becomes a key capability for a provider when moving to output-oriented advanced services. Leveraging data for the development and the provision of services becomes a critical challenge with the increasing degree of servitization of manufacturing and the move to advanced services (Meierhofer, 2018). Therefore, in this paper, we investigate how different types of SMEs cope with the challenge of moving into the new field of data-driven services.

Research Approach

In a multiple case study, different types of data-driven servitization approaches of SMEs were investigated and realized up to a rapid prototyping level. This procedure helped understand the value creation process under the constraint of limited resources. The four different types of cases were then compared by the criteria of managing constraint resources vs. the creation of service value for the customers. In the following paragraphs, the four types of cases are shortly described:

Optimization Case

The aim was to optimize the production in such a way that more precise planning of the operating times of the machines would be possible. This was enabled by the analysis of sensor data integrated in the machines monitoring the process. The data set used for the production optimization consisted of several data sets directly from the production line.

Condition Monitoring Case

The goal was to detected machine failures 24 hours in advance by a data-based monitoring. In addition, the condition of the machines should be observed in a continuous manner. The data set for monitoring the condition and predicting faults in the machines consisted of a collection of (synthetic) time series data from one hundred machines of four different types.

Error Message Case

The analysis should uncover any anomalies in the data and draw further conclusions from them as well as displaying them in a comprehensible way. The data used consisted of timestamped records like error messages, maintenance information, or machine meta information.

Expert System Case

In this class of cases the goal is to find a service for optimum settings for a machine given specific production requirements and context variables. In an early stage of development of data-driven services in these cases, a significant benefit can be achieved by applying rule-based expert systems without data-based analytics methods. In later stages the performance of the service is expected to be improved by machine learning (see also, e.g., (Lee et al., 2018)).

Findings

The case studies resulted in the following five findings: (1) The availability and quality of the data plays an important role. Data is often available in SMEs, but it causes difficulties in export and non-rival tasks during utilization. (2) Advanced analytics is often not necessary to answer the questions of SMEs, as initial questions often cover rather basic business aspects. (3) In the cases targeting at monitoring the condition of machines, in many cases a simple visualization of the current and past condition represents already a big step forward for the SME. Accordingly, no advanced evaluation of the data was necessary to achieve the initial needs of the SMEs (however, it is expected that these needs become more complex over time once the basic ones have been covered). (4) In some cases, a short-term prediction, e.g. of errors or failures, is possible through the use of simple, off-the-shelf analytics tools. This brings the requirements for the application of machine learning methods for SMEs to a level that they can manage. (5) Showcases can provide SMEs with inspiration to develop their own solutions and developments for the first steps with data-driven services. The showcases must make clear that the data-driven services can achieve useful results with moderate effort and complexity. Such a demo case was created for use in classrooms as well as in company workshops.

Conclusions and recommendations

SMEs planning to take first steps into the field data-driven services can get familiar with their data and appropriate analytics tools with straightforward and simple methods, by starting with visualizing past and current data and, if possible, by applying first predictions with common off-the-shelf tools. When moving forward to more advanced technologies, collecting, aggregating, and

preparing data get more relevance and need to be solved. It is recommended that SMEs leverage their position in their service ecosystem in order to benefit from inspiration and competence from partners.

References

Bondkar, C.P., Vaidya, S.M. (2015) Impact of Big Data. *International Journal of Scientific Engineering and Technology*,04(17), 3270-3276.

Cusumano, M.A., Kahl, S.J., & Suarez, F.F. (2015) Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal*, 36(4), 559-575. https://doi.org/10.1002/smj.2235

Hewitt-Dundas, N. (2006). Resource and capability constraints to innovation in small and large plants. *Small Business Economics*, 26(3), 257-277. https://doi.org/10.1007/s11187-005-2140-3

Kowalkowski, C., Windahl, C., Kindström, D., & Gebauer, H. (2015). What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies. *Industrial Marketing Management*, 45, 59-69. https://doi.org/10.1016/j.indmarman.2015.02.016

Lay, G. (2014). Introduction. In: *Servitization in Industry*. Ed. Lay, G. 1-20. https://doi.org/10.1007/978-3-319-06935-7_1

Lee, J., Davari, H., Singh, J., & Pandhare, V. (2018). Industrial Artificial Intelligence for industry 4.0-based manufacturing systems. *Manufacturing Letters*, 18, 20-23. https://doi.org/10.1016/j.mfglet.2018.09.002

Meierhofer, J. (2018). Data driven servitization for SMEs in manufacturing. *Spring Servitization Conference - Driving Competition through Servitization*, 101-108. Aston University, Birmingham.

Meierhofer, J., Kugler, P., & Etschmann, R. (2019). Challenges and approaches with data-driven services for SMEs : Insights from a field study. *Spring Servitization Conference : delivering services growth in the digital era*, pp. 39-49. Aston University, Birmingham.

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations management research*, 1(2), 103-118. https://doi.org/10.1007/s12063-009-0015-5

Opresnik, D., & Taisch, M. (2015). The value of Big Data in servitization. *International Journal of Production Economics*, 165, 174-184. https://doi.org/10.1016/j.ijpe.2014.12.036

Porter, M., & Heppelmann, J. (2014). How smart, connected products are transforming competition. *Harvard Business Review* 92(11), 64-88.

Vargo, S.L., & Lusch, R.F. (2008). From goods to service(s): Divergences and convergences of logics. *Industrial Marketing Management* 37, 254-259. https://doi.org/10.1016/j.indmarman.2007.07.004

Servitization of Manufacture and Spare Innovations: A Patent Citations Analysis

María-José Pinillos, Eloísa Díaz-Garrido, María Luz Martín-Peña, Ana I. Alarcón-Cediel

Rey Juan Carlos University

Abstract

Servitization can be defined as the process of increasing value by adding services to products. There is a growing interest in the role the services play in maintaining the competitiveness of manufacturing companies. The incorporation of services by an industrial company offers a wide range of opportunities, from installation, component training, to more complex services such as full maintenance contracts or consulting and spare parts management contracts. The objective of this study is to present the methodology used to identify the technology domain found with regard to repairs/spare parts (product-oriented services) as well as understand the technological advances associated with the propagation techniques of repairs/spare parts in recent years using patent citation analysis. The results of the study reveal that around 40% of the patents associated with spare innovations are linked to the digital and communications field.

Keywords: Servitization, patent citations, technology domain, spare parts.

Introduction

Servitization can be defined as the process of increasing value by adding services to products. The manufacturing industry is

undergoing a deep transformation, with services contributing to its income and a large proportion of employees performing service functions. Also, servitization provides opportunities to the manufacturing companies to create new and sustainable differentiation sources, sustainability and risk diversification. As such, servitization will be more important in mature markets with low growth and high competition, where the need to look for and build customer loyalty grows.

In short, it can be assumed that the manufacturing companies have found in servitization a new way to protect their traditional product markets as well as a way to find new business opportunities.

The incorporation of services by an industrial company offers a wide range of opportunities, from installation, component training, to more complex services such as full maintenance contracts or consulting and spare parts management contracts (Oliva & Kallenberg, 2003).

In this context, interest in servitization has grown in the literature. There is consequently a growing interest in the role these services play in maintaining the competitiveness of manufacturing companies, and this has led to the appearance of a series of research works analyzing the academic literature, with the intention of evaluating the state of the art, identifying the advances made, and proposing future research agendas (Díaz-Garrido, Pinillos, Soriano-Pinar & García-Magro, 2018; Martín-Peña, Pinillos & Reyes, 2017).

However, the use of patent documents as a source of technology information has been little explored in the academic environment. In fact, we have not found any research that adopts this methodology in the field of servitization. This study uses this novel perspective of patents to analyse the servitization of the manufacture with regard to repairs/spare parts (product-oriented services). Scientific literature about servitization and spare parts we

can find in Baines & Shi, 2015; Bao & Toivonen, 2015; Faccio, Persona, Sgarbossa & Zanin, 2014; Jovanovic, Engwall & Jerbrant, 2016; Visnjic, Wiengarten & Neely, 2016; Windahl & Lakemond, 2006, …, among others.

Hasner, Lima, and Winter (2019; p. 10) point out "scientific papers are a means of disseminating scientific knowledge whereas patents are a means of disseminating technology knowledge". The patent information clearly describes the current state of the art technologies within their field and report in detail the problem and the technical solution to overcome it. Moreover patents have the advantage that they are classified in databases, thus facilitating their retrieval.

Other benefits described in literature is the ability to use and interpret the citations contained in patents to identify technological advance, predict technological tendencies, monitor technologies and competitors as well as to study technology trajectories. Related to this, Hasner et al. (2019) state that citation studies based on patents, also known as patent citation analysis, seek to link patents in the same way that science citations link the references in scientific papers. The main idea behind patent citation analysis is to find which patents are most often cited, so it can be assumed that a highly cited patent is likely to contain an important technological advance, an advance that many later patents are built upon (Karki, 1997; p. 269).

Furthermore, patent citation studies can be used as an indicator of inventive quality on a patent level as well as an important indicator of the innovative output of a firm on a more aggregate level. Patent citations include references to patent documents, also known as patent literature (PL) allowing the study of spillovers in technologies and scientific fields between distinct industrial sectors. In addition, patent citation studies enable analysing the correlation between different actors, technology fields and inventors and,

consequently, identifying over-lapping technology areas and potential trajectory changes with the emergence of convergence and new science-based technologies.

In this context, this study aims to identify the technology domain found in servitization with regard to repairs/spare parts (product-oriented services) as well as understand the technological advances associated with the propagation techniques of repairs/spare parts in recent years using patent citation analysis.

For this, we analyse patents related to servitization (repairs/spare parts) since 1988 (date where the servitization term was coined, Vandermerwe & Rada, 1988) until 2009, as such covering a research period of 21 years.

The methodology is based on the study of patent citations. The results are subdivided into: 1) Profile of the Selected Patent Documents, 2) Citation Analysis, 3) Relationship between citation documents, 4) Technology Domain Identification and 5) Geographic Distribution Analysis.

Methodology and results

The methodology is divided into four steps. In the first step, the patent documents to be studied were selected. To do so, patent documents related to spare servitization were selected through bibliometric analysis carried out on Derwent Innovations Index of Thomson Reuteurs, using various keywords such as: service, product*, spare.

The second step was to extract the information of the selected servitization patent documents.

The third step consisted in tabulating all the results from the second step into an Excel spreadsheet containing the patent number; the year of publication; the country of publication of the

patent family, the applicant's or Journal's name; the priority number and the International Patent Classification (IPC).

The last step was the data analysis itself, consisting of:

a) Making a graph of the evolution of PL according to the publication date;

b) Analysing the relationship between the selected patent documents and the citations patent documents (PL), using only the priority number of cited and citing patent documents. The analysis was conducted using UCINET software package and NetDraw tool of social networks.

c) Identifying the process of a technology domain by analysing all patent documents, i.e. cited and citing documents and the selected patent documents, taking into account the international classifications of the patent (IPC);

d) Studying the geographical distribution and analysing the country of publication of each patent family document.

The analysis performed allowed us to identify 85 patents related to spare innovations (product-oriented services). The results of the study reveal that around 40% of the patents associated with spare innovations are linked to the digital (27%) and communications (13%) field.

We used patent citation analysis to identified the wealth of patent citation information. The citation-based patent study seeks to link patents in the same way that science citation links the references in the scientific papers. Citation to prior art is an indicator of the importance of the prior art to subsequent inventions. The key idea behind patent citation analysis is that when a patent is very highly cited then that highly cited patent is likely to contain an important technological advance, an advance that many later patents are built upon. So far, patent citation analysis has been used as a measure of

technological relevance and influence and in studying diffusion of technological information.

References

Baines, T., & Shi, V. G. (2015). A Delphi study to explore the adoption of servitization in UK companies. *Production Planning and Control*, *26,* 14-15. 1171–1187. https://doi.org/10.1080/09537287.2015.1033490

Bao, S., & Toivonen, M. (2015). Cultural differences in servitization: Nordic manufacturers in China. *Journal of Science and Technology Policy Management*, 6(3), 223-245. https://doi.org/10.1108/JSTPM-01-2015-0001

Díaz-Garrido, E., Pinillos, M.-J., Soriano-Pinar, I., & García-Magro, C. (2018). Changes in the intellectual basis of servitization research: A dynamic analysis. *Journal of Engineering and Technology Management*, (September 2017), 1-14. https://doi.org/10.1016/j.jengtecman.2018.01.005

Faccio, M., Persona, A., Sgarbossa, F., & Zanin, G. (2014). Industrial maintenance policy development: A quantitative framework. *International Journal of Production Economics,* 147(A), 85-93. https://doi.org/10.1016/j.ijpe.2012.08.018

Hasner, C., Alves de Lima, A., & Winter, E. (2019). Technology advances in sugarcane propagation: A patent citation study. *World Patent Information*, 56(September 2018), 9–16. https://doi.org/10.1016/j.wpi.2018.09.001

Jovanovic, M., Engwall, M., & Jerbrant, A. (2016). Matching service offerings and product operations: A key to servitization success. *Research Technology Management*, 59(3), 29-36. https://doi.org/10.1080/08956308.2016.1161403

Karki, M. M. S. (1997). Patent citation analysis: A policy analysis tool. *World Patent Information*, 19(4), 269-272. https://doi.org/10.1016/S0172-2190(97)00033-1

Martín-Peña, M. L., Pinillos, M.-J., & Reyes, L.-E. (2017). The intellectual basis of servitization: A bibliometric analysis. *Journal of Engineering and Technology Management*, 43, 83–97. https://doi.org/10.1016/j.jengtecman.2017.01.005

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. https://doi.org/10.1108/09564230310474138

Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, *6*(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the Brave: Product Innovation, Service Business Model Innovation, and Their Impact on Performance. *J Prod Innov Manag*, 33(1), 36-52. https://doi.org/10.1111/jpim.12254

Windahl, C., & Lakemond, N. (2006). Developing integrated solutions: The importance of relationships within the network. *Industrial Marketing Management*, 35(7), 806–818. https://doi.org/10.1016/j.indmarman.2006.05.010

Applications of Internet of Things (IoT) and Blockchain for supply chain management in humanitarian Disasters

Daniel Arias Aranda, Luis Miguel Molina Fernández

Universidad de Granada

Vladimir Stantchev

SRH Hochschule Berlin

Abstract

Since the creation in 1945 of the United Nation agencies, humanitarianism has developed ominously by receiving more attention from researchers focusing on different aspects related to the impact of humanitarian actions. This attention has grown in parallel to the legitimacy of humanitarian intervention that has led to the creation of humanitarian units in governmental and public institutions as well as the increase of worldwide reach Nongovernmental organizations (NGOs). The scope of humanitarianism has also become broader including not only the deployment of resources to relief victims of conflicts, poverty or catastrophes but also human rights development, and peacebuilding (Barnett, 2003). Humanitarian interventions are based on the preservation of life and dignity conditions for all human beings. In this context, the integration of Internet of Things (IoT) devices with Blockchain technology offers a profuse opportunity to overcome many of the weaknesses in HASC derived from a lack of information or confusing data on issues such as resource needs and deployments, on time delivery, volunteer hours, accessibility, energy use and availability, stocks or budget deviations among many others.

Such integration is based on a decentralized approach generating transparency, resiliency and security by developing smart contracts.

Keywords: Humanitarianism, Blockchain, Supply Chain Management, Internet of Things (IoT).

Parallel session 5

Product-Service Innovation System III

Chair: Ferran Vendrell-Herrero

The Role of T-KIBS on the Innovation Performance of Manufacturing Firms: The Case of Mexico

Francisco Carrillo-Carrillo

University of Deusto

Henar Alcalde-Heras

Henar Alcalde-Heras

Abstract

Despite the extended literature on KIBS, little is known about their functioning in other contexts rather than advanced economies. Using data from the Mexican innovation survey, the purpose of this study is to explore the association between technology-based KIBS (T-KIBS), and innovation performance of manufacturing firms. Specifically, we investigate how the utilisation of these services differ on the innovation output of manufacturing firms according to its sectorial technological base, and the type of ownership (domestic-owned and foreign-owned firms). Different logit models are tested using data from 3,907 manufacturing firms from 2010 to 2013. The data analysis reveals that i) T-KIBS tend to support innovation output in manufacturing firms associated to medium-low and medium-high technological sectors; ii) in medium-low technological sectors the use of T-KIBS exert a more significant influence on innovation output of foreign companies than local firms; and iii) in the case of medium-high technological sectors, the use of T-KIBS show higher significance levels on innovation output of local firms than foreign companies. These results confirm the huge potential that T-KIBS can exert on emergent economies as drivers of innovation performance in manufacturing firms.

Keywords: Servitization, T-KIBS, Emerging Economies, Manufacturing firms.

Introduction

Over the last three decades the term "servitization" (Vandermerwe & Rada, 1988) has bloomed in both the practitioner's domain and the academia (Neely, 2009; Barnett et al., 2013). The shift towards more service-centred value propositions led to emergence of KIBS, which fulfil a key role in manufacturing sectors according to its potential as suppliers of crucial knowledge for innovation, but also foster a process of co-creation with clients (Landry et al., 2013). However, despite the extended literature on KIBS, little is known about their functioning in other contexts rather than advanced economies (Javalgi et al., 2011). Thus, a major question arises: what is the role of KIBS in a context where innovation rates tend to be low and firms normally stand far behind the technological frontier?

This study aims to explore the impact of T-KIBS in the innovativeness of manufacturing firms in an economic context where science-based activities might not be fully integrated to the portfolio of strategies to manage technological change and cope with competition.

Theoretical Framework

Literature distinguishes KIBS based on technology (T-KIBS) as those services that use formalised scientific and technical knowledge; involving R&D, engineering, and IT services (Rodriguez et al., 2017).

As posited in the previous section, growth of the service sector is not restricted to advanced economies. Several forces have influenced the growth and strategic importance of services in emerging economies (rising cross-border activities of firms, the

need for scientific and technical expertise, advances in information technologies, and the need to sustain innovation and competitive advantage). Our argument draws on the idea that in emerging economies T-KIBS could assume the role of innovation "bridges" for industrial organizations (Lee & Miozzo, 2019). Thus, T-KIBS provide specific R&D-intensive activities and mobilise tacit knowledge that can be effectively absorbed by firms in emergent economies. Hence, these services would have the capacity to leverage firms' innovative potential especially when these are in intermediary technology sectors. In addition, we believe that the firm´s type of ownership would affect the degree of influence of T-KIBS according to their technology level. In medium-low technological sectors, T-KIBS would be useful for foreign companies to co-create knowledge with local actors and understand the local reality; however, for local firms its utility would be lower due to their weak absorptive capacity. On the other hand, in medium-high technological sectors, the use of T-KIBS would have a positive impact for local firms (that account with enough absorption capacities) covering those services of a typical manufacturing firm´s R&D department; however, foreign firms in these medium-high sectors would tend to exploit its home-based technological capacities.

H1. T-KIBS have a stronger impact in the innovation output of firms associated to medium technological sectors compared to firms associated to low and high technological sectors.

H2. In medium-low technological sectors, T-KIBS will have stronger impact in the innovation output of foreign companies than their domestic counterpart.

H3. In medium-high technological sectors, T-KIBS will have stronger impact in the innovation output of domestic companies than their foreign counterpart.

Methodology and results

The study is based on the Mexican Research and Technological Development Survey (ESIDET), using data from 3,907 manufacturing firms from 2010 to 2013. We control for the technological intensity of the sector using the OECD technology classification (Galindo-Rueda & Verger, 2016). We used two proxies of T-KIBS, on the one hand, we measure whether the firms reported expenditures on technical studies, or consultancy services based on engineering projects (*consultancy*); on the other hand, whether the firm reported payments for technical assistance related to machinery and equipment purchase (*technical assistance*). We used product innovation as our dependent variable, and we control for intramural R&D expenditures; firm size; exposition to international competition; and whether the firm belongs to a corporation or a single unit.

After running different logit models, results confirms that i)T-KIBS tend to support innovation output in manufacturing firms associated to medium-low and medium-high technological sectors; ii)in medium-low technological sectors the use of T-KIBS exert a more significance influence on innovation output of foreign companies than local firms; and iii) in the case of medium-high technological sectors, the use of T-KIBS show higher significance levels on innovation output of local firms than foreign companies.

Conclusion

In a nutshell, our results point out the huge potential that T-KIBS can exert on emergent economies as drivers of innovation performance in manufacturing firms. Specifically, T-KIBS could assume the role of innovation "bridges" for industrial organizations, providing specific R&D-intensive activities, and mobilise tacit knowledge that can be effectively absorbed by manufacturing firms in emergent economies.

References

Barnett, N. J., Parry, G., Saad, M., Mewnes, L. B., & Goh, Y. M. (2013). Servitization: is a paradigm shift in the business model and service enterprise required? *Strategic Change*, *22*(3-4), 145-156. https://doi.org/10.1002/jsc.1929

Galindo-Rueda, F., & Verger, F. (2016). *OECD taxonomy of economic activities based on R&D intensity* (OECD, Science, TEchnology and Industry Working Papers No. 2016/04). Paris.

Javalgi, R. (Raj) G., Gross, A. C., Joseph, W. B., & Granot, E. (2011). Assessing competitive advantage of emerging markets in knowledge intensive business services. *Journal of Business and Industrial Marketing*, 26(3), 171-180. https://doi.org/10.1108/08858621111115895

Landry, R., Amara, N., Cloutier, J. S., & Halilem, N. (2013). Technology transfer organizations: Services and business models. *Technovation*, 33(12), 431-449. https://doi.org/10.1016/j.technovation.2013.09.008

Lee, H. Fen, & Miozzo, M. (2019). Which types of knowledge-intensive business services firms collaborate with universities for innovation? *Research Policy*, 48(7), 1633-1646. https://doi.org/10.1016/j.respol.2019.03.014

Neely, A. (2009). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research*, 1(2), 103-118. https://doi.org/10.1007/s12063-009-0015-5

Rodriguez, M., Doloreux, D., & Shearmur, R. (2017). Variety in external knowledge sourcing and innovation novelty: Evidence from the KIBS sector in Spain. *Technovation*, 68, 35-43. https://doi.org/10.1016/j.technovation.2017.06.003

Vandermerwe, S., & Rada, J. (1988). Servitization of business: Adding value by adding services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Understanding the Service Market in an Era of Technological and Digital Disruption

Besma Glaa

Service Research Center (CTF), Karlstad University

Heiko Gebauer

University of St.Gallen, Switzerland and Fraunhofer IMW

Lars Witell

Service Research Center (CTF), Karlstad University

Abstract

The service market has become an increasingly important source of revenues and profits. However, the market logic for service provision is changing due to the product technology shifts (such as combustion to electric engines) and digitization (such as mechanical components to more software components). Typical illustrations of such core product technology shifts are combustion to electric engines and from human-driven to autonomous self-driving vehicles in, onshore to offshore wind turbines, or optical to digital microscopy devices. Such technology shifts re-shape existing service markets. Company can only succeed in reshaping the service, if they are able to modify the service capabilities. The aim of this study is to address this research gap in the literature by investigating how the service market is affected by a shift in the core product technology. To the best of our knowledge this is the first research exploring the effect of core product technology shift in the service market.

Keywords: Servitization, digitalization, technology shift, business model, capabilities.

Introduction

Manufacturing firms engage in servitization to respond to the challenges of unceasing change in the business environment and to achieve competitive advantage (Forkmann et al., 2017; Zeithaml et al., 2014; Gebauer et al., 2010; Ostrom et al., 2010; Neu & Brown 2005; Oliva & Kallenberg, 2003; Wise & Baumgartner, 1999). As a consequence, services are impacting the organization and are becoming a crucial part of manufacturing firms' offerings (Gebauer et al., 2010). Besides, services are vital for firm´s growth, and help them to sustain a high level of revenue, higher profit margins and to improve customer satisfaction and loyalty (Vandermerwe & Rada, 1988; Anderson & Narus, 1995; Wise & Baumgartner, 1999; Fischer, Gebauer % Fleisch, 2012; Eggert et al., 2014). However, the servitization literature assumes that the core product technology is stable, but neglects situations, in which it is going through a dramatical change. A typical illustration of such core product technology change is the shift from combustion to electric engines and normal to autonomous self-driving vehicles in the automotive industry, optical to digital microscopy devices, or, onshore to offshore wind turbines. Such technology shifts re-shape existing service markets and require modifications in the service capabilities.

Certainly, after-sales services are often the longest part of a product's life and an important source of revenues to manufacturers (Kowalkowski, Gebauer & Oliva, 2017; Gebauer et al., 2005; Neely, 2008; Martinez et al., 2010). Aircraft manufacturers, for instance, can gain revenues for as long as 25 years after a sale. Besides, providing service market support can help manufacturers to gain valuable knowledge about customers, their needs and build stronger

business relationships. However, what happens to the service business when there is technological leap in the core product technologies is not studied. Especially, when the technology shift reshapes the boundaries and logic of the service market. Following the market logic of service provision, electric engines provide less traditional service business opportunities. The service provider has to serve to parallel markets for service provision, one shrinking market for combustion vehicles and one growing market for electric engines with a limited growth potential. In this context, it becomes interesting to investigate how to win the service market when there is a shift in the core product technology.

Research setting and research questions

This paper is based on the insights gained from an ongoing research project in collaboration with manufacturing firms that experience a shift in the core product technology. These firms include a gearbox manufacturer, microscopy device manufacturer, wind turbine manufacturer, and a commercial vehicle manufacturer. We propose to explore this subject by an empirical study of this selection of manufacturing firms to investigate the following research questions:

-*How should a manufacturer develop a new service market for emergent product technologies? What are the similarities and differences for the service market for different technologies?*

-*What are the synergies between different technologies and what are the cannibalization effects of new technologies?*

-*What are the service capabilities needed to win the service market for different core product technologies?*

-*How should digitization be combined with different core product technologies to win the service market?*

We follow a multiple case study approach. For each case study, we collected data through a series of workshops and interviews. The workshops followed three steps. First, the service market logic for the different product technologies were described. The aim of this step is to develop and visualize future scenarios for different technologies and identify synergies and cannibalization between product technologies, services, and digitalization. Second, a series of in-depth interviews were performed to identify the necessary capabilities, the need for new capabilities and capability gaps for future scenarios in the service market. The third step aims to to consolidate the findings through series of workshops and interviews and finding out ways of aligning the service market for different core product technologies.

Preliminary results and contribution

Our preliminary results confirm that to win the service market, there is a need to understand the effect of the technological shift on the service market and how various technologies change the market logic for service provision. Besides, it is important to find out ways of aligning the service market for different core product technologies. In the case of commercial vehicle manufacturer experiencing a technology shift in the core product, the preliminary results show the importance of understanding how new digital technologies and autonomous driving services, open up new business opportunities, and if these manufacturers need to reinvent their business model.

Furthermore, our preliminary results show that in order to succeed in the service market, manufacturers need to manage the shifts in product technology successfully. To do so, manufacturers need to understand the following themes (See Figure 1):

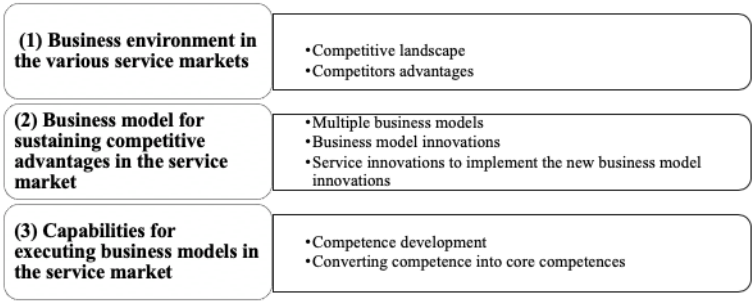


Figure 1. The elements needed to secure the future of service market

The main contributions of this paper are as follows: first a theoretical contribution aiming at addressing a research gap in the literature by investigating how the service market is affected by a shift in the core product technology. In particular, the influence on the business model and the service capabilities are explored. Second, a managerial contribution for practitioners in order to help them in how to win the service market for different core product technologies, secure the service market as a profit pool and to determine the role of manufacturing firms in the service market during a technological shift in the core product technology.

References

Anderson, J. C., & Narus, J. A. (1995). Capturing the value of supplementary services. *Harvard Business Review,* 73(1), 75-83.

Eggert, A., Hogreve, J., Ulaga, W. & Muenkhoff, E. (2014). Revenue and profit implications of industrial service strategies. *Journal of Service Research,* 17(1), 23-39. https://doi.org/10.1177/1094670513485823

Forkmann, S., Ramos, C., Henneberg, S.C., & Naudé, P. (2017). Understanding the service infusion process as a business model reconfiguration. *Industrial Marketing Management,* 60, 151-166. https://doi.org/10.1016/j.indmarman.2016.05.001

Gebauer, H., Edvardsson, B., Gustafsson, A., & Witell, L. (2010). Match or mismatch: Strategy-structure configurations in the service business of manufacturing companies. *Journal of Service Research*, 13(2), 198-215. https://doi.org/10.1177/1094670509353933

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the Service Paradox in Manufacturing Companies. *European Management Journal*, 23(1), 14-26. https://doi.org/10.1016/j.emj.2004.12.006

Kowalkowski, C., Gebauer, H., & Oliva, R. (2017). Service growth in product firms: Past, present, and future. *Industrial Marketing Management*, 60 (1), 82-88. https://doi.org/10.1016/j.indmarman.2016.10.015

Martinez, V., Bastl, M., Kingston, J., & Evans, E. (2010). Challenges in transforming manufacturing organisations into product-service providers. *Journal of Manufacturing*, 21(4), 449-469. https://doi.org/10.1108/17410381011046571

Neely, A. (2008). Exploring the Financial Consequences of the Servitization of Manufacturing. *Operations Management Research*, 1, 103-118. https://doi.org/10.1007/s12063-009-0015-5

Neu, W., & Brown, S. (2005). Forming successful business-to-business services in goods-dominant firms. *Journal of Service Research,* 8(1), 3-17. https://doi.org/10.1177/1094670505276619

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. https://doi.org/10.1108/09564230310474138

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. https://doi.org/10.1177/1094670509357611

Valtakoski, A. (2017). Explaining servitization failure and deservitization: A knowledge-based perspective. *Industrial Marketing Management*, 60, 138-150. https://doi.org/10.1016/j.indmarman.2016.04.009

Vandermerwe, S., & Rada, J. (1988). Servitization of business: Adding value by adding services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Wise, R., & Baumgartner, P. (1999). Go downstream: The new profit imperative in manufacturing. *Harvard Business Review*, 77(5), 133-141.

Zeithaml, V. A., Brown, S.W., Bitner, M. J., & Salas, J. (2014). *Profiting from services and solutions.* New York: Business Expert Press.

Innovation Activities, Performance and Innovation Services in Manufacturing Firms from an Emerging Economy

Jean Pierre Seclen Luna, Franco Riva Zaferson

Pontifical Catholic University of Peru

Abstract

Most studies on innovation have focused on developed economies, with less emphasis on emerging economies, such as Latin America. Nevertheless, several manufacturing firms are innovating their existing business models, traditionally centred in product offering, by adding services to their products or by delivering these products as services. The aim of this research is to know the relationship between innovation activities and the performance of the manufacturer firms in terms of sales and the export intensity. In this way, we used SEM in order to analyse the structural model proposed in 1155 Peruvian firms operating in various manufacturing industries. Preliminary results indicate that manufacturing firms' strategic decision based on service innovation favours looking in customer since there are links between innovation activities and sales of the manufacturers and above all, on export intensity. Specially, investment levels in R&D internal and Industrial Engineering Design were found significant as predictors for service innovation.

Keywords: Innovation Activities, Performance Innovation, Servitization, Peru.

Theoretical Framework

Most studies on innovation have focused on developed economies, with less emphasis on emerging economies, such as Latin America, which has only been investigated according to expenses of R&D, innovative performance and profit of the firm rather than innovation activities (Becheikh et al., 2006; Ketelhöhn & Ogliastri, 2013; Geldes et al., 2017; Tello-Gamarra et al., 2018).

Although emerging countries are highly heterogeneous in terms of their innovation environments (Crespi & Zuñiga, 2012) nowadays there has been a growing body of literature dealing with innovation activities (Goedhuys & Veugelers, 2012).

According to the Oslo Manual, the basic definition of innovation activities includes all developmental, financial and commercial activities undertaken by a firm, that are intended to result in an innovation for the firm. The Manual identifies eight broad types of activities that firms can undertake in pursuit of innovation: research and experimental development activities, engineering, design and other creatives work activities, marketing and brand equity activities, IP-related activities, employee training activities, software development and database activities, activities related to the acquisition or lease of tangibles assets, innovation management activities (OCDE, 2018).

On the other hand, several manufacturing firms are innovating their existing business models, traditionally centred in product offering, by adding services to their products or by delivering these products as services (Brax & Visintin, 2016; Kohtamaki et al., 2013; Visnjic & Van Looy, 2013). Specially, large manufacturers develop advanced services through internal development (Bustinza et al., 2019), since they usually have financial resources (Keupp & Gassmann, 2009). Even, they are looking access to talent that enables successful servitization (Opazo et al., 2019).

Assumption of Hypothesis

The aim of this research is to know the relationship between innovation activities and the performance of the manufacturer firms in terms of sales and the export intensity. This approach contributes to servitization literature, specially, the internationalization of product-service offering.

In this way, the research questions are: There are manufacturer firms in emerging countries that achieve servitization activities? What kind of innovations activities manufacturers carry out? Is there a positive relationship between innovation activities and performance of the manufacturers? Do manufacturers that carry out services innovation get better performance compared to their counterparts that not carry out?

Methodology

The methodology that supports this research is SEM, Logistic regression and MANOVA. We used SEM in order to analyse the structural model proposed, MANOVA to test differences in the variables present in the structural model between manufacturers which develop innovation in service and those who had not. Authors draw on the national survey on innovation in the Peruvian manufacturers industry (2015) to shed light to the research questions. Cross-sectional surveys conducted contain 1155 firms operating in various manufacturing industries. Finally, Logistic regression was used with the variables whose relationship with innovation was found significant in the previous analysis as predictors to control the multivariate effects and find which variables were correlated with the innovation.

Results and Discussion

Preliminary results indicate that manufacturing firms' strategic decision based on service innovation favours looking in customer (Vandemerwe & Rada, 1988; Parry et al., 2012) since there are links between innovation activities and sales of the manufacturers and above all, on export intensity (Lodefalk, 2014; Lejpras, 2019). Specially, six out of nine variables were found with significant relation with sales. Also, two variables were found significant as predictors of export propensity. Performing service innovation was found not significant as a moderator variable in the structural model. This is partly because less than 10% of the sample performed service innovation; therefore, the effect size is greatly underpowered due to smaller standard errors. This also resonates with the servitization process being in early stages within the Peruvian manufacturing industry. However, investment levels in R&D internal and Industrial Engineering Design were found significant as predictors for service innovation.

Likewise, we find that these manufacturer firms have their servitization pathway and continuously innovate to maintain the market share (Lee & Malerba, 2017), even they extend the product lifecycle through the inclusion of services (Cusumano et al., 2015). Therefore, it is interesting to understanding the variables related to the servitization process and service trajectory analysis (Bustinza et al., 2017) in the context an emerging economy (Ayala et al., 2017).

References

Ayala, N.F., Paslauski, C.A., Ghezzi, A., & Frank, A. G. (2017). Knowledge sharing dynamics in service suppliers' involvement for servitization of manufacturing companies. *International Journal of Production Economics*. 193, 538-553. https://doi.org/10.1016/j.ijpe.2017.08.019

Becheikh, N., Landry, R., & Amara, N. (2006). Lessons from innovation empirical studies in the manufacturing sector: a systematic review of the literature from 1993–2003. *Technovation*, 26(5), 644-664. https://doi.org/10.1016/j.technovation.2005.06.016

Brax, S., & Visintin, F. (2017). Meta-model of servitization: The integrative profiling approach. *Industrial Marketing Management*. 60, 17-32. https://doi.org/10.1016/j.indmarman.2016.04.014

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research*, forthcoming. https://doi.org/10.1016/j.jbusres.2019.01.035

Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2017). Service implementation in manufacturing: an organizational transformation perspective. *International Journal of Production Economics*. 192, 1-8.https://doi.org/10.1016/j.ijpe.2017.08.017

Crespi, G., & Zuniga, P. (2012). Innovation and productivity: evidence from six Latin American Countries. *World Development*, 40(2), 273-290. https://doi.org/10.1016/j.worlddev.2011.07.010

Cusumano, M., Kahl, S., & Suarez, F. (2015). Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal*, 36(4), 559-575. https://doi.org/10.1002/smj.2235

Geldes, C., Felzensztein, C., & Palacios, J. (2017). Technological and non-technological innovations, performance and propensity to innovate across industries. The case of an emerging economy. *Industrial Marketing Management*, 61, 55-66. https://doi.org/10.1016/j.indmarman.2016.10.010

Goedhuys, M., & Veugelers, R. (2012). Innovation strategies, process and product innovations and growth: Firm-level evidence from Brazil. *Structural Change and Economic Dynamics*, 23(4), 516-529.https://doi.org/10.1016/j.strueco.2011.01.004

Ketelhöhn, N., & Ogliastri, E. (2013). Introduction: innovation in Latin America. *Academia Revista Latinoamericana de Administración*, 26(1), 12-32. https://doi.org/10.1108/ARLA-05-2013-0037

Keupp, M., & Gassmann, O. (2009). Determinants and archetype users of open innovation. *R&D Management*, 39(4), 331-341. https://doi.org/10.1111/j.1467-9310.2009.00563.x

Kohtamäki, M., Partanen, J., Parida, V. (2013). Non-linear relationship between industrial service offering and sales growth: The moderating role of network capabilities. *Industrial Marketing Management*. 42(8), 1374-1385. https://doi.org/10.1016/j.indmarman.2013.07.018

Lee, K., & Malerba, F. (2017). Catch-up cycles and changes in industrial leadership: Windows of opportunity and responses of firms and countries in the evolution of sectoral systems. *Research Policy*, 46(2), 338-351.https://doi.org/10.1016/j.respol.2016.09.006

Lejpras, A. (2019). Determinants of export performance: differences between service and manufacturing SMEs. *Service Business*, 13(1), 171-198. https://doi.org/10.1007/s11628-018-0376-7

Lodefalk, M. (2014). The role of services for manufacturing firm exports. *Review of World Economics*, 150(1), 59-82. https://doi.org/10.1007/s10290-013-0171-4

OECD/EUTROSTAT (2018). *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation*, 4th Edition, The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg.

Opazo-Basáez, M., Vendrell-Herrero, F. & Bustinza, O.F. (2019). Talent for services: How gaining access to talent enables successful servitization. In Y. Liu (Ed.) *Research Handbook of International Talent Management*. UK: Edward Elgar Publishing. In Press. https://doi.org/10.4337/9781786437105.00014

Parry, G., Bustinza, O. F., & Vendrell-Herrero, F. (2012). Servitisation and value co-production in the UK music industry: an empirical study of

consumer attitudes. *International Journal of Production Economics*, 135(1), 320-332. https://doi.org/10.1016/j.ijpe.2011.08.006

Tello-Gamarra, J., Machado Leo, R., Mello Silva, A. & Wendland, J. (2018). Innovation studies in Latin America: a bibliometric analysis. *Journal of Technology Management & Innovation*, 13(4), 24-36. https://doi.org/10.4067/S0718-27242018000400024

Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Visnjic, I., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management*. 31(4), 169-,180. https://doi.org/10.1016/j.jom.2013.02.001

Parallel session 6

Product-Service design

Chair: Glenn Parry

Making it Practitioners-Friendly: A Service Design Toolkit for the Design of Advanced Services

Ion Iriarte, Iker Legarda

Mondragon University

Maya Hoveskog

Halmstad University University

Daniel Justel

Mondragon University

Abstract

In order to differentiate in highly competitive markets, an increasing number of manufacturers are adopting servitization strategies (Baines, & Lightfoot, (2013). 'Advanced services' embody the most sophisticated offerings among servitization (Ziaee Bigdeli et al., 2018). However, several financial, organisational, market and cultural challenges prevent manufacturers from developing advanced services (Reim, Sjödin, & Parida, 2019). In particular, from a design perspective, designing such advanced service oriented value propositions requires singular service design capabilities (Patrício & Fisk, 2013) and manufacturers often lack these design skills (Author 2, Author 1, Author 3, & Author 4, 2019).

The objective of this paper is to present the IND-SERVDES (Industrial Service Design) toolkit (University 1, 2019). The toolkit aims to provide manufacturing companies with an easy-to-use guide for the design of advanced services. Based on Author 1, Author 2,

Author 4, Val, & Halila's (2018) experimental design process, the toolkits suggest a series of service design tools to be used through participatory design workshops. In this paper we present the toolkit, we describe how the toolkit was applied in five Basque manufactures through different design interventions and finally we discuss the results obtained by the manufacturers.

Keywords: Servitization, service design, business models, design tools.

References

Baines, T., & Lightfoot, H. (2013). *Made to serve: How manufacturers can compete through servitization and product service systems*. Hoboken, NJ: John Wiley & Sons. https://doi.org/10.1002/9781119207955

Patrício, L., & Fisk, R. P. (2013). Creating new services. *Serving customers globally*, 185-207.

Reim, W., Sjödin, D. R., & Parida, V. (2019). Servitization of global service network actors–A contingency framework for matching challenges and strategies in service transition. *Journal of Business Research,* in Press. https://doi.org/10.1016/j.jbusres.2019.01.032

Ziaee Bigdeli, A., Baines, T., Schroeder, A., Brown, S., Musson, E., Guang Shi, V., & Calabrese, A. (2018). Measuring servitization progress and outcome: the case of 'advanced services'. *Production Planning & Control*, 29(4), 315-332. https://doi.org/10.1080/09537287.2018.1429029

Facilitate Value Capture by Creating an Understanding of Value Proposition Foundations

Maria Åkesson, Nina Löfberg, Peter Magnusson, Jan Erik Odhe, Antti Sihvonen

Karlstad University

Abstract

In this paper we lean towards the service eco-system perspective when claiming that capturing value from servitization efforts is facilitated by applying a service eco-system perspective. We further claim that this is needed to fully understand the actors who are taking part in the co-creation of value. The aim is to illustrate the value proposition foundations from a service eco-system perspective. The empirical study for this paper consists of a field study that has been conducted within the industrial sector of packaging. The empirical data consist of in-depth interviews, observations, and field notes from various workshops and meetings throughout a one-and-a-half-year period. The case company is a multinational company that undertake servitization. Our preliminary findings illustrate how the service eco-system perspective can be applied in a servitization context to understand the foundation of the value propositions. It also offers guidance to practitioners struggling to capture value from their servitizations efforts.

Keywords: Value capture, servitization, value proposition, service eco-system.

To create a competitive advantage, companies engage in servitization efforts with the hope of reaching increased sales and

profitability (Robinson, Clarke-Hill & Clarkson, 2002). Many companies are those who's revenue remain absent despite servitization efforts, often referred to as 'the servitization paradox' (Gebauer, 2005). Taking the stance that a servitization journey is embarked on in order to co-create value and this value emerge during interaction amongst actors (e.g. firms, customers, and other stakeholders), it is possibly so that these actors needs to be fully understood. In this paper we therefore lean towards the service eco-system perspective (Lusch and Vargo, 2014) when claiming that capturing value from servitization efforts is facilitated by applying a service eco-system perspective.

Actors and resources play a key role in service eco-systems. But since they are interdependent when co-creating value, Lusch and Nambisan (2015) argue that actors are only able to offer value propositions, as invitations to engage in service eco-systems. Skålén et al. (2015:154) define value propositions as "(co-)created promises of customer value that are backed up by plans regarding how resources can be efficiently integrated through practices". This implies that the plans regarding how resources can be integrated is something that is carried out by actors and in order to understand these, we need to understand the context of the service eco-system they are part of. As uttered by Vargo et al. (2008, 2014), actors' resource integration and value co-creation efforts are almost impossible to understand without a deep understanding of service eco-systems.

Against the backdrop of above and as there are a lack of research regarding how value is captured when servitizing, this study wants to add a piece of knowledge into this gap by illustrating how companies by adopting a holistic view of their service eco-system can move closer towards overcoming the servitzation paradox. More precisely, the aim is to illustrate the value proposition foundations from a service eco-system perspective.

The empirical study for this paper has been conducted within the industrial sector of packaging. We conducted a field study guided by systematic combining approach (Dubois & Gadde, 2002). The empirical data consist of in-depth interviews, observations, and field notes from various workshops and meetings throughout a one-and-a-half-year period. The case company is a multinational company that undertake servitization. The respondents are all working at the headquarter in Sweden, they have different positions within the company, reaching from middle management to sellers with customer contact.

Leaning on Skålén et al. (2015:154) view of value propositions as being backed up by plans of how resources can be efficiently integrated, our preliminary findings illustrate the foundations to these plans by giving an understanding of the importance to Stay close to your customers and stakeholders, Stay loyal to your position of your offering, and Highlight the co-created value. Hence this paper contributes by empirically illustrating how the service eco-system perspective can be applied in a servitization context to understand the foundation of the value proposition. The findings offer guidance to practitioners struggling to capture value from their servitizations efforts.

References

Dubois, A., & Gadde, L. E. (2002). Systematic combining: An abductive approach to case research. *Journal of Business Research*, 55(7), 553-560. https://doi.org/10.1016/S0148-2963(00)00195-8

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal*, 23(1), 14-26. https://doi.org/10.1016/j.emj.2004.12.006

Lusch, R. F., & Nambisan, S. (2015). Service innovation: A service-dominant logic perspective. MIS quarterly, 39(1). https://doi.org/10.25300/MISQ/2015/39.1.07

Lusch, R.F, & Vargo, S.L. (2014). *Service-Dominant Logic: Premises, Perspectives, Possibilities*. Cambridge University Press. https://doi.org/10.1017/CBO9781139043120

Robinson, T., Clarke-Hill, C.M., & Clarkson, R. (2002). Differentiation through service: A perspective from the commodity chemicals sector. *Service Industries Journal*, 22(3), 149-166. https://doi.org/10.1080/714005092

Skålén, P., Gummerus, J., von Koskull, C., & Magnusson, P. R. (2015). Exploring value propositions and service innovation: a service-dominant logic study. *Journal of the Academy of Marketing Science*, 43(2), 137-158. https://doi.org/10.1007/s11747-013-0365-2

Vargo, S.L., Maglio, P.P., & Akaka, M.A. (2008). On value and value co-creation: a service systems and service logic perspective. *European Management Journal*, 26(3), 145-152. https://doi.org/10.1016/j.emj.2008.04.003

Vargo, S.L., Wieland, H., & Akaka, M.A. (2014). Innovation through institutionalization: a service ecosystems perspective. *Industrial Marketing Management*, 44(January), 63-72. https://doi.org/10.1016/j.indmarman.2014.10.008

Requirement Design for Servitization

Qingbin Cui

University of Maryland

Xinyuan Zhu

Boeing Company

Abstract

Servitization is increasingly becoming a strategic necessity for businesses and organizations across industries to meet rapidly changing market conditions and demands. While the terms are used differently in each industry, e.g. performance based logistics in defense, product-service innovation in manufacturing, and public private partnership in infrastructure, key features and challenges exist across industrial boundaries. This paper addresses the critical requirement design issue for long-term servitization contract under uncertain market conditions and supplies. A stochastic dynamic optimization model is presented to define major contract provisions including performance requirement and guarantee, payment amount and timing, as well as contract term. The application of the model to an infrastructure system will be discussed and explained to demonstrate the optimal contract design method to achieve economic return for both parties of the service contract. One interesting result from the study shows a concave-shape payment schedule outperforms other payment strategies and incentives proactive maintenance at a lower life-cycle cost. The paper also compares the similarity and difference of servitization contracts across various industrial sectors.

Parallel session 7

Challenges and geographical prospects in servitization

Chair: Saara Braax

Challenges in the journey to services

Kristina Zabala, Lorea Narvaiza, Tontxu Campos

University of Deusto

Abstract

Firms are increasingly providing services to complement their product offerings. Most studies on the service journey, also known as servitization or service transition, examine the challenges and enablers of the process of change through case studies. Investigations that provide an in-depth longitudinal analysis of the steps involved in the service journey are much rarer. Such a detailed understanding is required in order to appreciate fully how firms can leverage the enablers while overcoming the challenges of servitization.

The purpose of this paper is to present the challenges experienced by a basque manufacturing company undergoing a servitization journey to becoming product-service provider. This paper emphasizes real life complexity and the most common and problematic challenges experienced by practitioners.

Using the rich body of literature regarding the drivers of servitization and business transformation and organizational change, this research investigates challenges and enablers of the change process and identifies a pattern to be compared with emergent patterns identified in recent research.

Keywords: Servitization, change management, transformation, product-service, case study.

Challenges in the journey to services

In order to attain a sustainable competitive advantage, manufacturers in western economies are increasingly evolving into

solution providers (Wise & Baumgartner, 1999; Neely, 2008; Kucza & Gebauer, 2011).

As Huikkola and Kohtamaki state (2017) this journey towards a combination of products and services is known in several ways, such as, servitization (Vandermerwe & Rada, 1998; Baines & Lightfoot, 2013), going downstream (Wise & Baumgartner, 1999), tertiarization (Léo & Philippe, 2001) moving from products to services (Oliva & Kallenberg, 2003) and service infusion (Kowalkowski et al., 2012).

Manufacturers have struggled during the past decades and their traditional value-chain of producing and selling goods has become less and less attractive as demand for products has stagnated throughout the economy (Wise & Baumgartner, 1999). In addition to that, customers are asking for more services (Oliva & Kallenberg 2003) and many manufacturers are transforming into solution providers (Kindström et al., 2012; Kucza & Gebauer, 2011; Story et al., 2016; Windahl, 2015; Huikkola & Kohtamaki 2017).

This trend has been studied in different countries such as UK (Baines et al. 2009; Baines et al. 2014) and several European countries (Dachs et al. 2012) from different perspectives, but there are still several questions unanswered.

Some previous studies have discussed the challenges when implementing servitization in companies (Alghisi & Saccani, 2015; Martinez et al., 2010), and others have studied the key processes and practices needed to execute servitization (Baines & Lightfoot, 2013; Gebauer, 2011; Storbacka, 2011; Storbacka et al., 2011; Rabetino et al., 2017). But this transformation process is quite complex and still needs a better understanding (Tukker, 2004; Martínez et al., 2010; Martínez et al., 2017). Organisations that want to propose a combined product-service offering need to change and adapt their

strategies, operations, systems, technologies, processes and people (Davies, 2003; Oliva & Kallenberg 2003; Araujo & Spring, 2006).

Many companies have gone downstream towards the customer, but there is a gap to study the downstream side and see the inter-organisational relationships when servitising (Martínez, et al., 2010). More specifically, there is limited reporting on in-depth longitudinal studies explaining the details of individual firms' step by step service journeys (Vendrell-Herrero, et al., 2014; Baines et al., 2016; Martínez et al., 2017) and little work has been done in servitization in SMEs (Confente et al., 2015).

So, the purpose of this paper is to present the internal challenges experienced by a manufacturer undergoing a servitization journey to become product-service provider from the manufacturer perspective and the perceptions of this servitization journey from their retailer's perspective.

Following Pettigrew et al. (2001) in this paper, we will focus on 3 of the 6 key issues that they propose:

1-The examination of multiple contexts and level of analysis. How firm, sector and economic level of context interact to energize change processes.

2-The inclusion of time, history, process and action. Change and continuity. Phenomena over time using the language of: what, who, where, why, when and how.

5-The study of receptivity, customization, sequencing, pace and episodic versus continuous change processes.

The paper offers several contributions.

1.The first contribution is to study the nature of the change. Whether the servitization process follows a continuous change rather than a punctuated equilibrium (Martínez et al., 2017).

2.The second contribution wants to analyse which is the pace of service development and related to that, the existence of types of services: basic, intermediate and complex services.

3. The third contribution takes the seven stages of the service strategy model (Martínez et al., 2017) and adds the retailer perspective to it.

References

Alghisi, A., & Saccani, N. (2015). Internal and external alignment in the servitization Journey – overcoming the challenges. *Production Planning & Control: The Management of Operations,* 26(14-15), 1219-1232. https://doi.org/10.1080/09537287.2015.1033496

Araujo, LM., & Spring, M. (2006). Services, products and the institutional structure of production. *Industrial Marketing Management*, 35(7), 797-805. https://doi.org/10.1016/j.indmarman.2006.05.013

Baines, T., Lightfoot, H., Benedettini, O., & Kay, J., (2009). The servitization of manufacturing. A review of literature and reflection on future challenges. *J. Manufacturing Technology,* 20(5), 547–567. https://doi.org/10.1108/17410380910960984

Baines, T., & Lightfoot, H. (2013). *Made to Serve: How Manufacturers can Compete Through Servitization and Product-Service Systems*. Wiley, Hoboken, NJ, Chichester. https://doi.org/10.1002/9781119207955

Baines, T., Lightfoot, H., Smart, P., & Fletcher, S. (2014). Servitization of the manufacturing firm: exploring the operations practices and technologies that deliver advanced services. *Int. J. Oper. Prod. Manag.* 34(1), 2-35. https://doi.org/10.1108/IJOPM-02-2012-0086

Baines, T., Bigdeli, A.Z., Bustinza, O.F., Shi, V.G., Baldwin, J., & Ridgway, K. (2016). Servitization: revisiting the state of the art and research priorities. *International Journal of Operations and Production Management*, 37(2), 256-278. https://doi.org/10.1108/IJOPM-06-2015-0312

Confente, I., Buratti, A., & Russo, I. (2015). The role of servitization for small firms: drivers versus barriers. *Int. J. Entrepreneurship and Small Business*, 26(3), 312-331. https://doi.org/10.1504/IJESB.2015.072394

Davies, A. (2003). Integrated solutions: the changing business of systems integration. In Prencipe, A., Davids, A., & Hobday, M. (Eds), *The Business System Integration.* Oxford University Press, Oxford.

Dachs, B., Biege, S., Borowiecki, M., Lay, G., Jäger, A., & Scharting, D., (2012). *The Servitization of European Manufacturing Industries*. MPRA Paper.

Gebauer, H. (2011). Exploring the contribution of management innovation to the evolution of dynamic capabilities. *Industrial Marketing Management* 40(8), 1238-1250. https://doi.org/10.1016/j.indmarman.2011.10.003

Huikkola, T., & Kohtamaki, M. (2017). Solution providers' strategic capabilities. *Journal of Business & Industrial Marketing* 32(5), 752-770. https://doi.org/10.1108/JBIM-11-2015-0213

Kindström, D., Kowalkowski, C., & Nordin, F. (2012). Visualizing the value of service-based offerings: empirical findings from the manufacturing industry. *Journal of Business & Industrial Marketing*, 27(7), 538-546. https://doi.org/10.1108/08858621211257301

Kowalkowski, C., Kindström, D., Brashear Alejandro, T., Brege, S., & Biggermann, S. (2012). Service infusion as agile incrementalism in action. *Journal of Business Research,* 65(6), 765-772. https://doi.org/10.1016/j.jbusres.2010.12.014

Kucza, G., & Gebauer, H. (2011). Global approaches to the service business in manufacturing companies. *Journal of Business & Industrial Marketing,* 26(7), 472-483. https://doi.org/10.1108/08858621111162271

Léo, P.-Y., & Philippe, J. (2001). Offer of services by goods exporters: strategic and marketing dimensions. *The Service Industries Journal*, 21(2), 91-116. https://doi.org/10.1080/714005023

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *Int. J. Serv. Ind. Manag.* 14, 160-172. https://doi.org/10.1007/s12063-009-0015-5

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Oper. Manag. Res.,* 1(2), 103-118. https://doi.org/10.1007/s12063-009-0015-5

Martinez, V., Bastl, M., Kingston, J., & Evans, S. (2010). Challenges in transforming manufacturing organisations into product service providers. *Journal of Manufacturing Technology Management,* 21 (4), 449-469. https://doi.org/10.1108/17410381011046571

Martinez, V., Neely, A., Velu, C., Leinster-Evans, S., & Bisessar, D. (2017). Exploring the journey to services. *International Journal of Production Economics,* 192, 66-80. https://doi.org/10.1016/j.ijpe.2016.12.030

Pettigrew, A.M., Woodman, RW., & Cameron, KS. (2001). Studying organizational change anda development: challenges for future research. *Academy of Management Journal.* 44(4), 697-713. https://doi.org/10.2307/3069411

Rabetino, R., Kohtamäki, M., & Gebauer, H. (2017). Strategy map of servitization. *International Journal of Production Economics*, 192, 144-156. https://doi.org/10.1016/j.ijpe.2016.11.004

Storbacka, K. (2011). A solution business model: capabilities and management practices for integrated solutions. *Ind. Mark. Manag.,* 40, 699-711. https://doi.org/10.1016/j.indmarman.2011.05.003

Storbacka, K., Polsa, P., & Sääksjärvi, M. (2011). Management Practices in Solution Sales—A Multilevel and Cross-Functional Framework. *J. Pers. Sell. Sales. Manag.,* 31, 35-54. https://doi.org/10.2753/PSS0885-3134310103

Story, V.M., Raddats, C., Burton, J., Zolkiewski, J. & Baines, T. (2016). Capabilities for advanced services: a multi-actor perspective. *Industrial Marketing Management,* 60. https://doi.org/10.1016/j.indmarman.2016.04.015

Tukker, A. (2004). Eight types of product-service system; eight ways to sustainability? Experiences from suspronet. *Bus. Strategy Environ.*, 13, 246-260. https://doi.org/10.1002/bse.414

Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, 6(4), 314-24. https://doi.org/10.1016/0263-2373(88)90033-3

Vendrell-Herrero, F., González-Pernía, J.L., & Peña-Legazkue, I. (2014). Do incentives matter to promote high technology-driven entrepreneurial activity? *International Entrepreneurship and Management Journal* ,10(1), 43-66. https://doi.org/10.1007/s11365-011-0181-4

Wise, R., & Baumgartner, P. (1999). Go downstream: the new profit imperative in manufacturing. *Harv. Bus. Rev.*, 77, 133-141.

Windahl, C. (2015). Understanding solutions as technology-driven business innovations. *Journal of Business & Industrial Marketing*, 30(Nos 3/4), 378-393. https://doi.org/10.1108/JBIM-11-2013-0253

Longitudinal Analysis of International Sales Growth of Highly Servitized Products: Best entry Strategies

Waleed Shleha, Yancy Vaillant

Department of Strategy, Entrepreneurship & Innovation. Toulouse Business School (TBS)

Abstract

The aim of this research is to understand how foreign market entry strategies influence the sales growth of SMEs offering highly servitized product-service systems in international markets. In this research, we argue that the highly servitized products will positively impact sales growth. However, different international entry modes will significantly change this impact, considering the varying paradoxical balances between proximity versus complexity that each penetration strategy can offer. The empirical application employs a longitudinal approach of the sales growth, entry modes and the degree of servitization of goods sold. The empirical analysis is drawn from primary data collected in a servitized international firm, involved in the high tech optic industry. The time series data of the international sales covers a period of ten years and is organised according to each of the company's foreign markets. Along with a complementary set of control variables, this primary data allows us to analyse each international market based on the entry mode implemented, the annual growth of sales within each foreign market, as well as the degree of servitization of goods sold in each of these markets. The results show a primary confirmation of the main argument in the research. However, the results are found to diverge depending on the international entry mode used. The results contribute to the literature on what international market strategy

servitizing manufacturers should follow when selling their highly servitised product-service systems abroad.

Keywords: Servitization, entry modes, SMEs, longitudinal analysis.

Research motives

With the competitiveness gained through the addition of services to their manufactured goods, many manufacturers are differentiating themselves by offering greater value-added product-service systems to their customers (Bustinza et al., 2017). This process is defined as servitization (Vandermerwe & Rada, 1988; Baines et al., 2017; Rabetino et al., 2018). As these manufacturers are brought to compete within increasingly globalized value-chains, many are seeking to internationalize their product-service offerings (Turunen & Finne, 2014; Urban & Zucchella, 2011).

Servitization literature has explored the influence over firm growth of implementing services within a manufacturing context (Fang et al., 2008; Guajardo et al., 2012; Suarez et al., 2013; Visnjic et al., 2012). But growth in international markets of servitized firms can be much more difficult to achieve due to the added complexity involved in international business (Vaillant et al., 2018). This complexity may be amplified for manufacturers offering servitised goods (Vendrell-Herrero et al., 2018). This is because the proper delivery of product-service systems usually requires close customer relational proximity (Vendrell-Herrero et al., 2017). The greater the degree of servitization of the goods on offer, the higher the involvement of the clients in crafting an appropriate service-augmented solution (Vaillant et al., 2019). Reaching such customer proximity in international markets may be especially challenging without a proper foothold within the foreign market (Vaillant & Lafuente, 2019), suggesting the need for foreign direct investment and presence. However, if market development and sales growth are

the objectives being pursued, it is possible that forgoing customer proximity in order to benefit from the advantages of the lessened complexity offered by other penetration strategies (e.g. using distributors or direct sales) may be warranted. The degree of servitization of the goods sold in the foreign markets is likely to influence which penetration strategy is best to promote international sales growth (Shleha & Vaillant, 2018).

Therefore, according to the previous discussion, the objective of this study is to determine how foreign market penetration strategies affect international sales growth of manufacturers offering different degrees of service-augmented products.

Data, methodology, and primary findings

In order to reach the study's set objective, the methodology used relies on a longitudinal analysis of the sales growth, entry modes and the degree of servitization of goods sold in international markets. The unit of analysis of the study is delimited by each foreign market, where the separate penetration strategies and degrees of servitization of goods sold can be identified and compared against each other to help determine correlations with sales growth.

The empirical analysis is drawn from primary data collected for a ten years period in a servitized international firm involved in the high-tech optic industry. The firm has implemented different penetration strategies in different external markets. Therefore, it is possible to analyse the evolution of annual sales over the decade under observation, comparing the results of the different penetration strategies, whilst keeping the micro-level factors related to the firm constant. Annual sales growth is longitudinally measured for each of the firms' foreign markets. The degree of servitization is measured for each year in each foreign market using the different

levels of servitized products sold, as categorised by Bains and Lightfoot (2013). The penetration strategies are described as the entry modes adopted by the firm to sell their product-service systems in the different foreign markets; including foreign direct investments, the use of distributors, and direct sales from the headquarters. Additional control variables are included from the primary data.

The results show a primary confirmation of the main theoretically-based argument proposed by the research. Therefore, the results are found to diverge depending on the international entry mode used and the degree of servitization of goods sold. The results contribute to the literature on international market strategies for servitizing manufacturers selling their highly servitized product-service systems abroad.

References

Baines, T., & Lightfoot, H. (2013). *Made to Serve: How Manufacturers Can Compete through Servitization and Product Service Systems.* John Wiley & Sons, London, UK. https://doi.org/10.1002/9781119207955

Baines, T., Bigdeli, A., Bustinza, O.F., Shi, V., Baldwin, J.S., & Ridgway, K. (2017). Servitization: revisiting the state-of-the art and research priorities. *International Journal of Operations & Production Management*, 37(2), 256-278. https://doi.org/10.1108/IJOPM-06-2015-0312

Bustinza, O. F., Vendrell-Herrero, F., & Baines, T. (2017). Service implementation in manufacturing: An organisational transformation perspective. *International Journal of Production Economics*, 192, 1-8. https://doi.org/10.1016/j.ijpe.2017.08.017

Fang, E., Palmatier, R.W., & Steenkamp, J.B.E. (2008). Effect of service transition strategies on firm value. *Journal of marketing*, 72(5), 1-14. https://doi.org/10.1509/jmkg.72.5.001

Guajardo, J.A., Cohen, M.A., Kim, S.H., & Netessine, S. (2012). Impact of performance-based contracting on product reliability: An empirical analysis. *Management Science*, 58(5), 961-979. https://doi.org/10.1287/mnsc.1110.1465

Rabetino, R., Harmsen, W., Kohtamäki, M., & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations & Production Management,* 38(2), 350-371. https://doi.org/10.1108/IJOPM-03-2017-0175

Suarez, F.F., Cusumano, M.A., & Kahl, S.J. (2013). Services and the business models of product firms: An empirical analysis of the software industry. *Management Science*, 59(2), 420-435. https://doi.org/10.1287/mnsc.1120.1634

Shleha, W., & Vaillant, Y. (2018). How servitized products perform in international markets? The impact of servitization level and different entry modes. *7th International Conference on Business Servitization: book of abstracts*, 31-35.

Turunen, T., & Finne, M. (2014). The organisational environment's impact on the servitization of manufacturers. *European Management Journal*, 32(4), 603-615. https://doi.org/10.1016/j.emj.2013.11.002

Urban, S., & Zucchella, A. (2011). Building the future through real value creation and innovation: achieving competitiveness in a chaotic world. *International Journal of Entrepreneurship and Small Business*, 13(2), 126-149. https://doi.org/10.1504/IJESB.2011.040756

Vaillant, Y, Lafuente, E., & Bayon, M. (2018). Early internationalization patterns and export market persistence: A pseudo-panel data analysis. *Small Business Economics*, 1-18. https://doi.org/10.1007/s11187-018-0071-z

Vaillant, Y., & Lafuente, E. (2018). The increased international propensity of serial entrepreneurs demonstrating ambidextrous strategic agility: A precursor to international marketing agility. *International Marketing Review*, 36(2), 239-259. https://doi.org/10.1108/IMR-01-2018-0015

Vaillant, Y., Lafuente, E., Vendrell-Herrero, F., & Bustinza Sánchez, Ó. F. (2019). Servitization: allowing better solution delivery and performance for manufacturers of longer lifespan products. *8th International Conference on Business Servitization: book of abstracts*, 1-9.

Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Vendrell-Herrero, F., Gomes, E., Collinson, S., Parry, G., & Bustinza, O. F. (2018). Selling digital services abroad: How do extrinsic attributes influence foreign consumers' purchase intentions? *International Business Review*. 27(1), 173-185. https://doi.org/10.1016/j.ibusrev.2017.06.003

Vendrell-Herrero, F., Gomes, E., Mellahi, K, & Child, J. (2017). Building international business bridges in geographically isolated areas: The role of Foreign Market Focus and Outward Looking Competences in Latin American SMEs. *Journal of World Business*. 52, 489- 502. https://doi.org/10.1016/j.jwb.2016.08.007

Visnjic, I., Neely, A., & Wiengarten, F. (2012). Another performance paradox?: A refined view on the performance impact of servitization. A Refined View on the Performance Impact of Servitization (July 4, 2012). *ESADE Business School Research Paper*, (231). https://doi.org/10.2139/ssrn.2117043

The Relevance of Servitization for Ecoinnovation Activities among Manufacturing Firms

Bart Kamp, Jabier Retegi

Orkestra-Basque Institute of Competitiveness & Mondragon Unibertsitatea

Abstract

Industrial firms are encouraged to practice ecoinnovation e.g. for the sake of competitiveness and (environmental) sustainability.
To innovate in an ecology-friendly manner and support circular economy principles many ways are open to them, one of them being the implementation of servitization practices and another being the use of servitized payment modalities.
Based on a survey among manufacturing firms from the Basque Country, we examine how important these two "forms" of ecoinnovation are amidst the wider range of options that companies make use of, and which economic and other benefits they obtain from them.

Keywords: Ecoinnovation, servitization, circular economy, novel payment models.

Outline

Ecoinnovation as a concept refers to all forms of innovation that pursue to save the environment or to lower the burden on it.

Carrillo-Hermosilla et al. (2010) emphasize that ecoinnovation can be beneficial for the environment through more ecological forms of production and consumption of goods. Over time, many scholars have also pointed at the benefits from a business

perspective for firms that embrace ecoinnovation. Notably Plouffe et al. (2011) and the IRRC argue that ecoinnovation offers a clear potential to contribute to turnover increase and cost reductions. Similarly, Kesidou and Demirel (2012) or Pereira and Vence (2012) cite the following advantages for firms practicing ecoinnovation: cost savings, productivity improvements, more attractive value propositions to the market, and an increase in the ability to innovate on behalf of the eco-innovating organization

When operationalizing ecoinnovation several types of acts can be discerned, like the devising of new production processes or the creation of new goods and services (Alvarez et al., 2014). This forms the traditional way of breaking down ecoinnovation activities on behalf of companies. I.e., to focus on input (choice of materials), throughput (operational processes) and output (product or service design) indicators. However, ecoinnovation can also be brought about via practices from the realm of "servitization" and "payment model innovation" (Kamp, 2016).

Consequently, we set out to examine how important these two "forms" of ecoinnovation amidst the wider range of options that companies make use of, and which economic and other benefits they obtain from them.

For this, we recur to a sample of manufacturing firms from the Basque Country with a track record in ecodesign, ecoefficient production and use of recycled materials. Basque firms have been a frontrunner in terms of initiating ecoinnovation activity as this tradition goes back to the start of the 21st century when a set of companies transmitted the need for measures to foster and make further progress in the field of ecoinnovation (Ihobe, 2014; De Miguel Molina et al., 2015). Afterwards, demand side evolutions and environmental legislation have contributed to raising Basque firms' interest in ecoinnovation. According to 2017 data from Ihobe, 54% of the Spanish firms that are certified under the UNE EN ISO

14006 standard is located in the Basque Country. According to the same source, the Basque Country counts with 43 companies that comply with environmental product labelling.

The Basque Environmental Development Agency Ihobe keeps track of firms conducting ecoinnovation and/or circular economy activities. This subset of companies forms our basis to determine the relevance of "servitization" and "servitized payment modalities" amidst other forms of ecoinnovation.

By means of a structured questionnaire, these companies have been asked about recent initiatives in the realm of product/service design, operational processes, service delivery and payment modalities. With regard to these initiatives, questions to map their environmental and economic effects have also been posed.

Overall, the research allows to see in which ways companies apply service delivery and servitized payment modalities for the sake of ecoinnovation and it enables appreciating its relative importance compared to more conventional (input-throughput-output) levers to ecoinnovation that companies apply.

References

Álvarez, M.J., Fernández, R.I., & R. Romera (2014). ¿Es la eco-innovación una estrategia inteli-gente de especialización para Andalucía? Una aproximación desde el análisis multivariante. *Revista de Estudios Regionales,* 100, 171-195.

Carrillo-Hermosilla, J., Del Río P., & Könnl Ä.T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, 18, 1073-1083. https://doi.org/10.1016/j.jclepro.2010.02.014

De Miguel Molina, M, Merizalde Freire, E., Peiró Signes, A., & Segarra Oña, M. (2015). Análisis comparativo del fomento de la eco-innovación empresarial en las Comunidades Autónomas. *Revista de Estudios Regionales*, 104, 15-31.

IHOBE (2017). *Oportunidades de negocio que ofrece el ecodiseño a las empresas del País Vasco.* Bilbao.

IRRC (2015). *Driving Revenue Growth Through Sustainable Products and Services.* New York.

Kamp, B. (2016). Servitizar la propuesta de valor: un paso más allá para competir en el merca-do y servir al cliente. *Harvard Deusto Márketing y Ventas*, November, 140, 68-74.

Kesidou, E., & Demirel, P. (2012). On the Drivers of Eco-Innovations: Empirical Evidence from the UK. Research Policy, 41, 862-870. https://doi.org/10.1016/j.respol.2012.01.005

Pereira, A., & Vence, X. (2012). Factores empresariales clave para la eco-innovación: una revisión de estudios empíricos recientes a nivel de empresa. *Cuadernos de Gestión,* 12(Especial Innovación), 73-103. https://doi.org/10.5295/cdg.110308ap

Plouffe, S., Lanoie, P., Berneman, C., & Vernier, M-F (2011) Economic benefits tied to ecodesign. *Journal of Cleaner Production*, 19, 573-579. https://doi.org/10.1016/j.jclepro.2010.12.003

Servitization in Wind Power - a Complexity Perspective

Saara A. Brax

School of Business and Management, LUT University

Wenting Zou

Department of Industrial Engineering and Management, Aalto University

Abstract

The study investigates the servitization and PSS offerings in the renewable energy sector focusing on wind power. While the circular economy perspective receives attention among servitization scholars, there is a lack of attention in the new advanced services that enable the renewable energy supply chains. The special characteristics of this sector also warrant the need to understand the sources and forms of complexity associated with servitization. The offerings of four European case firms are analysed using two frameworks from servitization literature: the classic SSP/SSC-framework from Mathieu (2001) and as an emergent theme, the complexity framework by Zou et al. (2018). The data is collected from public and private documents as well as interviews and analysed using thematic content analysis. As a result of the empirical analysis, the study reports a categorization of service business models in the wind power sector, and discusses their special characteristics.

Keywords: Service complexity, servitization, wind power, renewable energy.

Introduction

Servitization is considered as a competitive strategy for manufacturing to survive in competitive markets. The interest in servitization of manufacturing firms has received an increasing attention from academics and practitioners over the last decade, and continues to remain relevant (Baines et al., 2017). New research interests have arisen in the area of resource-efficiency, sustainable services, and product-service-systems (PSS) for circular economy (Spring & Araujo, 2017; Wasserbaur & Sakao, 2018). Research on servitization for circular economy considers the service systems that enable the supply and utilization of waste resources that can be used effectively for new materials or as an energy resource in a demand-based energy production.

This study proposes the production of clean energy as an important new subject area in servitization research agenda. To reduce CO2 emissions European countries are rapidly changing their energy systems to those that rely on renewable energy (RE) sources. Wind power is considered a particularly good option as the energy production generated electricity without emissions and, due to the fast development of the turbines, has become profitable without public subsidiaries. The wind energy sector in Europe develops with great speed and new service-based business models are formed in the RE supply chain between the investor and the end user. Digitalization has a key enabling role in this development as RE production needs to be balanced using various forms of RE (e.g., wind, solar, bio gas) to meet the demand in the energy system.

While servitization increases the value generated for the customers, it also increases the complexity of the offering for service providers such as original equipment manufacturers (OEMs) and maintenance management companies that face the diversified customer needs that arise in different business environments (Brax & Jonsson, 2009; Brax & Visintin, 2017; Zou et al., 2018).

Moreover, this offering-level complexity casts new challenges at the organizational level in designing and implementing successful service strategies (Brax & Jonsson, 2009).

Complexity is still an emerging research theme with current investigations focusing on conceptualization of the construct (Zou et al., 2018; Kreye, 2019). So far, empirical studies that examine service complexity based on different service offerings remain scant. To support RE companies in the development of PSSs and service solutions in the wind power sector, the possibilities and complexities associated with current service offerings are investigated empirically in selected forerunner companies. Building on the existing works - the four dimensions of service complexity (Zou et al., 2018) and service offering orientations (Mathieu, 2001), this study investigates and categorizes service solutions using a comparative case research design.

Methodology

Four European providers in the wind power sector have been selected for the current analysis. The data consist of publicly available documents that describe the firms, their offerings, and operations. In addition, the data set contains supplementary data provided privately by the companies, and thematic interviews with firm representatives. The data has been collected during the year 2019. The main analysis method used is thematic content analysis in which researchers implemented three steps. First the different service and PSS offerings provided by these firms were identified. Second, their level of customer orientation versus product orientation was investigated using the SSP and SSC constructs from Mathieu (2001). Third, the offerings were examined using the complexity framework by Zou et al. (2018).

Contribution

As a result of the empirical analysis, the study reports a categorization of service business models in the wind power sector. The study explores the different types of offerings identified in the four case companies, and discusses their characteristics using the complexity framework as its theoretical lens. In addition this theoretical contribution to the servitization research, the study provides managerially interesting descriptions of different service types provided by leading companies in the wind power sector, which promote better understanding about the industry, and are particularly useful for decision-makers, potential investors, and newcomers in the industry.

References

Baines, T., Ziaee Bigdeli, A., Bustinza, O. F., Shi, V. G., Baldwin, J., & Ridgway, K. (2017). Servitization: revisiting the state-of-the-art and research priorities. *International Journal of Operations and Production Management*, 37(2), 256-278. https://doi.org/10.1108/IJOPM-06-2015-0312

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. https://doi.org/10.1108/01443570910953621

Brax, S. A., & Visintin, F. (2017). Meta-model of servitization: The integrative profiling approach. *Industrial Marketing Management*, 60, 17-32. https://doi.org/10.1016/j.indmarman.2016.04.014

Kreye, M. E. (2019). Does a more complex service offering increase uncertainty in operations?. *International Journal of Operations Production Management*, 39(1), 75-93. https://doi.org/10.1108/IJOPM-01-2018-0009

Mathieu, V. (2001). Product services: from a service supporting the product to a service supporting the client. *Journal of Business & Industrial Marketing*, 16(1), 39-61. https://doi.org/10.1108/08858620110364873

Spring, M., & Araujo, L. (2017). Product biographies in servitization and the circular economy. *Industrial Marketing Management*, 60, 126-137. https://doi.org/10.1016/j.indmarman.2016.07.001

Wasserbaur, R., & Sakao, T. (2018).Analysing interplays between PSS business models and governmental policies towards a circular economy. *10th CIRP IPS2 Conference 2018*, 130-136. https://doi.org/10.1016/j.procir.2018.04.004

Zou, W., Brax, S. A., & Rajala, R. (2018). Complexity in product-service systems: review and framework. *Procedia CIRP*, 73(1), 3-8. https://doi.org/10.1016/j.procir.2018.03.319

Parallel session 8

Roundtable on business ecosystems

Moderation of the session:
Emanuel Gomez & Bart Kamp

Parallel session 9

Product-Service Innovation System IV

Chair: Yancy Vaillant

The Evolution of Digital Platforms: Exploring the Interplay between Digital Generativity and Solution Value Space

Marin Jovanovic

Copenhagen Business School

Vinit Parida, David R. Sjödin

Luleå University of Technology

Abstract

This study explores how the evolution of digital platforms enable the growth of solution value space in manufacturing firms. Greater generativity of digital modules increases the value space and associated solution scope of the digital platforms. This study focuses on the evolution of digital platforms, that is, how design recombination of digital module units can facilitate manufacturers to deliver multiple advanced solutions through use recombination. Based on multiple case studies in the construction industry, the findings present the maturity model of three digital platforms for manufacturers: (1) connected product platform, (2) fleet management platform and (3) digital industrial platforms. First, connected product platform generates a service space from a single digital module as a value offer to customer. Second, fleet management platform leverages on assemblages of digital modules that enables multiple advanced solutions though use recombination. Finally, digital industrial platform extends the level of platform openness by promoting digital generativity to specialized complementors. Thus, study also sheds light on the generativity tension by helping firms to navigate the balance between promoting and constraining digital generativity.

Keywords: Digital platforms, generativity, value spaces, servitization.

The Impact of Product-Service Innovation on Labor Productivity: Analysis of the Relevance of R&D Investments and Innovation-Driven Partnerships in Manufacturing Businesses

Krisztina Horváth, László Szerb, Attila Varga

University of Pécs

Abstract

This study analyzes strategic trajectories that optimize labor productivity in manufacturing organizations, distinguishing businesses adopting product-service innovation (PSI) systems from businesses with a product-centric business model. Our analysis pays special attention to the potentially differentiating effect of the business' prior experience in R&D projects and the experience in innovation-driven partnerships. We employ a fuzzy set qualitative comparative analysis (fsQCA) on a unique dataset of 77 Hungarian manufacturing businesses that includes information for the period 2010-2013. Based on a sub-sample of 17 manufacturers, the second analytical stage provides a supplementary (descriptive) analysis of the configuration of innovative partnerships in businesses adopting PSI systems and product-oriented businesses. The results highlight two ideal strategic configurations in order for manufacturers to achieve optimal labor productivity: a configuration specific to PSI firms that underlines the role of R&D investments, and a configuration that highlights the role of R&D investments and innovative partnerships among large non-PSI firms. In addition, the descriptive findings for the sub-sample of manufacturers indicate that businesses adopting PSI systems and product-oriented manufacturers show some differences in terms of both the

motivations to engage in innovation partnerships and the types of innovation relationships that they develop.

Keywords: Product-service innovation (PSI), R&D investment, innovation-driven partnerships, labor productivity.

Extended Abstract

In an increasingly competitive economic environment, manufacturing businesses grapple between catering to the tastes of their customers and developing value-adding strategies with a long term perspective. Recently, strategic management scholars have invoked the introduction of product-service innovation (PSI) systems or business servitization, defined as the shift from a product-centric to a service-centric business model that lead to develop hybrid product-service offerings (Bustinza et al., 2018; Rabetino et al., 2018), as a viable strategy with the potential to generate economic value for the business (e.g., Kohtamäki et al., 2013; Suarez et al., 2013; Bustinza et al., 2019).

Nevertheless, transforming business operations —such as the introduction of PSI systems— entails complex processes as well as drastic modifications in business operations that do not always produce the desired outcomes (Gebauer et al., 2005; Bustinza et al., 2019). Prior work has identified a number of factors that may condition both the implementation and the outcomes resulting from PSI systems, including the quality of management (Gebauer et al., 2005), scale and type of services offered (Visnjic & Van Looy, 2013; Bustinza et al., 2019), and the match between the servitization strategy and the specific market context (Sjödin et al., 2019).

In this study, we ask whether the performance level of businesses that have adopted servitization strategies is conditioned by the business' prior R&D record and the development of innovation-driven partnerships. More concretely, the objective of

this study is to analyze the strategic trajectories that optimize labor productivity in manufacturing organizations, distinguishing businesses adopting PSI systems from businesses with a product-centric business model. Our analysis pays special attention to the potentially differentiating effect of the business' prior experience in R&D projects and the experience in innovation-driven partnerships.

The empirical analysis is based on a unique sample of 77 Hungarian manufacturing businesses for the year 2013. For the sampled manufacturing businesses, the dataset includes information about innovation networks and processes during 2010-2013, while labor productivity figures are reported for 2013. By employing fuzzy set qualitative comparative analysis (fsQCA), we analyze whether the businesses' R&D record (investments between 2010 and 2012) and the innovation-driven partnerships created before 2013 are important determinants of the labor productivity level in 2013, and whether the effects of these strategic factors are conditioned by the adoption of PSI systems strategies between 2010 and 2012.

Additionally, we conducted a supplementary (descriptive) analysis based on a sub-sample of 17 manufacturing businesses. This analysis seeks to offer further information and insights on the strategic characteristics of manufacturers adopting PSI systems viz.-à-viz. businesses with a product-oriented business model, including motivations for developing partnerships, number of innovative partners (including suppliers), average length of partnerships, and the type of partnership.

Table 1 is the 'Truth Table Algorithm' presenting the results of the fuzzy set analysis. The table shows the efficient configurations to optimize labor productivity levels using the notation introduced by Ragin and Fiss (2008) in which large circles indicate core conditions and small circles point to peripheral (or contributing) conditions. Full circles denote conditions that must be present in the

configuration, while crossed-out circles represent conditions that must be absent.

Table 1 provides coverage scores, a measure that indicates how many cases take the focal path to the outcome variable. Regarding overall coverage the computed solution accounts for 27.2% of membership in the labor productivity model, thus presenting acceptable fit. Furthermore, the computed solution consists of two strategic configurations, and all configurations show high consistency values between 0.954 and 0.955, with the overall solution consistency at 0.946.

The findings indicate two ideal strategic configurations in order for manufacturing firms to achieve optimal labor productivity level. In the first strategic configuration, the results suggest that in large manufacturing businesses—in terms of employment—the most important factor for achieving optimal labor productivity levels is high R&D investments, while the number of innovative partnerships with suppliers and market experience are less important (complementary factors). This strategic configuration is specific to large non-PSI manufacturing businesses with strong R&D investments.

The second strategic configuration is specific to manufacturers adopting PSI systems. In this configuration, optimal labor productivity is achieved by combining the adoption of PSI systems with R&D investments. Also, business size plays a secondary role in this configuration and a greater weight is given to market experience (business age). Finally, the number of innovative partnerships with suppliers is not a prerequisite for achieving superior productivity levels.

	Dependent variable: Labor productivity in 2013	
	Configuration (1)	Configuration (2)
Product-service innovation (2010-2012)	⊗	●
R&D investments (2010-2012)	●	●
Number of innovative partnerships with suppliers (before 2013)	·	⊗
Business size (ln employees)	●	·
Business age (ln years)	·	●
Goodness of fit statistics		
Consistency	0.955	0.954
Raw coverage	0.220	0.104
Unique coverage	0.168	0.052
Overall solution consistency	0.946	
Overall solution coverage	0.272	
Number of observations	77	

Table 1. Fuzzy set analysis: Strategic configurations for achieving labor productivity

Note: Full circles refer to conditions that must be present in the configuration: large circles are core conditions and small circles peripheral conditions. Crossed-out circles denote conditions that must be absent.

The results for the second analytical stage, focused on describing the characteristics of the partnerships developed by manufacturers adopting PSI systems and non-PSI manufacturing businesses, are presented in Figure 1. The descriptive findings for the sub-sample of manufacturers indicate that businesses adopting PSI systems and product-oriented manufacturers show some differences in terms of both the motivations to engage in innovation partnerships and the types of innovation relationships that they develop.

Among manufacturers adopting PSI systems, collecting data about the market and the direct competitors as well as the need for generating data that permit to pursue higher cost efficiency results are the main motivations for developing partnerships. In addition, businesses adopting PSI systems have higher labor productivity

levels and develop more partnerships with suppliers that facilitate their innovation activities, while the length of their innovation-led partnerships is lower, relative to the figures shown by the group of non-PSI manufacturers.

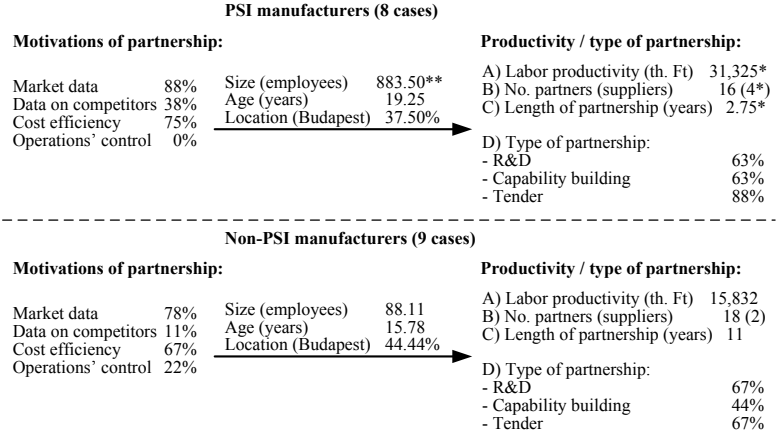


Figure 1. Motivations and characteristics of innovative partnerships

Note: * and ** indicate that, for the focal variable, the median value for manufacturers adopting PSI systems is significantly different, at 10% and 5% level, respectively, than the observed median for product-oriented manufacturers (non-parametric two-sample test of equality of medians).

As a conclusion, the results of the fuzzy set qualitative comparative analysis (fsQCA) underline that optimal performance levels—in our case, labor productivity—can be achieved by following different innovative strategic choices. This result is in line with prior servitization studies (e.g., Gebauer et al., 2005; Bustinza et al., 2019).

At the organizational level, change can be a costly process with uncertain outcomes. By analyzing the role of the previous

experience in R&D projects and the experience of the business in innovation-driven partnerships, our findings reveal how the effectiveness and economic outcomes of PSI systems may be conditioned by the development of other, complementary strategies related to the engagement in R&D projects and innovation partnerships.

References

Baines, T., & Lightfoot, H.W. (2014). Servitization of the manufacturing firm. *International Journal of Operations & Production Management,* 34(1), 2-35. https://doi.org/10.1108/IJOPM-02-2012-0086

Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E., & Swink, M. (2009). Towards an operations strategy for product–centric servitization. *International Journal of Operations & Production Management,* 29(5), 494-519. https://doi.org/10.1108/01443570910953603

Bustinza, O.F., Vendrell-Herrero, F., & Baines, T. (2017). Service implementation in manufacturing: An organizational transformation perspective. *International Journal of Production Economics*, 192, 1-8. https://doi.org/10.1016/j.ijpe.2017.08.017

Bustinza, O.F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research*, in Press. https://doi.org/10.1016/j.jbusres.2019.01.035

Bustinza, O. F., Vendrell-Herrero, F., Gomes, E., Lafuente, E., Opazo, M., Rabetino, R., & Vaillant, Y. (2018). Product-service innovation and performance: Unveiling the complexities. *International Journal of Business Environment,* 10(2), 95-111. https://doi.org/10.1504/IJBE.2018.095819

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal,* 23(1), 14-26. https://doi.org/10.1016/j.emj.2004.12.006

Kohtamäki, M., Partanen, J., Parida, V., & Wincent, J. (2013). Non-linear relationship between industrial service offering and sales growth: The moderating role of network capabilities. *Industrial Marketing Management,* 42(8), 1374-1385. https://doi.org/10.1016/j.indmarman.2013.07.018

Rabetino, R., Harmsen, W., Kohtamäki, M., & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations & Production Management,* 38(2), 350-371. https://doi.org/10.1108/IJOPM-03-2017-0175

Ragin, C.C. and Fiss, P.C. (2008). Net effects analysis versus configurational analysis: An empirical demonstration. In C.C. Ragin (Ed.), *Redesigning Social Inquiry: Set Relations in Social Research* (pp. 190-212). Chicago, IL: University of Chicago Press.

Sjödin, D., Parida, V., & Kohtamäki, M. (2019). Relational governance strategies for advanced service provision: Multiple paths to superior financial performance in servitization. *Journal of Business Research*, 101, 906-915. https://doi.org/10.1016/j.jbusres.2019.02.042

Suarez, F.F., Cusumano, M.A., & Kahl, S.J. (2013). Services and the business models of product firms: An empirical analysis of the software industry. *Management Science,* 59(2), 420-435. https://doi.org/10.1287/mnsc.1120.1634

Visnjic Kastalli, I. and Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management,* 31(4), 169-180. https://doi.org/10.1016/j.jom.2013.02.001

The Role of Service-oriented Technologies supported by KIBS in Enhancing Servitized Manufacturers' Performance

Oscar F. Bustinza

University of Granada

Marco Opazo-Basaez

Deusto Business School

Emanuel Gomes

Nova School of Business and Economics, Universidade Nova

Abstract

Manufacturers are developing product-service innovation by relying in product and service oriented technologies. This study proposes that performance is enhanced when servitized manufacturers support service develop and delivery by using a set of service-delivery technologies that configure the existing Industry 4.0. To test this hypothesis, we analyse the role of KIBS on the servitization-performance relationship. In doing so, a sample of Spanish manufacturing firms is purpose-selected. fsQCA analysis of the data shows that those manufacturers that internally develop service innovation are more aligned to performance when implementing cloud computing technologies. On the other side, for externally servitized manufacturers, a set of service-related technologies is aligned with superior performance. This study highlights the importance of KIBS for helping manufacturers to develop product-

service innovation and fully accomplish the potential of Industry 4.0 technologies.

Keywords: Product-service innovation, Industry 4.0, KIBS, performance.

Extended Summary

Servitization, explained as the configuration of bundles of product, service and knowledge (Vandermerwe & Rada, 1988; Baines, 2015; Rabetino et al., 2017, 2018), requires the implantation of appropriate technologies. Manufacturing operations has transitioned from product-oriented technologies –Enterprises Systems (ERP, CRM)– to implement service-related technologies allowed by the new Industry 4.0 context (Cloud computing, Big data, Virtual augmented reality). This service-related technologies implementation can be supported internally or externally, being this decision conditioning the achievement of different levels of performance (Liao et al., 2017)

Previous studies (Bustinza et al., 2015; 2019) have shown that servitizing manufacturers try to develop new services in-house or have to rely on external providers (KIBS). These different approaches are driven by technology maturity and regulatory contexts. On some countries the technology maturity is a barrier for internal implementation as well as suddenly regulatory changes can occur that push manufacturing firms to rely on external providers. But relying on KIBS for developing product-service innovation due to environmental issues is not the only reason for establishing this kind of relationship. Using a sample of 370 multinational manufacturing enterprises (MMNEs), Bustinza et al. (2019) showed that MMNEs developing product-service innovation achieve the highest performance levels by relying in KIBS providers in two out of three of the service continuum stages (Base and Intermediate

services); and keeping the development of Advanced services in-house. While the role of KIBS providers have been demonstrated to be critical in developing specific types of services (base, intermediate, or advanced), little is understood about their role on supporting the technology implementation required for manufacturing transiting to servitized offers.

The role played by KIBS in product-service innovation is an emerging avenue of research that attracts the interest of both academic and practitioners (Lafuente, Vaillant & Vendrell-Herrero, 2017). KIBS role analysis is critical for understanding the successful developing of specific services as well as for supporting their management inside manufacturers' operations. In this sense, servitized manufacturers are characterized by incorporating base, intermediate and advanced services developed though a) repair and maintenance services, b) data processing, hosting, and related IT services, c) professional, scientific, and technical services, d) administrative and support services or e) waste management and remediation services (Gomes et al., 2019). For developing these entire sets of services manufacturers rely on new service-oriented technologies (cloud computing, big data analysis, and virtual augmented reality) that, even when based on external software providers, need to be internally or externally managed. The current research proposes that the alignment between service-oriented technologies management and servitization trajectories will be responsible of the level of performance achieved.

This study thus argues that the importance of service-oriented technologies for the performance of servitized manufacturers is in part explained by role of KIBS in successfully managing these technologies. For contrast this statement, firstly a fuzzy-set QCA is used by measuring technology implementation and calibrating performance measures (Table 1) to uncover which technologies reach superior performance for manufacturers on one hand, and

servitized manufacturers on the other hand. Finnaly, the role of KIBS will be tested by analysing performance achieved by firms that internally or externally manage service-oriented technologies.

Outcome variables					
	Financial Performance				
Type of firm / Strategy	Product-oriented technologies: Enterprise Systems		Service-oriented technologies: Industry 4.0		
	ERP	CRM	Cloud computing	Big data	Virtual reality
	Organizational Performance				
Type of firm / Strategy	Product-oriented technologies: Enterprise Systems		Service-oriented technologies: Industry 4.0		
	ERP	CRM	Cloud computing	Big data	Virtual reality
Type of firms: Non-servitized Manufacturers; Internally servitized manufacturers; Externally servitized manufacturers					

Table 1. Fuzzy-set QCA of the role of managing product and service-oriented technologies for achieving superior performance

This novel methodological approach to understanding the role of KIBS in developing product-service innovation is expected to shed light for many manufacturing businesses that do not have the capacity to internally realize the potential benefits of PSI. This study contributes to the understanding of the connection between internal and external PSI management and the innovation trajectories of manufacturers, an issue that have received critical importance in recent call for further analysis.

References

Baines, T. (2015). Exploring service innovation and the servitization of the manufacturing firm. . *Research-Technology Management*, 58(5), 9-11. https://doi.org/10.5437/08956308X5805002

Bustinza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and competitive advantage: the importance of organizational structure and value chain position. *Research-Technology Management*, 58(5), 53-60. https://doi.org/10.5437/08956308X5805354

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research,* forthcoming. https://doi.org/10.1016/j.jbusres.2019.01.035

Gomes, E., Bustinza, O. F., Tarba, S., Khan, Z., & Ahammad, M. (2019). Antecedents and implications of territorial servitization. *Regional Studies*, 53(3), 410-423. https://doi.org/10.1080/00343404.2018.1468076

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Liao, Y., Deschamps, F., Loures, E. D. F. R., & Ramos, L. F. P. (2017). Past, present and future of Industry 4.0-a systematic literature review and research agenda proposal. *International Journal of Production Research*, 55(12), 3609-3629. https://doi.org/10.1080/00207543.2017.1308576

Rabetino, R., Kohtamäki, M., & Gebauer, H. (2017). Strategy map of servitization. *International Journal of Production Economics*, 192, 144-156. https://doi.org/10.1016/j.ijpe.2016.11.004

Rabetino, R., Harmsen, W., Kohtamäki, M. & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations & Production Management*, 38(2), 350-371. https://doi.org/10.1108/IJOPM-03-2017-0175

The Mediating Effect of Supply Chain Collaboration on the Relationship between Servitization and Firm's Innovation capability

Inmaculada Freije

Universidad de Deusto, Deusto Business School Faculty

Alberto de la Calle

Universidad de Deusto, Engineering Faculty

José Vicente Ugarte, Miguel Ángel Larrinaga

Universidad de Deusto, Deusto Business School Faculty

Objective/rationale

In recent decades, manufacturing companies in many countries faced increasing competition and product commoditization. In this context, services appear as an interesting strategy to escape from the consequent danger for sales and profits. But opportunities arise not only from creating new markets and income sources through the new service offerings, but also from their impact in product markets. Arguably, services provide new opportunities to innovate in product offerings, creating competitive advantages and enhancing company´s positioning.

Although commonly referred as servitization, different authors use other names such as product-service innovation (Bustinza et al

2018), product-related services, product-service systems, integrated solutions (Dachs et al., 2014), service infusion, service addition, service transition (Brax. et al., 2005). Most of the mentioned terms reflect the required evolution to carry out the diversification strategy from being a traditional product-centred manufacturing company to walk the path of product-service integration.

The clear attractiveness of this strategy for manufacturing companies is reflected in the evolution of literature, with more articles and special issues devoted to this subject, reaching the level of about 100 articles per year, according to Gebauer et al. (2016). The well-known cases of companies that have made an important journey in this direction, such as the paradigmatic cases of Rolls, Xerox or IBM, have also contributed.

However, achieving the expected results is not easy nor clear. And like other diversification strategies, it requires a profound transformation of the business model demanding new capabilities and organizational transformations, to which frequently manufacturing companies have not pay enough attention in the past.

In addition to being complex, it is a very time-consuming process (Oliva & Kallenberg, 2003) and results may become elusive. Servitization is a long-term commitment, which often requires a critical mass to become profitable (Visnjic & van Looy, 2013). In this vein, Gebauer et al. (2016) state that the "one reason for the service paradox is that companies underestimate the complexity of the service business".

Along with internal organizational changes, customer and supplier relationships need to be reconfigured. Core competences and capabilities, outsourcing and level of integration in the supply chain need to be re-identified. In fact, one of the elements usually considered in the servitization literature is the change from a more

transactional relationship to a more relational one (Neely et al., 2011).

As services infusion and customization increase, scope of change also grows, broadening the interactions between suppliers and customers, reaching the highest point in the upper level of servitization, in the case of product-service co-designed total solutions. Provider-customer relationship arises as a central question to realise profits through servitization, not enough covered by literature (Sjödin et al., 2019)

On the other hand, service innovation play a key role not only in addressing service needs but also because of its impact in product innovation itself. For instance, they can improve manufacturer's understanding of the customer's broader needs (Visnjic & van Looy, 2013) and, consequently, facilitate knowledge transfer and new product innovation (Golara, 2018). Cusumano et al (2015) highlight that services can reveal information about consumption and usage which companies can leverage in technology development.

Moreover, the fit between the service offerings and product innovation activities may be crucial to profit from them (Eggert et al., 2011, Dachs et al., 2014).

Thus, developing collaboration and innovation capabilities, although can require a great effort for the company, which will in turn affect the profitability in the short run, appear to be crucial for servitization performance. So the objective of this work is to study the relationship between the level of servitization and both, collaboration within the supply chain and innovation capabilities.

Methods / Results / Findings

This study involves an empirical research using a quantitative approach to analyse and evaluate the relationship between servitization level and firm's innovation capability and the mediating

effect of supply chain collaboration. For this study, supply chain collaboration is defined as the strategic collaboration of the intra and inter-business processes that lead to a more cohesive organization of the chain. Thus, the research hypotheses are:

H1. Servitization level is positively related to firm's Innovation Capability.

H2. Supply chain collaboration is positively related to firm's Innovation Capability

H3. The relationship between Servitization level and firm's Innovation Capability is mediated by supply chain collaboration.

Based on the purpose of our study, the best method to test the research hypotheses is the structural equation modelling using partial least squares. The data were collected using survey questionnaires for those variables that can not be measured directly: Supply Chain Collaboration, and firm's Innovation Capability. Firm's Innovation Capability is a first order construct while Supply Chain Collaboration is a second order construct. Supply Chain Collaboration covers both intra and inter business processes along the supply chain. This is supplier, customer and internal collaboration. Each of them form a first order constructs.

All measurement items were developed from literature review. Servitization level is measured directly using the percentage of turnover due to service commercialization, available in the SABI (Sistema de Análisis de Balances Ibéricos) database. The model is tested using the responses from 100 Basque country manufacturing companies.

The results indicated that taking the explicative variables independently, servitization level and supply chain collaboration play a key role in the development of firm's Innovation Capability. However considering the mediation effect the servitization level is mediated by supply chain collaboration. This research contribute to the literature adding empirical evidences about the impact of

servitization on the business competitiveness. In addition, the findings also contribute to the practitioners giving clues about the importance of involving customers, suppliers and the firms departments into the business model.

Keywords: Servitization, supply chain collaboration, innovation capabilities, customer integration, provider collaboration, manufacturing companies.

References

Brax, S. (2005) A manufacturer becoming service provider – challenges and a paradox, *Managing Service Quality: An International Journal*, 15(2), 142-155. https://doi.org/10.1108/09604520510585334

Bustinza, O.F., Vendrell-Herrero, F., Gomes, E., Lafuente, E., Opazo, M., Rabetino, R., & Vaillant, Y. (2018). Product-service innovation and performance: unveiling the complexities, *International Journal of Business Environment*, 10(2), 95-111. https://doi.org/10.1504/IJBE.2018.095819

Cusumano, M. A., Kahl, S. J., & Suarez, F. F. (2015), Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal*, 36(4), 559-575. https://doi.org/10.1002/smj.2235

Dachs, B., Biege, S. Borowiecki, M., Lay, G., Jäger, A., & Schartinger, D. (2014). Servitisation of European manufacturing: evidence from a large scale database. *The Service Industries Journal*, 34(1), 5-23. https://doi.org/10.1080/02642069.2013.776543

Eggert, A., Hogreve, J., Ulaga, W., & Muenkhoff, E. (2011). Industrial services, product innovations, and firm profitability: a multiple-group latent growth curve analysis. *Industrial Marketing Management*, 40(5), 661-670. https://doi.org/10.1016/j.indmarman.2011.05.007

Gebauer, H., Joncourt, S., & Saul, C. (2016). Services in product-oriented companies: past, present, and future/Servicios en empresas orientadas a productos: pasado, presente y futuro. *Universia Business Review*, 49(1), 32-53.

Golara, S. (2018). *Product-Service Bundling in Manufacturing Firms.* Arizona State University (Doctoral dissertation), Arizona, USA.

Neely, A., Benedettini, O., & Visnjic, I. (2011). The servitization of manufacturing: further evidence. *Proceedings of the European Operations Management Association Conference*, Cambridge, UK.

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. https://doi.org/10.1108/09564230310474138

Sjödin, D. R., Parida, V., & Kohtamäki, M. (2019). Relational governance strategies for advanced service provision: Multiple paths to superior financial performance in servitization. *Journal of Business Research*, 101, 906-915. https://doi.org/10.1016/j.jbusres.2019.02.042

Visnjic, I. K., van Looy, B., & Neely, A.(2013). Steering Manufacturing Firms Towards Service Business Model Innovation. *California Management Review*, 56(1), 100-123. https://doi.org/10.1525/cmr.2013.56.1.100

Parallel session 10

Territorial servitization and business ecosystems

Chair: Bart Kamp

Territorial servitization and the neighborhood coupling

Silvia Lombardi

ISTAT - Italian National Institute of Statistics, Business Statistics Directorate

Erica Santini

University of Trento – Department of Economics and Management

Giovanni Francesco Truglia

ISTAT - Italian National Institute of Statistics, Business Statistics Directorate

Abstract

The structural configuration of many manufacturing systems supporting virtuous paths of development has changed its traditional shapes. Complementary services to manufacturing have entered such systems opening renewed paths of development. The assessment of the effects of localization of knowledge-intensive business services (KIBS) in manufacturing areas is a growing literature. However, the loops of co-localization of manufacturing and KIBS within some areas and their impact on the recovery capability of such areas are still underexplored. There is indeed a lack of studies exploring the spatial and temporal effects of these co-localization processes. This paper paves the way to understand coupling local systems when territorial servitization occurs. Applying spatial panel data models at the LMA level, we make an extensive use of Business Register data from 2011 to 2015. Our

results find out the transmissions of servitization knowledge intensive services-oriented effects through territories and the implications for manufacturing over time.

Keywords: Territorial servitization; structural configuration; coupling effects; KIBS; spatial panel models.

Introduction

The contemporary challenges ask for the adjustment of the knowledge bases embedding in manufacturing systems. The availability of renewed knowledge bases at a firm and local level is necessary to catch some of these opportunities opened by the wave of technologies. In some cases, processes of value creation and redistribution started to integrate knowledge business services (KIBS) in manufacturing value chains by means of in-house servitization strategies (Baines & Lightfoot, 2013; Bustinza et al., 2019; Vendrell-Herrero et al., 2017). Some others, such as in many territories characterized by manufacturing small and medium sized enterprises (SMEs), started outsourcing processes of service functions (Horváth & Rabetino, 2019). This last trend tends to trigger loops of co-localization of manufacturing and service activities (Gomes et al., 2019). In this regard, empirical evidences suggest that there is correlation between the localization of KIBS and the increasing competitiveness of manufacturing (Bustinza, et al., 2015). This increase of competitiveness influences the localization choice of manufacturing firms leading to structural reconfigurations of territories affected by territorial servitization (TS) (Lafuente et al., 2017).

In this scenario, it is not clear where such tendencies are encouraged and if there are some 'coupling effects' between the neighbors of servitized territories. This paper aims at filling this gap,

employing Italy as a reference case study during the economic crisis and its aftermath.

The processes of the neighborhood coupling

TS is a phenomenon that might spread across territories. The agglomeration of KIBSs in a specific area might indeed increase the competitive advantages of the embedded manufacturers but also of the neighborhood manufacturers. When the manufacturing of an area takes advantage of the structural transformation of the neighbor, which increase its services knowledge bases, it can support the strengthening of the manufacturing without a "canonical" TS. In this area the loop of co-localization does not start because the two systems are not independent. In such a case, TS rises indeed as the result of a neighborhood coupling. Vice versa, the localization of KIBS in a productive system might activate imitation processes in the neighborhood. This process triggers the localization in adjacent areas of KIBS which might lead the starting of a potential new loop of co-localization. In this case we speak about neighborhood decoupling.

The neighborhood coupling is not a trivial phenomenon to identify.

A case study: Italy

Consistently with a broad literature, Italy is recognized for an industrial landscape characterized by populations of SMEs. Its traditional manufacturing industries are strongly competitive in the global market thanks to the benefits resulting from local external economies (Bellandi, 2006).

Our unit of analysis is the Local Market Area (LMA) as proxy of the local system. By definition (Istat, 2014), a LMA is a set of contiguous municipalities that show a high degree of self-

containment of the daily commuting inflows and outflows between the same municipalities. The bulk of the labour force of a LMA lives and works in the same LMA and the local firms find into the area the main part of competences they need.

The neighborhood coupling is explored over the period 2011-2015. This time span allows us to take into account the Italian GDP inversion (2014-2015). In our investigation the spatial causalities in the neighborhood coupling between manufacturing and services focusses only on KIBS. For the empirical investigation, we apply the classification of KIBS proposed by Wong and He (2005) with an adjustment related to the public administration sector.

We make an extensive use of Business Register data from 2011 and 2015 and compute a set of agglomeration indicators (i.e. localization, diversification and urbanization economies) at the LMA level. Localization economies are proxied by the location quotient (LQ), which measures the relative concentration of a sector in a LMA regarding the average concentration of the same sector in the country. Urbanization externalities are proxied by means of population density. Moreover, an entropy measure is included in the empirical model to capture diversification externality and decompose it into related and unrelated variety.

Our methodology refers to statistical spatial analysis in order to detect neighborhood coupling across LMAs and concentrates on Spatial lag and Error lag models. Making use of a large data set of geo coded information at the LMA level through time, we model neighborhood coupling by means of a panel data approach. This approach enables us to take into account both spatial and temporal heterogeneity. Indeed, the applied space specific time-invariant variables and time specific space-invariant variables asses both the spatial diffusion process of random shocks and their evolutionary process. We make use of Auto regressive panel models in order to

take into consideration not only individual LMA and longitudinal pattern (direct effects), but also the indirect effects of interactions among LMAs over time.

References

Baines, T., & Lightfoot, H. (2013). Made to serve: How manufacturers can compete through servitization and product service systems. Hoboken, NJ: John Wiley & Sons. https://doi.org/10.1002/9781119207955

Bellandi, M. (1996). On entrepreneur ship, region and the constitution of scale and scope economies. *European planning studies*, 4(4), 421-438. https://doi.org/10.1080/09654319608720356

Bustinza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and competitive advantage: the importance of organizational structure and value chain position. *Research-Technology Management*, 58(5), 53-60. https://doi.org/10.5437/08956308X5805354

Bustinza, O. F., Gomes, E., Vendrell−Herrero, F., & Baines, T. (2019). Product–service innovation and performance: the role of collaborative partnerships and R&D intensity. *R&D Management*, 49(1), 33-45. https://doi.org/10.1111/radm.12269

Gomes, E., Bustinza, O. F., Tarba, S., Khan, Z., & Ahammad, M. (2019). Antecedents and implications of territorial servitization. *Regional Studies*, 53(3), 410-423. https://doi.org/10.1080/00343404.2018.1468076

Horváth, K., & Rabetino, R. (2019). Knowledge-intensive territorial servitization: regional driving forces and the role of the entrepreneurial ecosystem. *Regional Studies*, 53(3), 330-340. https://doi.org/10.1080/00343404.2018.1469741

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Comparative Assessment of the Links between KIBS and Manufacturing Sectors in two Spanish Regions: Cataluña and Basque Country

Eduardo Sisti

Orkestra - Basque Institute of Competitiveness

Arantza Zubiaurre

Deusto University - Deusto Business School

Bart Kamp

Orkestra - Basque Institute of Competitiveness

Abstract

Literature recognizes the role of KIBS in innovation and hence the influence of this advanced service sector in technological change and economic growth. Particularly, the presence and growth of KIBS sector can be seen as an indicator of regional modernization and renewal processes (Corrocher & Cusmano,2014), but their colocation with the manufacturing sector does not imply that there are strong interactions. Then, there is a current interest to analyse the links between KIBS and manufacturing sectors in different regional settings (f.e. RIS specialization and/or institutional setup: Koch & Stahlecker, 2006). This paper aims at investigating the links between KIBS and manufacturing sectors sector regarding the regional innovation systems frame. More in depth, the research question asks to what extent the KIBS sector can be explained by regional techno-economic structure evolution, whether/how the

concentration of high-tech manufactures contribute to new KIBS and whether/how the innovation intensity of the RIS places KIBS in the centre of knowledge-based learning. The study follows a comparative case approach. The cases are Cataluña and Basque Country. The research is based on the integration of quantitative information (input-output tables and the SABI-Informa firm-level data-base) and qualitative data (semi structured interviews). This study aims to contribute on the ongoing debate around territorial servitization from a mesoeconomic perspective. The study might provide insights to policymakers about how to strengthen and stimulating the development of KIBS sector and thus to provide insight to strength ties between KIBS and manufacturers.

Keywords: Territorial servitization, manufacturing industry.

Rationale

"Servitization", as a new economic paradigm, focuses on the introduction of knowledge-based services into manufacturers' operations that enable firms to provide advanced product-service systems (Lafuente et al., 2017; Vendrell-Herrero & Wilson, 2017; Kamp & Parry, 2017; Horváth & Rabetino, 2018). The scholar debate recognizes the role of KIBS in servitization highlighting how manufacturers can achieve product service innovation by partnering with KIBS (Bustinza et al., 2017). Recent literature on servitization has shown that not only firms, but territories materialize the positive effects of a solid KIBS sector (Lafuente, Vaillant & Vendrell-Herrero, 2017).

Due to the territorial servitization heterogeneity, the explanation of mechanisms that facilitate interactions between manufacture and KIBS remains difficult to analyze. Therefore, with the aim to understand the effects and how local manufacturers competitiveness can be achieved through local knowledge diffusion from KIBS, it could be interesting to have a view about the links between the supply side and the demand side. From the supply side, it is

proposed to differentiate among different KIBS categories: technical services (T-KIBS), computer related services (C-KIBS), and the "traditional" professional services (P-KIBS) as providers of complementary innovative solutions to their customers. From the demand side, local hybrid value chains have long been observed on industrial strategies that internalize the value-adding capacity of product-service innovation.

The rational follows Stranbach (2008), cited by Kamp and Sisti (2018), who argues "that over time, firms develop competencies that are highly sector-and technology-specific and they also develop competencies which are related to the specific features of users demand". The issue go beyond the idea of KIBS as provider entities that supported their client processes, and connect with scholars that recognize these services as carriers of change in cooperation with their clients (Muller & Doloreaux, 2009). In other words KIBS not only transfer knowledge to other firms, but also perform collective learning (Toivonen, 2004; Strambach, 2008) since KIBS and clients can maintain intensive and long-term collaborations in dynamic patterns of knowledge exchange (Hung-Nien et al., 2015).

Methods

The study follows a comparative case approach using a mixed-method frame to analyze the interactions between KIBS and manufacturing sectors. The cases of the Spanish regions of Catalonia and the Basque Country are considered following a two-step approach. First, the quantitative analysis is made through the use of data from input-output tables, produced by the respective regional statistics institutes (Eustat & IDESCAT), together with the aggregation of data from firms using the SABI-Informa database. Second, semi-structured interviews (regional experts in KIBS and regional development, and business firms) are conducted to

investigate the role and impact of KIBS on manufacturers and in the Regional Innovation System (RIS).

References

Bustinza, O.; Gomes, E.; Vendrell-Herrero, F., & Baines, T. (2017). Product-service innovation and performance: the role of collaborative partnerships and R&D intensity. *R & D Management*. https://doi.org/10.1111/radm.12269

Corrocher, N., & Cusmano, L. (2014). The "KIBS Engine" of Regional Innovation Systems. Empirical Evidence from European Regions. *Regional Studies*, 48(7), 1212-1226. https://doi.org/10.1080/00343404.2012.731045

Horváth, K., & Rabetino, R. (2018). Knowledge-intensive territorial servitization: regional driving forces and the role of the entrepreneurial ecosystems. *Regional Studies*. https://doi.org/10.1080/00343404.2018.1469741

Hung-Nien Hsieh, Chi-Mei Chen, Jun-Yao Wang & Tai-Shan Hu (2015). Knowledge-Intensive Business Services as Knowledge Intermediaries in Industrial Regions: A Comparison of the Hsinchu and Tainan Metropolitan Areas. *European Planning Studies,* 23(11), 2253-2274. https://doi.org/10.1080/09654313.2014.958133

Koch, A., & Stahlecker, T. (2006). Regional innovation systems and the foundation of knowledge intensive business services. A comparative study in Bremen, Munich, and Sttugart, Germany. *European Planning Studies*, 14(2), 123-146. https://doi.org/10.1080/09654310500417830

Kamp, B., & Parry, G. (2017). Servitization and advanced business services as levers for competitiveness. *Industrial Marketing Management,* 60. https://doi.org/10.1016/j.indmarman.2016.12.008

Kamp, B., & Sisti, E. (2018). Assessing the relationship between ICT services and the manufacturing industry from a meso-economic perspective. *European Review of Service Economics and Management*, 23-151.

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics,* 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Muller, E., & Doloreux, D. (2009). What we should know about knowledge-intensive business services. Technology in Society, 31(1), 64-72. https://doi.org/10.1016/j.techsoc.2008.10.001

Strambach, Simone. (2008). Knowledge-Intensive Business Services (KIBS) as drivers of multilevel knowledge dynamics. *International Journal of Services Technology and Management*, 10(2),152-174. https://doi.org/10.1504/IJSTM.2008.022117

Toivonen, M. (2004). *Expertise as business: Long-term development and future prospects of knowledge-intensive business services (KIBS).* Helsinki University of Technology.

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60, 69-81. https://doi.org/10.1016/j.indmarman.2016.06.013

Vendrell-Herrero, F., & Wilson, J. R. (2016). Servitization for territorial competitiveness: Taxonomy and research agenda, *Competitiveness Review*, 26(5).

Ecosystems as Coordination Mechanism for Value Creation in the Context of Servitizing SMEs

Xander Stegehuis, Lambert J.M. Nieuwenhuis

Fontys International Business School, Fontys University of Applied Sciences

Department of Industrial Engineering and Business Information Systems, University of Twente

Abstract

The present study investigates the relevance of ecosystems as coordination mechanisms for value creation in the context of servitizing SMEs. Digitalization in the manufacturing industry enables more modularity of service offerings. Due to this increasing modularity, it can be expected that ecosystems become increasingly important means for coordinating value creation in a servitization context. However, servitization literature has paid little attention to the ecosystem concept. Based on a multiple case study approach, this study so far finds an increasing interdependence between small OEMs and suppliers of complementing offerings through distribution channel practices. This interdependence may lead to increased importance of ecosystems as coordination mechanism for value creation in a servitization context.

Keywords: Servitization, SME, ecosystems, value creation, international distribution channel.

Introduction

Businesses increasingly engage in servitization practices by adding services to their core products to enhance business and

customer value (Vandermerwe & Rada, 1988). Kowalkowski et al. (2013) demonstrate that IT and digital connections are one of the driving forces of service-oriented business models. Because of developments in IT, services can be increasingly modularized which means that an offering is delivered by multiple autonomous firms (Ostrom et al., 2015). The increasing modularization of offerings can especially benefit SMEs given their specialized character and limited financial resources to internalize new capabilities required for delivering services (Mittal et al., 2018; Oliva & Kallenberg, 2003). Because of increasing offering modularization and the nature of SMEs, it can be expected that servitizing SMEs increasingly face coordination of value creation through ecosystems.

Ecosystems are considered communities of interrelated and co-evolving businesses (Moore, 1993). At the center of an ecosystem is a modular focal value proposition (Adner, 2017). Jacobides et al. (2018) highlight two forms of modularity that are relevant to ecosystems. First, there is super modularity which means that more of A makes B more valuable and/or vice versa. The second form refers to unique modularity and means that A cannot function without B and/or B cannot function without A. Moreover, unique modularity can be generic or non-generic. Non-generic modularity refers to modularity that requires active coordination between all co-creating firms and therefore cannot be coordinated through market forces only (Jacobides et al., 2018). To materialize the ecosystem value proposition, several business and non-business actors interact (Adner, 2017). What makes an ecosystem unique is that this community of business and non-business actors are bound together while leaving control over module integration at the customer (Jacobides et al., 2018).

To date, there is only scant empirical evidence on the emergence of ecosystems and their role as a mechanism to coordinate value creation in an SME context (Jacobides et al., 2018). Besides, there is

limited research that investigates ecosystems as a coordination mechanism for value creation in the face of servitization (Sklyar et al., 2019). Hence, the purpose of this study is to investigate servitizing SMEs in terms of their product modularity, and structure of their external environment. This will lead to increased understanding on the role of ecosystems for servitizing SMEs.

Preliminary results

Based on a multiple case study of three servitizing OEMs with less than 50 employees, preliminary findings on value proposition modularity and structure of the external environment can be reported. All cases show modularity of the ecosystem value proposition that is two-sided unique and generic. Results show that all observed complementors could potentially cooperate and no technical restrictions appeared (i.e., generic complementarity). Following the work of Jacobides et al. (2018), this finding makes us expect that value creation is coordinated through markets. However, this may not be the case in foreign markets of the observed firms. Because the observed OEMs sold specialized offerings, they were forced to sell their offerings internationally. Besides, due to their smallness, these OEMs and suppliers of complementary offerings must rely on intermediaries. This distribution channel is governed through contracts and based on mutual exclusivity arrangements. Because suppliers of different modules have similar exclusivity arrangements, complementors are bound together while remaining autonomous and keeping individual customer interaction. Hence, we argue that the reliance of small OEMs on intermediates in foreign markets may lead to ecosystems as coordination mechanism for value creation. This finding adds to existing literature by revealing new elements that drive the emergence of ecosystems (Jacobides et al., 2018). This could mean that small OEMs pursuing a servitization strategy must consider performance of

complementors that sell their products through the same intermediaries. So far, we have not seen this consideration at the studied OEMs. Further and more elaborate results are expected in autumn 2019.

References

Adner, R. (2017). Ecosystem as Structure: An Actionable Construct for Strategy. *Journal of Management*, 43(1), 39-58. https://doi.org/10.1177/0149206316678451

Jacobides, M. G., Cennamo, C., & Gawer, A. (2018). Towards a theory of ecosystems. *Strategic Management Journal*, 39(8), 2255-2276. https://doi.org/10.1002/smj.2904

Kowalkowski, C., Kindström, D., & Gebauer, H. (2013). ICT as a catalyst for service business orientation. *Journal of Business and Industrial Marketing*, 28(6), 506-513. https://doi.org/10.1108/JBIM-04-2013-0096

Mittal, S., Khan, M. A., Romero, D., & Wuest, T. (2018). A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs). *Journal of Manufacturing Systems*, 49, 194-214. https://doi.org/10.1016/j.jmsy.2018.10.005

Moore, J. F. (1993). Predators and Prey: A New Ecology of Competition. *Harvard Business Review*, 71(3), 75-86.

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. https://doi.org/10.1108/09564230310474138

Sklyar, A., Kowalkowski, C., Sörhammar, D., & Tronvoll, B. (2019). Resource integration through digitalisation: a service ecosystem perspective. *Journal of Marketing Management*, 1-18. https://doi.org/10.1080/0267257X.2019.1600572

Vandermerwe, S., & Rada, J. (1988). Servitization of Business: Adding Value by Adding Services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Parallel session 11

Conceptual and methodological perspectives

Chair: Rodrigo Rabetino

Understanding Innovation in Digital Product-Service Ecosystems – A Business Model Perspective

Tor Helge Aas

NORCE Norwegian Research Centre and University of Agder

Karl Joachim Breunig

Oslo Business School - OsloMet

Magnus Hellström

University of Agder and Åbo Akademi University

Katja Maria Hydle

NORCE Norwegian Research Centre

Extended abstract

The delivery of integrated solutions (Davies, 2004) or advance services (Baines & Lightfoot, 2013), which focuses on delivering results or performance to the buyer, obviously build on an in-depth understanding of both product technologies and customer's service needs (Tongur & Engwall, 2014). Particularly so, as such strategies increasingly require the integration of digital technologies into mechanical engineering products and, hence, technology cross-fertilization (Björkdahl, 2009). Still, research on the management of innovation processes has typically focused on either new product

development (NPD) (Cooper, 2008) or new service development (NSD) (Hipp & Grupp, 2005), while the development of new combinations of products, technologies and services, such as integrated solutions or product-service systems (PSS), has received less attention (Zhang & Banerji, 2017).

Empirical studies have found that NSD processes are typically more incremental, iterative and ad-hoc than NPD processes (e.g., Hipp & Grupp, 2005), and as a consequence, scholars have argued that firms need to implement different processes for NSD and NPD (Droege et al., 2009). This recommendation is reasonable in cases when services and products may be separated, but more problematic in servitized firms that offer integrated digital product-service systems (Zhang & Banerji, 2017). Previous studies also point at the importance of the external network in developing solutions (Windahl & Lakemond, 2006). More recent studies have called for increased inter-industry collaboration and the development of external hybrid value chains to stimulate servitization-based innovations (Landry et al., 2013; Lafuente et al., 2017). Moreover, strategic partnerships seem to enhance product-service innovation performance (Bustinza et al. 2014). At the same time, servitization strategies seem to focus mostly on adding advanced services in the context of the internal value chain (Baines et al., 2017; Rabetino et al., 2018; Visnjic et al., 2018) and developing advanced services in-house (Cusumano et al., 2015; Bustinza et al., 2019).

Hence, there seems to be a need for further research on the mechanisms and strategies underpinning the innovation process of new product-service systems. We are especially interested in product-service innovations that involve constellations of firms that are new to the industry and invoke major changes in established business activities, relationships, and value propositions. For the purpose, we adopt a business ecosystem perspective leaning towards the structuralist tradition of ecosystem research (Adner, 2017). The

business ecosystem metaphor, defined as the "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize" (Adner, 2017, p. 40), is useful also because it stresses the existence of a common goal (i.e. the "focal value proposition"). Thus, we pose the following question: How do (radical) product-service innovations come about among multilateral sets of partners?

To answer the research question, we used a qualitative multiple case study approach. Five firms from a business cluster in Norwegian energy and maritime sector were selected as case organizations for our study. The degree of service orientation in the firms varied, but all five firms offered advanced equipment (such as drilling equipment and heavy lifting equipment) in combination with digital services. All firms also had a strategic focus on innovation and had several ongoing new digital product-service system development initiatives in their innovation portfolios. Data related to how new digital product-service development processes were implemented in the case organizations was collected through semi structured in-depth interviews with 43 key-employees. The data was coded and analyzed in an inductive manner by performing both within-case and cross-case analysis.

The paper aims at contributing to the ongoing debate related to new digital product-service system development processes (Zhang & Banerji, 2017). Our preliminary findings advance this debate by suggesting that the characteristics and management of these processes are contingent upon the business model and type of services.

Keywords: Product-service innovation, innovation process, business model, business ecosystem.

References

Adner, R. (2017). Ecosystem as structure: an actionable construct for strategy. *Journal of Management*, 43(1), 39–58. https://doi.org/10.1177/0149206316678451

Baines, T., & Lightfoot, H. (2013). *Made to serve: How manufacturers can compete through servitization and product service systems.* Hoboken, NJ: John Wiley & Sons. https://doi.org/10.1002/9781119207955

Baines, T., Ziaee Bigdeli, A., Bustinza, O.F., Shi, V.G., Baldwin, J., & Ridgway, K. (2017). Servitization: revisiting the state-of-the-art and research priorities. *International Journal of Operations & Production Management*, 37(2), 256-278. https://doi.org/10.1108/IJOPM-06-2015-0312

Björkdahl, J. (2009). Technology cross-fertilization and the business model: The case of integrating ICTs in mechanical engineering products. *Research Policy*, 38(9), 1468-1477. https://doi.org/10.1016/j.respol.2009.07.006

Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Baines, T. (2019). Product-service innovation and performance: The role of collaborative partnerships and R&D intensity. *R&D Management*, 49(1), 33-45. https://doi.org/10.1111/radm.12269

Cooper, R. G. (2008). Perspective: The stage gate® idea to launch process—update, what's new, and nexgen systems. *Journal of Product Innovation Management*, 25(3), 213-232. https://doi.org/10.1111/j.1540-5885.2008.00296.x

Cusumano, M. A., Kahl, S. J., & Suarez, F. F. (2015). Services, industry evolution, and the competitive strategies of product firms. *Strategic Management Journal,* 36(4), 559-575. https://doi.org/10.1002/smj.2235

Davies, A. (2004). Moving base into high-value integrated solutions: a value stream approach. *Industrial & Corporate Change*, 13(5), 727-756. https://doi.org/10.1093/icc/dth029

Droege, H., Hildebrand, D., & Heras Forcada, M. A. (2009). Innovation in services: present findings, and future pathways, *Journal of Service Management*, 20(2), 131-155. https://doi.org/10.1108/09564230910952744

Hipp, C., & Grupp, H. (2005). Innovation in the service sector: The demand for service-specific innovation measurement concepts and typologies. *Research Policy*, 34(4), 517-535. https://doi.org/10.1016/j.respol.2005.03.002

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial Servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Landry, R., Amara, N., Cloutier, J. S., & Halilem, N. (2013). Technology transfer organizations: Services and business models. *Technovation*, 33, 431-449. https://doi.org/10.1016/j.technovation.2013.09.008

Rabetino, R., Kohtamäki, M., & Gebauer, H. (2017). Strategy map of servitization. *International Journal of Production Economics*, 192, 144-156. https://doi.org/10.1016/j.ijpe.2016.11.004

Tongur, S., & Engwall, M. (2014). The business model dilemma of technology shifts. *Technovation*, 34, 525-535. https://doi.org/10.1016/j.technovation.2014.02.006

Vendrell-Herrero, F., Gomes, E., Bustinza, O., & Mellahi, K. (2018). Uncovering the role of cross-border strategic alliances and expertise decision centralization in enhancing product-service innovation in MMNEs. *International Business Review*, 27(4), 814-825. https://doi.org/10.1016/j.ibusrev.2018.01.005

Visnjic, I., Neely, A., & Jovanovic, M. (2018). The path to outcome delivery: Interplay of service market strategy and open business models. *Technovation*, 72-73, 46-59. https://doi.org/10.1016/j.technovation.2018.02.003

Windahl, C.. & Lakemond, N., (2006). Developing integrated solutions: The importance of relationships within the network. *Industrial Marketing Management*, 35(7), 806-818. https://doi.org/10.1016/j.indmarman.2006.05.010

Zhang, W., & Banerji, S. (2017). Challenges of servitization: A systematic literature review. *Industrial Marketing Management*, 65, 217-227. https://doi.org/10.1016/j.indmarman.2017.06.003

Applying a Transaction Cost Economics perspective to assess the commercial chances of machine tool builders to supply advanced services among their industrial clients

Bart Kamp

Orkestra-Basque Institute of Competitiveness

Introduction

The concept of Industry 4.0 (referring to a family of activities and technologies that entail the use and coordination of information, automation, and computation, software, and (remote) sensing technologies (PCAST, 2011)) is gaining an increased interest among manufacturing communities.

The deployment of this concept unlocks new ways to manufacture existing products and to manufacture new products (PCAST, 2011). Similarly, it allows making products and manufacturing processes smarter (Davies et al., 2012). In parallel, it can act as a catalyzer for the design and delivery of knowledge-intensive or advanced services (Acatech, 2015). I.e., when making assets smart and connected by endowing them with sensors, suppliers of goods obtain an improved understanding of the use of their offering by their clients, and which attributes and functionalities they value. This kind of information can be used to come up with new (on-line) support services (Porter & Heppelmann, 2014; Parry et al., 2016; EPO, 2017). Similarly, digital data gathering provides a basis from which firms may move from

providing base services that support goods to advanced services that assist clients in their own value-creating processes (Monostori et al., 2016). The former can give way, among others, to the following types of smart services: predictive maintenance solutions, corrective intervention and repair mechanisms, life cycle management schemes, productivity/output performance management tools, energy/material consumption and idle time vigilance.

In comparison to traditional or base services (like repair and spare part delivery), smart services tend to have a stronger (positive) impact on the performance of their users (Porter & Heppelmann, 2014).

At the same time, they tend to have a more pervasive impact on the relationship between the provider and user of such services. I.e., fostering the bonds and inter-dependence between buyers and suppliers as the connectivity between assets and actors induces a stronger mutual orientation among them in regard to value creation processes that span the boundaries of individual firms (Kamp & Parry, 2017).

Whether the subsequent "embeddedness" is experienced as something positive and desirable, particularly on the user side, is debatable and arguably influences suppliers' chances to market advanced services to industrial users of machine tools.

Aim of the paper

By means of applying a Transaction Cost Economics (Williamson, 1985; Baker, Gibbons & Murphy, 2002; Brouthers & Nakos, 2004) perspective, we set out to examine the smart service business prospects of four companies from the machine tool industry. By testing the character of the services to be offered on their asset specificity, of B2B relationships in terms of frequency of

interactions and the environmental uncertainty of the business context within which transactions take place, we assess the chances of OEMs to become the suppliers of choice for smart services by means of a "network governance arrangement", instead of the potential clients recurring to a make (internal solutions) or buy (purchasing on the spot market) mode.

(Williamson, 1985; Baker, Gibbons & Murphy, 2002; Brouthers & Nakos, 2004)

Expected results

Validation or falsification of hypotheses that follow from TCE reasoning.

Insights for industrial firms to understand under which circumstances (aspects of asset specificity, frequency of interaction and environmental uncertainty) they can expect to commercialize smart services successfully.

Keywords: Advanced services, servitization, transaction cost economics, Industry 4.0.

References

Acatech. (March 2015). *Smart Service Welt: Recommendations for the Strategic Initiative Web-based Services for Businesses*. Frankfurt am Main: Acatech.

Baker, G., Gibbons, R., & Murphy, K. J. (2002). Relational Contracts and the Theory of the Firm. *Quarterly Journal of Economics,* 117, 39-83. https://doi.org/10.1162/003355302753399445

Brouthers, K., & Nakos, G. (2004). SME entry mode choice and performance: a transaction cost perspective. *Entrepreneurship Theory & Practice*, *Spring*, 229-247. https://doi.org/10.1111/j.1540-6520.2004.00041.x

Davies, J., Edgar, Th., Porter, J., Bernaden, J., & Sarli, M. (2012). Smart manufacturing, manufacturing intelligence and demand-dynamic performance. *Computers and Chemical Engineering*, 47, 145-156. https://doi.org/10.1016/j.compchemeng.2012.06.037

EPO (2017). *Patents and the Fourth Industrial Revolution (4IR)*. München: EPO.

Kamp, B., & Parry, G. (2017). Servitization and advanced business services as levers for competitiveness. *Industrial Marketing Management*, 60, 11-16. https://doi.org/10.1016/j.indmarman.2016.12.008

Monostori, L,. Kadar, B., Bauernhansl, T., & Kondoh, G. (2016). Cyber-physical systems in manufacturing. *CIRP Ann Manuf Technol*, 65, 621-641. https://doi.org/10.1016/j.cirp.2016.06.005

Parry, G., Brax, S., Maull, R., &. Ng, I. (2016). Visibility of consumer context: improving reverse supply with internet of things data. *Supply Chain Management: An International Journal,* 21(2), 228-244. https://doi.org/10.1108/SCM-10-2015-0386

PCAST/The President's Council of Advisors on Science & Technology. (2011). *Ensuring American Leadership in Advanced Manufacturing*. Washington: Exec. Office of the President.

Porter, M.E., & Heppelmann, J.E. (2014). How smart, connected products are transforming competition. *Harvard Business Review*, 92, 11-64.

Williamson, O.E. (1985). *The economic institutions of capitalism*. New York: Free Press.

How are solutions co-produced in B2B? An investigation of servitizing manufacturing firms

Lisa Bakir

Fontys International Business School, Fontys University of Applied Sciences

Department of Industrial Engineering and Business Information Systems, University of Twente

Raymond P.A. Loohuis

Centre for Entrepreneurship, Strategy, International Business, and Marketing, University of Twente

Lambert J.M. Nieuwenhuis

Fontys International Business School, Fontys University of Applied Sciences

Department of Industrial Engineering and Business Information Systems, University of Twente

Abstract

Servitization results in closer collaboration with customers. Research recognizes the benefits of collaborating with customers for improved service innovation. Yet, not much is known about how solutions actually are jointly developed between providers and customers. This research aims to depict the key activities within the process of co-production and the different roles customers take on.

We collected data of two servitizing firms who are in the process of co-producing a solution with their customer. The findings show that co-production is a non-linear process with continuous interaction in and parallel execution of the phases where customers take on multiple roles throughout the process.

Keywords: Co-production, B2B, solutions, servitization.

Introduction

Servitization inherently is an act of collaborative manner. Undoubtedly, providing solutions to customers results in closer collaboration and increased customer intimacy (Visnjic & Van Looy, 2013) in order to align the processes of a firm with its customers' (Grönroos, 2011; Raddats & Easingwood, 2010). Customers' willingness to adopt providers' offerings, share knowledge, and integrate resources in the process of developing solutions affects the success of delivering customer-oriented offerings that create sufficient customer value (Tuli, Kohli & Bharadwaj, 2007; Valtakoski, 2017). Co-production refers to the participation of customers in the development of an offering taking place in the production process, preceding the usage process (Lusch & Vargo, 2006). Although research shows that collaboration with customers enhances service novelty and meeting customer needs (Heirati & Siahtiri, 2019), we know little on how solutions are jointly developed. This research aims to explore the key activities and customer roles in the process of collaborative development of servitized solutions. Hereby, the research seeks to provide insights into how the collaboration activities shape the process and the success of the developed solution. As such, provider firms have better understanding of how to successfully manage the co-production process.

Methodology

A multiple case study was conducted of two selected firms who are in the process of co-producing a solution with their customers. Table 1 gives an overview of the companies and the key informants. Case A produces vegetable processing machinery. Case B is a business unit of a large water solutions provider which develops beer membrane filtration systems. The companies are jointly developing an IoT-enabled service with a launching customer: a condition-based monitoring (CBM) system that monitors the production process and alerts accordingly to set key indicators. We conducted semi-structured interviews with several key members of the companies. Interviewees were asked to describe the activities happening in the process of developing the solution.

Case	Employees	Industry	Solution	Key informant
Case A	73	Vegetable processing	Condition-based monitoring system	CEO (1) Manager Engineering (1) R&D Engineer (1)
Case B	10.000	Beer brewing	Condition-based monitoring system	Service Manager (1) Global IoT Manager (1)

Table 1. Overview of key characteristics of companies

Preliminary results

Following Baines and Lightfoot (2013), the CBM systems can be classified as an intermediate service. The developed CBM system lays the foundation to eventually offer predictive maintenance services in the future for the companies. The co-production process is classified according to Malshe and Friend's (2018) classification of collaborative processes: defining solutions, designing solutions, deploying solutions, and debriefing solutions. Customer roles are

based on Aarikka-Stenroos and Jaakkola's (2012) typology. Table 2 and 3 describe the key findings of the cases.

Case A

	Defining solution	Designing solution	Deploying solution	Debriefing solution
Activities	Defining KPIs with customer and IT party	Designing platform and dashboard with IT party	Partial implementation through providing remote access to platform	Inquiring organization-wide for feedback and suggestions: "it's an interplay. That is also the intent, that hopefully, from all levels in the organization, questions and ideas will come" (CEO).
Customer role	Co-diagnoser	-	Co-implementor	Co-assessor Co-innovator
Nature of relationship and collaboration	-Long established relationship with customer; collaboration happened organically: "[…] at a given moment you get a kind of natural growth process that you can no longer define afterwards as something like: this was what we intended, that is how we proceeded. It just happens to you" (CEO). -Loosely defined verbal agreements: "[…] in any case, [there is no] no contract that you can argue over" (CEO).			

Table 2. Case A: Overview of co-production process.

Case B

	Defining solution	Designing solution	Deploying solution	Debriefing solution
Activities	Defining KPIs with customer project team and wider customer needs: "we go a few steps further than only product requirements. We have done a value proposition session [with the customer] where we have brainstormed together about new business metrics and our strategies" (Global IoT Manager).	Designing blue print of IT architecture and dashboard with customer project team: "so, what will the first look and feel be like, what will the first output look like, how will we respond to that?" (Global IoT Manager).	Partial implementation through providing remote access to platform	Inquiring feedback throughout the whole process ensuring continuous improvements: "we have set up a logbook where the customer can drop their findings and suggested improvements" (Service Manager).
Customer role	Co-diagnoser	Co-designer	Co-implementor	Co-assessor Co-innovator
Nature of relationship and collaboration	-A historical and intense relationship with customer; the customer is a strategic business partner of the company: *"we talk to each other three times per week, that is really close"* (Global IoT Manager). -The development of the solution is "a logical next step for them. We are the forerunners of their future strategy" (Global IoT Manager).			

Table 3. Case B: Overview of co-production process.

References

Aarikka-Stenroos, L., & Jaakkola, E. (2012). Value co-creation in knowledge intensive business services: A dyadic perspective on the joint problem solving process. *Industrial Marketing Management*, 41(1), 15-26. https://doi.org/10.1016/j.indmarman.2011.11.008

Baines, T., & Lightfoot, H. (2013). *Made to serve: how manufacturers can compete through servitization and product service systems*. Chichester, West Sussex, United Kingdom: John Wiley & Sons Inc. https://doi.org/10.1002/9781119207955

Evanschitzky, H., Wangenheim, F. V., & Woisetschläger, D. M. (2011). Service & solution innovation: Overview and research agenda. *Industrial Marketing Management*, 40, 657-660. https://doi.org/10.1016/j.indmarman.2011.06.004

Grönroos, C. (2011). A service perspective on business relationships: The value creation, interaction and marketing interface. *Industrial Marketing Management*, 40, 240-247. https://doi.org/10.1016/j.indmarman.2010.06.036

Heirati, N., & Siahtiri, V. (2019). Driving service innovativeness via collaboration with customers and suppliers: Evidence from business-to-business services. *Industrial Marketing Management*, 78, 6-16. https://doi.org/10.1016/j.indmarman.2017.09.008

Lusch, R. F., & Vargo, S. L. (2006). Service-dominant logic: Reactions, reflections and refinements. *Marketing Theory*, 6(3), 281-288. https://doi.org/10.1177/1470593106066781

Malshe, A., & Friend, S. B. (2018). Initiating value co-creation: Dealing with non-receptive customers. *Journal of the Academy of Marketing Science*, 46, 895-920. https://doi.org/10.1007/s11747-018-0577-6

Raddats, C., & Easingwood, C. (2010). Services growth options for B2B product-centric businesses. *Industrial Marketing Management*, 39(8), 1334–1345. https://doi.org/10.1016/j.indmarman.2010.03.002

Tuli, K., Kohli, A. K., & Bharadwaj, S. G. (2007). Rethinking customer solutions: From product bundles to relational processes. *Journal of Marketing*, 71(3), 1-17. https://doi.org/10.1509/jmkg.71.3.001

Valtakoski, A. (2017). Explaining servitization failure and deservitization: A knowledge-based perspective. *Industrial Marketing Management*, 60, 138-150. https://doi.org/10.1016/j.indmarman.2016.04.009

Visnjic Kastalli, I., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm performance. *Journal of Operations Management*, 31(4), 169-180. https://doi.org/10.1016/j.jom.2013.02.001

Parallel session 12

Business viability and sustainability

Chair: Marin Jovanovic

Servitization: Allowing Better Solution Delivery and performance for Manufacturers of Longer Lifespan Products

Ferran Vendrell-Herrero

University of Birmingham

Yancy Vaillant

Toulouse Business School (TBS

Oscar F. Bustinza

University of Granada

Esteban Lafuente

Polytechnic University of Catalonia (UPC Barcelona Tech

Abstract

Manufacturers are shifting the traditional transactional paradigm by delivering customized solutions in a process known as servitization. This study proposes that the competitive performance of servitization is higher for firms selling long-lifespan products as they enable better customization cost recovery. To test this hypothesis, we analyse the moderating role of product lifespan on the servitization-performance relationship. Through merging a unique survey of Manufacturing Multinational Enterprises (MMNEs) and the Lifespan Database for Vehicles, Equipment and Structures (LiVES) a unique sample is created. Analysis of the data shows a

positive relationship between servitization and performance. This relationship becomes significantly stronger for MMNES that sell long-lifespan products. Our findings are robust for correlation, regression and structural equation modelling analyses. This study explains why servitization boosts performance in some industries but has a neutral effect on others. By including product lifespan in the equation, we improve understanding of why servitization is an excellent mechanism for asset management in industrial relationships.

Keywords: Servitization, solution business models, product lifespan, competitive performance.

Extended Summary

Manufacturers are increasingly pushed to transition from a standardised product business model towards a solution model that offers greater customisation and responds to the specific needs of each customer (Storbacka et al., 2013). Rising market orientation as well as increased information availability and affordability together with the limited scope of cost leadership strategies for manufacturers within a knowledge-based economy have combined with advances in production techniques to drive manufacturers towards greater personalisation. By offering customised solutions, producers are adding greater value to their products (Bustinza et al., 2018, 2019; Storbacka, 2011).

As such, intangible assets are crucial for manufacturers in their efforts to create this added value (Teece, 1998). Intangible assets generate differentiation that enables firms to achieve competitive advantage. Intangible assets materialize as economic value in the form of services which, when developed in the context of product firms, require organizational change known as servitization (Rabetino et al., 2018). Offering complementary services is increasingly important for manufacturers, as it enables them to co-create with users and more easily personalise their products

(Storbacka et al., 2011). As a result, manufacturers can establish more lasting relationships with end consumers than do the simple transactions associated with business models based on the guileless sale of products.

But the transition towards a solution business model is not of equal value to all manufacturers (Nordin & Kowalkowski, 2010). Indeed, the more extraordinary and infrequent is a purchase for a buyer, and the more the purchase represents an important investment, the greater the importance of offering customization. This, especially when the lifespan of the purchased product is considerable (Vendrell-Herrero et al., 2019). And therefore, in these circumstances, the greater the role of servitization is likely to be for the performance of the manufacturers of these products.

This study argues that the importance of servitization for the performance of manufacturers is in part explained by the longevity of the product commercialized. Long lifespan products, due to their frequently high purchase cost and complexity of maintenance requiring a substantial asset management effort, are especially susceptible to the benefits of servitization as conducer of customised value-added from a more solution-oriented business model. Product longevity also allows servitization to better reach the customer embeddedness and solution integration benefits, which are key for manufacturers to transition towards a solution business model (Storbacka et al., 2013). As such we hypothesize that Product lifespan positively moderates the relationship between servitization and firm performance.

This study tests the working hypothesis with a unique database of 301 multinational manufacturing firms that operate worldwide in conjunction with LiVES (Lifespan Database for Vehicles, Equipment and Structures), a database that provides information about the average products' lifespan for a number of industries (Murakami et al., 2010). Part of the sample produces and

commercializes products with long lifespans (e.g. aerospace, defence and automotive) whilst other part of the sample operates in sectors with less costly products with shorter lifespans (e.g. electronics and appliances). Preliminary results are summarized in the contour plot exhibited in Figure 1. The figure shows a two-dimension graph where different combinations of servitization (Y-axis) and product lifespan (X-axis) yield different predicted performance levels which are represented in the colour-scale of the figure. From the contour plot, we observe that firms selling products with shorter lifespan (<10 years of product lifespan) do not benefit from servitization strategies. Additionally, servitization seems essential for enhanced performance in businesses offering longer lifespan products (>30 years of product lifespan).

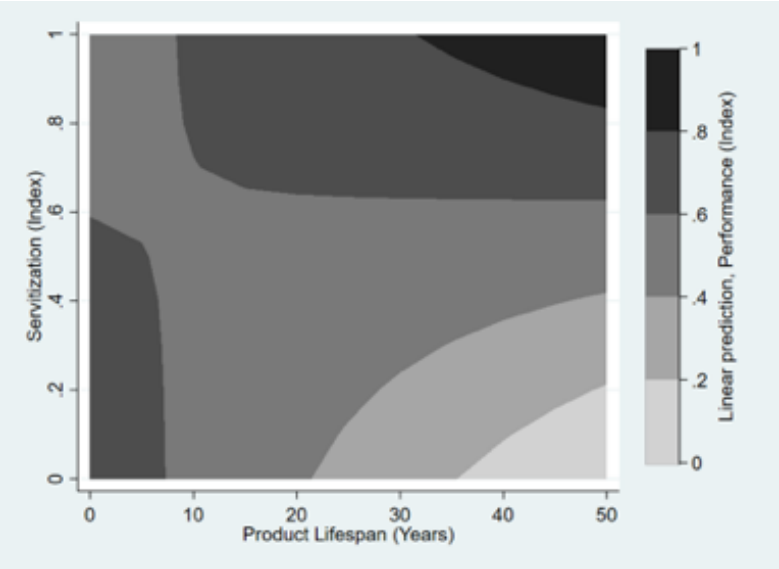


Figure 1. The relationship between servitization and performance along different product lifespan

It is worth stressing the importance of the analysis. In line with Markides and Williamson (1994), our study concludes that in the context of an increasingly knowledge-based competitive environment, transactional strategies of product exploitation are insufficient in the long term. We show that multinational firms that supply integrated product-service solutions through servitization are more successful when they offer products with long lifespans that have the time to generate synergetic value-added that is greater than the sum of its parts (Storbacka, 2011). An enduring servitization facilitates the development of joint competencies that enable customer embeddedness and the co-creation of advanced solutions which, in turn, helps to achieve a greater coverage of customers' technological needs (Storbacka et al., 2013).

Manufacturers producing short lifespan servitized products may not only have difficulties optimizing their servitized value, they may be left with an insufficiently long relational investment cost recovery period. Thus, the issue of the contextualization of capitalization on intangible assets in long-term relationships is affected by our findings. To date, the literature has analysed this matter in contexts of product innovation (Lafuente et al., 2018). Our study extends the analysis to models of service implementation in manufacturing.

A limitation of this study relates to the cross-sectional nature of the data used in the study, which does not allow for longitudinal heterogeneity analyses. As a result, future work based on longitudinal data seems decisive to better understand the temporal evolution of servitization strategies in businesses offering products with different lifespans. Finally, the conclusions generated in this study are the result of the analysis of large manufacturing multinational firms. We believe that our findings and recommendations can be extended to organizations with a heterogeneous product-service portfolio, for example, distinguishing between firms whose customers are end users and firms that sell

their products-services to other organizations, or to other types of firms, such as large firms whose activity focuses more on local markets vs. small and medium-sized enterprises (SMEs).

References

Bustinza, O., Vendrell-Herrero, F., Gomes, E., Lafuente, E. M., Opazo-Basáez, M., Rabetino, R., & Vaillant, Y. (2018). Product-service innovation and performance: unveiling the complexities. *International Journal of Business Environment*, 10(2), 95-111. https://doi.org/10.1504/IJBE.2018.095819

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research,* forthcoming. https://doi.org/10.1016/j.jbusres.2019.01.035

Lafuente, E., Vaillant, Y., & Leiva, J. C. (2018). Sustainable and traditional product innovation without scale and experience, but only for KIBS! *Sustainability*, 10(4), 1169-1187. https://doi.org/10.3390/su10041169

Murakami, S., Oguchi, M., Tasaki, T., Daigo, I., & Hashimoto, S. (2010). Lifespan of commodities, part I: the creation of a database and its review. *Journal of Industrial Ecology*, 14(4), 598-612. https://doi.org/10.1111/j.1530-9290.2010.00250.x

Nordin, F. & Kowalkowski, C. (2010). Solutions offerings: a critical review and reconceptualisation, *Journal of Service Management, 21*(4), 441-459. https://doi.org/10.1108/09564231011066105

Rabetino, R., Harmsen, W., Kohtamäki, M., & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations & Production Management*, 38(2), 350-371. https://doi.org/10.1108/IJOPM-03-2017-0175

Storbacka, K. (2011). A solution business model: capabilities and management practices for integrated solutions. *Industrial Marketing Management*, 40(5), 699-711. https://doi.org/10.1016/j.indmarman.2011.05.003

Storbacka, K., Windahl, C., Nenonen, S., & Salonen, A. (2013). Solution business models: transformation along four continua. *Industrial Marketing Management*, 42(5), 705-716. https://doi.org/10.1016/j.indmarman.2013.05.008

Teece, D. J. (1998). Capturing value from knowledge assets: the new economy, markets for know-how, and intangible assets. *California Management Review*, 40(3), 55-79. https://doi.org/10.2307/41165943

Vendrell-Herrero, F., Bustinza, O.F., & Lafuente, E (2019). La innovación producto-servicio como activo intangible y su rol para rentabilizar inversiones específicas: Evidencia en empresas multinacionales de producción. *Economia Industrial,* forthcoming.

Assessing the Role of KIBS Geographical Proximity in Firm's Servitization Capacity: A Basque Country Example

Marco Opazo-Basáez, Lorea Narvaiza Cantín, José Antonio Campos

Deusto Business School, University of Deusto

Abstract

Servitization strategy is increasingly recognized as a key source of value with important competitive and economic potential across the globe. Over the years, it has been proven to contribute to territorial performance through the provision of services to manufacturing businesses. Such contribution, however, has been to a large extent consequential to the configuration of local industrial structures, and most importantly, by interconnectedness between manufacturing firms and knowledge intensive business services (KIBS) firms. Hence, the process of territorial servitization is highly conditioned to the association between manufacturing businesses and KIBS firms. To date, territorial servitization literature mostly describes the implications of KIBS firms for service deployment and service innovation in manufacturing, considering knowledge and technological capabilities as main variables for its success. Nevertheless, the literature is silent on how geographical distance between KIBS firms and manufacturing companies may affect servitization capacity. Therefore, this research attempts to disclose the importance of geographical distance of KIBS firms in manufacturers´ servitization capacity. In doing so, we analyze two manufacturing companies*; Alpha* and *Beta*, both located in the Basque country but collaborating with KIBS firms in different geographical areas, "inside" and "outside" the Basque region respectively. Through a qualitative study based on (1) measuring

firm's capacity for servitization, and (2) in-depth interviews, results suggest that geographical distance in terms of proximity plays a key role on the KIBS-Manufacturer relationship for servitization capacity, and require to be considered as an important aspect for successful territorial servitization.

Keywords: Servitization capacity, knowledge intensive business services sector (KIBS), geographical distance.

Introduction

Servitization refers to the transition process that involves the innovation of an organization's capabilities and processes to shift from selling products to selling integrated product and service offerings (Raddats et al., 2016). In manufacturing environments, servitization has proven to be an important source of competitiveness as well as differentiation, enabling manufacturing companies to sustain a competitive advantage among their competitors (Vandermerwe & Rada, 1988).

However, the development and provision of services differs greatly from the traditional design and manufacture of products (Bustinza et al., 2019). By virtue of this, the dynamic nature of services requires companies to reformulate their organizational structures, capabilities, talent, and their conception of value to be truly effective in manufacturing settings (Bustinza et al., 2015). Consequently, servitization demands the consolidation of service capabilities, for overcoming the various critical junctures that firms face in the service-provision transition.

According to Vargo and Lush (2008) manufacturing capabilities and services capabilities emerge from two opposite standpoints or dominant logics for understanding value; whereas manufacturing capabilities (goods-dominant logic) emphasize value-in-exchange, the service-dominant logic, emphasizes value-in-use. Hence, whereas traditional manufacturing capabilities settle on tangibility,

economies of scale, trade-off among costs and quality, and product functions—service capabilities focus on intangibility, customization, flexibility, customer centricity, and innovation (Pistoni & Songini, 2017). Accordingly, the transition towards servitization can be very complex and in some cases can result in a dead-end street, bringing serious consequences for the organization and its survival, a situation defined as the service paradox (Gebauer et al., 2005), that has materialized itself in a reverse or backward transition, defined as Deservitization (Valtakoski, 2017).

In most cases, problems arise from the inability of the company to establish a coherent guide towards service orientation (Lenka et al., 2018), something that requires the commitment of the entire organization and demands firms to integrate distinctive knowledge and capabilities not traditionally required in product-based firms (Opazo-Basáez et al., 2019). To this aim, and in order to mitigate possible difficulties and expedite the transition towards services, product-based firms seek in external partners the essential capabilities that they do not possess within the organization, building thus relationships with particular-type "entities" with deep knowledge in technical areas that exceed the scope the firm, defined as knowledge intensive business services (KIBS) firms (Lafuente et al., 2017).

Knowledge intensive business services (KIBS) firms are defined as organizations or private companies that use professional knowledge, related to specifics (technical) disciplines to develop and provide advanced, and highly intellectual "value-added" business services. In servitized contexts, KIBS firms are increasingly recognized as "bridges for innovation" in services (Cooke and Leydesdorff, 2006), and vectors of knowledge transmission (Strambach, 2008) as they provide a platform to create and transfer service innovation, as well as for developing and co-producing

service oriented knowledge together with manufacturing firms and other players in the value network (Muller & Doloreux, 2009).

The blossoming of KIBS firms has promoted proactive and open knowledge sharing between otherwise unconnected firms in the regional, national and international context, which has generated the revitalization of depressed regions and sectors (Gomes et al., 2019) as well as the emergence of highly specialized competitive poles in the form of either "clusters" or "industrial districts" (Grandinetti, 2011). Thus, the convergence of high−level knowledge and innovation services in manufacturing has generated a synergistic development in economic sectors that has benefited not only firms with the need for servitization, but has also revitalized once non-competitive geographical areas that have found in KIBS firms a catalyst for local networks, partnerships, and innovation systems (Liu et al., 2019).

As manufacturing competitiveness increasingly depends on knowledge contents, KIBS firms play an important role offering manufacturers access to stock of knowledge capital created, accumulated or disseminated by them (Gomes et al., 2019) and also helping them to develop value-adding services (Lafuente et al., 2017). As such, the interconnected coexistence of manufacturers and service providers has given rise to a new territorial competitive concept, built on the premise of servitization as the main axis for knowledge transfer between companies and the KIBS firms, the concept of territorial servitization (Lafuente et al., 2019).

At territorial level, the interconnectedness between product-based firms and KIBS firms could improve and strengthen the capacity of a territory to compete (Vendrell-Herrero & Wilson, 2017). However, research is still needed on the mechanisms through which this collaboration can be effectively carried out (Cabigiosu & Campagnolo, 2019), and the key factors that might strengthen or

weaken this type of relationships (Hu, 2017). Although existing literature on KIBS firms consider geographical proximity as one key factor influencing the relationship between KIBS firms and manufacturers (Freel, 2016; Growe, 2019), research is still silent on the effect of KIBS firms' geographic proximity on firm´s servitization capacity and the factors that might positively or negatively influence this effect.

To address this gap, our paper aims to assess empirically the effect of KIBS geographical proximity on the firm's servitization capacity through a qualitative study of two manufacturing companies located in the Basque country, *Alpha* and *Beta*; both of them servitized, both of them collaborating with KIBS firms to enhance their service provision, but with KIBS collaborators located

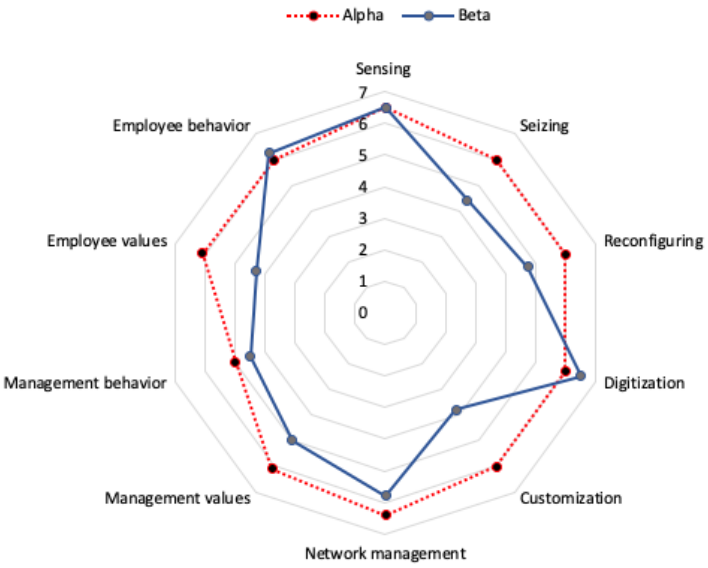


Figure 1. Firms' servitization capacity comparison

in different geographic areas, that is "inside" and "outside" the Basque country (Spain and France) respectively.

To measure this effect, 2 rounds of in-depth interviews were conducted with two firm`s representatives. In a first stage, each interview focused over the servitization capacity of the firm using as framework Coreynen´s servitization capacity tool (Coreynen et al., 2018). In the second stage, interviews focused on the incidence of KIBS firms on the company`s servitization capacity. Altogether, this combined approach enables us to rate and compare between the current servitization capacity of the firm and the incidence of KIBS firms to such purpose.

Key findings suggest that firms' servitization capacity results are higher when KIBS collaborators are located geographically nearer to

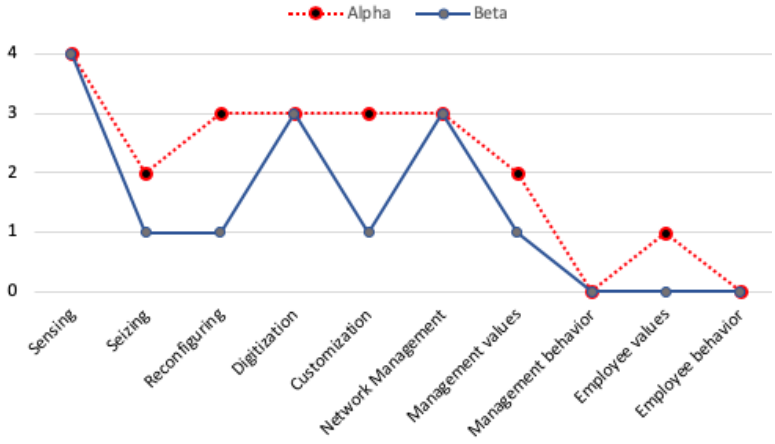


Figure 2. Perceived incidence of KIBS on servitization capacity. Based on your firm's service orientation, please rate the perceived incidence of the collaborating KIBS on the following categories. Response options: 0 = not at all important, 1 = low importance, 2 = medium importance, 3 = high importance, and 4 = critical importance

manufacturing companies. Furthermore, results obtained indicate that KIBS firm's incidence on servitization capacity is also higher in firms with KIBS collaborators situated nearer to their operations. These results validate the notion that the relationship Manufacturer-KIBS firm influences positively servitization capacity when both entities are located closer to each other.

References

Bustinza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and competitive advantage: the importance of organizational structure and value chain position. *Research-Technology Management*, 58(5), 53-60. https://doi.org/10.5437/08956308X5805354

Bustinza, O. F., Vendrell-Herrero, F., & Gomes, E. (2019). Unpacking the effect of strategic ambidexterity on performance: A cross-country comparison of MMNEs developing product-service innovation. *International Business Review*. https://doi.org/10.1016/j.ibusrev.2019.01.004

Cabigiosu, A., & Campagnolo, D. (2019). Innovation and growth in KIBS: the role of clients' collaboration and service customisation. *Industry and Innovation*, 26(5), 592-618. https://doi.org/10.1080/13662716.2018.1483823

Cooke, P., & Leydesdorff, L. (2006). Regional development in the knowledge-based economy: The construction of advantage. *The Journal of Technology Transfer*, 31(1), 5-15. https://doi.org/10.1007/s10961-005-5009-3

Coreynen, W., Matthyssens, P., & Gebauer, H. (2018). Are you ready for servitization? A tool to measure servitization capacity. In *Practices and Tools for Servitization* (pp. 25-39). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-76517-4_2

Freel, M. (2016). Knowledge Intermediaries or Routine Service Producers? Exploring Finnish M-KIBS Using the Innovation System Approach. In *Knowledge-Intensive Business Services* (pp. 141-162). Routledge. https://doi.org/10.4324/9781315591216

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal*, 23(1), 14-26. https://doi.org/10.1016/j.emj.2004.12.006

Gomes, E., Bustinza, O. F., Tarba, S., Khan, Z., & Ahammad, M. (2019). Antecedents and implications of territorial servitization. *Regional Studies*, 53(3), 410-423. https://doi.org/10.1080/00343404.2018.1468076

Grandinetti, R. (2011). Local/global cognitive interfaces within industrial districts: an Italian case study. *The Learning Organization*, 18(4), 301-312. https://doi.org/10.1108/09696471111132513

Growe, A. (2019). Developing trust in face-to-face interaction of knowledge-intensive business services (KIBS). *Regional Studies*, 53(5), 720-730. https://doi.org/10.1080/00343404.2018.1473567

Hu, T. S. (2017). Developments in interactive relationships and knowledge between KIBS firms and their clients in Taiwan. *Knowledge Management Research & Practice*, 15(2), 257-271. https://doi.org/10.1057/s41275-016-0046-2

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. *International Journal of Production Economics*, 192, 19-28. https://doi.org/10.1016/j.ijpe.2016.12.006

Lafuente, E., Vaillant, Y., & Vendrell-Herrero, F. (2019). Territorial servitization and the manufacturing renaissance in knowledge-based economies. *Regional Studies*, In Press. https://doi.org/10.1080/00343404.2018.1542670

Lenka, S., Parida, V., Sjödin, D. R., & Wincent, J. (2018). Towards a multi-level servitization framework: Conceptualizing ambivalence in manufacturing firms. *International Journal of Operations & Production Management*, 38(3), 810-827. https://doi.org/10.1108/IJOPM-09-2016-0542

Liu, Y., Lattemann, C., Xing, Y., & Dorawa, D. (2019). The emergence of collaborative partnerships between knowledge-intensive business service (KIBS) and product companies: the case of Bremen, Germany. *Regional Studies*, 53(3), 376-387. https://doi.org/10.1080/00343404.2018.1510178

Muller, E., & Doloreux, D. (2009). What we should know about knowledge-intensive business services. *Technology in society*, 31(1), 64-72. https://doi.org/10.1016/j.techsoc.2008.10.001

Opazo-Basáez, M., Vendrell-Herrero, F., & Bustinza, O. F. (2019). 2. Talent for services: How gaining access to talent enables successful servitization. *Research Handbook of International Talent Management*, 35. https://doi.org/10.4337/9781786437105.00014

Pistoni, A., & Songini, L. (2017). Strategic managerial control for the servitization strategy. In *Servitization Strategy and Managerial Control* (pp. 111-224). Emerald Publishing Limited. https://doi.org/10.1108/S1479-351220170000032003

Raddats, C., Baines, T., Burton, J., Story, V. M., & Zolkiewski, J. (2016). Motivations for servitization: the impact of product complexity. *International Journal of Operations & Production Management*, 36(5), 572-591. https://doi.org/10.1108/IJOPM-09-2014-0447

Strambach, S. (2008). Knowledge-Intensive Business Services (KIBS) as drivers of multilevel knowledge dynamics. *International Journal of Services Technology and Management*, 10(2-4), 152-174. https://doi.org/10.1504/IJSTM.2008.022117

Valtakoski, A. (2017). Explaining servitization failure and deservitization: A knowledge-based perspective. ¡ *Industrial Marketing Management*, 60, 138-150. https://doi.org/10.1016/j.indmarman.2016.04.009

Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding services. *European Management Journal*, 6(4), 314-324. https://doi.org/10.1016/0263-2373(88)90033-3

Vargo, S. L., & Lusch, R. F. (2008). Service-dominant logic: continuing the evolution. *Journal of the Academy of marketing Science*, 36(1), 1-10. https://doi.org/10.1007/s11747-007-0069-6

Vendrell-Herrero, F., & Wilson, J. R. (2017). Servitization for territorial competitiveness: Taxonomy and research agenda. *Competitiveness Review: An International Business Journal*, 27(1), 2-11. https://doi.org/10.1108/CR-02-2016-0005

Hidden Services in the Lighting Industry – from Free to Fee

Jonas Ledermann, Shaun West

Lucerne University of Applied Sciences and Arts

Dominik Kujawski

Regent Lighting

Abstract

The purpose of this paper is to identify hidden services that were given away for free with the product and create a new service offering for a manufacturer that sells luminaires (e.g., lamps and lighting systems) to electrical installers. To identify the services that are given for free with the product, a survey was developed, targeting Swiss electrical installers, to analyze the pre- and post-sales activities that the firm delivered. The identification of the intangibles was initially undertaken by creating a journey for the pre-sales, post-sales and execution phases of typical transactions, based on interviews with the employees and supported by the literature research. The survey (n=68) provided insights into the intangibles that the firm delivered based on the analysis of perceived importance and satisfaction. Further, insights were obtained from five interviews with customers. The analysis of the survey and the interviews identified services that customers valued; service definitions were created for each of the 'hidden services' that were identified from the analysis. Using a modular approach to service definitions, two extreme modular offers were developed: a minimalistic offering and an 'inclusive' offering for the pre- and post- sales; both had options built on standard modules.

Keywords: Service modularity, luminaire market, lighting market, service offering.

Research Motivation and theoretical framework

The purpose of this paper is to identify hidden services that were given away for free with the product and create a new service offering for a manufacturer that sells luminaires (e.g., lamps and lighting systems) to electrical installers. A case-based study was conducted in cooperation with a Swiss luminaire manufacturer whose lighting systems are under price pressure, due to increased competition. The firm, like many other product-focused businesses (Hinterhuber & Snelgrove, 2017), was providing services for free, with associated costs being absorbed into the product price, and therefore this led to negative feedback about the firm's prices although customers were generally satisfied with the "quality". The term quality was considered by the sales team to be associated with the tangible product features, however senior management recognised the importance of the intangible aspects associated with the end-to-end transaction.

The firm had a diverse demand based on a mix of transactional offers and project tenders, coupled with architects and installers with different levels of competence. Given the diversity of demand the firm did not segment the market, rather considering the sales process as key, addressing transactional offers and project tenders differently and using geographic regions to define sales territories for the sales managers. Mukhopadhyay and Setoputro (2005) state that it is crucial that customer segments and customer needs are identified, which requires the supplier to understand the customer's processes.

The sales process bundled the services (intangibles) with the product (tangible) aspects, giving scant regard to the service value

that was provided over the pre-sales, sales, and post-sales phases. Pekkarinen and Ulkuniemi (2008) recommend bundling and unbundling individual services to various offers, to not only fulfil different customer needs but also influence the value perception and therefore increase the willingness to pay (Anderson et al., 2009; Pekkarinen & Ulkuniemi, 2008).

Methodology

A single case-based approach was applied to the study with four main phases; the process that was followed is shown in Figure 1. To identify the services that were valued by the customers a quantitative survey with 68 participants is used, supported by five in-depth interviews. The insights were from across the pre- and post-sales process. The analysis of the customer journey, empathy maps, and personas allowed the development of value propositions and supports the building of a modular offer structure. Finally, the modules were then packaged into clearly segmented offers with clear value propositions.

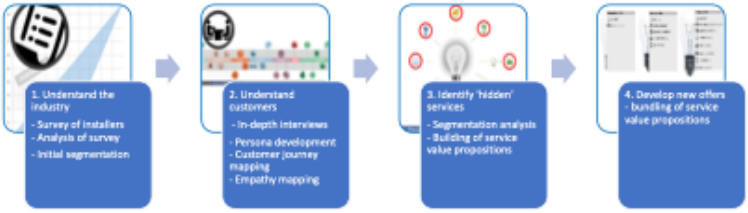


Figure 1. Methodology used in the study to identify hidden services and to convert them into service modules

Findings

The results of the survey and the interviews provided insight into the segmentation based on the competency of the installers:

- some are able to consult with end customers, reducing the need for service (high competency).
- some need additional services to design, specify and install the lighting system (low competency).

The satisfaction/importance diagram developed from the survey is shown in Figure 2, it confirms that some services are underserved. The analysis provided insights into the services that the installers valued.

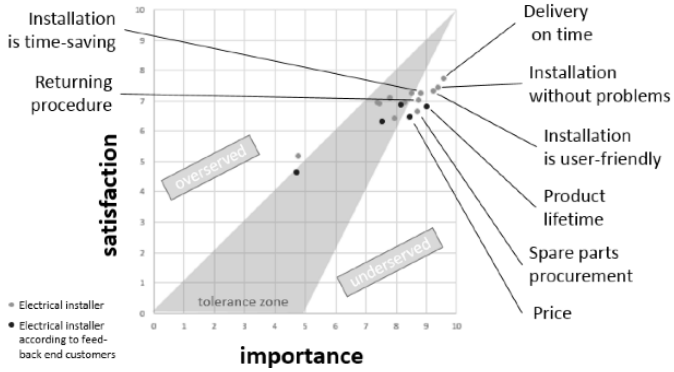


Figure 2. Importance/satisfaction diagram of the lighting industry

The customer journey map shown in Figure 3 was used to support the identification of the hidden services that are currently bundled with the product. It allowed the timing of the service events to be identified, and who they are important for. It confirmed that there are many intangible-based micro-value propositions that are provided without additional fees being charged

for the services. According to Kowalkowski et al.(2013) a customer will not value or buy a service if there is no match with the value perception.

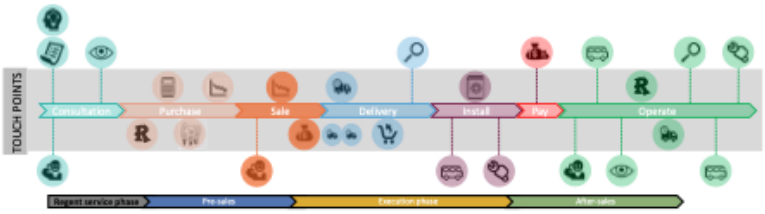


Figure 3. Hidden services identified in a customer journey map

Using the new identified "hidden" services a modular service offering was created that bunded the offerings to improve the segmentation. This was considered necessary as according to Hinterhuber & Snelgrove (2017) not every customer perceives the same value, which results in a diminished willingness to pay. Three different offers were created: i. a minimalistic offer, for the segment which generally does not value services; ii. a standard offer with the core services included within the offer and iii. an inclusive offer that includes all of the services within the fees. Optional services can be added to first two offers to improve the customisation. In all cases the tangible and the intangible service components have now been clarified for the sales managers and their customers.

Conclusions

This paper contributes by confirming that hidden services can be identified and then unbundled from the product. The identification of hidden services with customer journey maps, personas and empathy maps is an effective process and supports the detailed understanding and timing issues around a transaction. It also

supports the building of new micro-value propositions that can then be used to develop modular offers to satisfy the customers. The approach used confirms the usability of journey mapping, empathy mapping and satisfaction/importance diagrams to identify the 'hidden' services. The approach should be tested in other cases to confirm its applicability.

References

Anderson, J. C., Narus, J. A., & Narayandas, D. (2009). *Business market Management*. New Jersey: Pearson Education, Inc.

Hinterhuber, A., & Snelgrove, T. C. (2017). *Value first then price*. Oxon: Routledge.

Kowalkowski, C., Witell, L., & Gustafsson, A. (2013). Any way goes: Identifying value constellations for service infusion in SME's. *Industrial Marketing Management,* 42(1), 18-30. https://doi.org/10.1016/j.indmarman.2012.11.004

Mukhopadhyay, S. K., & Setoputro, R. (2005). Optimal return policy and modular design for build-to-order products. *Journal of Operations Management*, 23, 496-506. https://doi.org/10.1016/j.jom.2004.10.012

Pekkarinen, S., & Ulkuniemi, P. (2008). Modularity in developing business services by platform approach. The International Journal of Logistics Management, 19(1), 84-103. https://doi.org/10.1108/09574090810872613

Alternative Financial Entities as Allies for Advanced Services Implementation: Lessons from B2B cases

Bart Kamp, Ibon Gil de San Vicente

Orkestra-Basque Institute of Competitiveness

Myriad studies have pointed out that companies wanting to servitize are confronted with cultural and structural barriers. In the present paper, we argue that many firms -particularly SMEs- also face challenges in the sphere of financial engineering/access to funding and industrial asset management when considering the implementation of use-based or performance-based services.

When offering advanced services, the payment modalities are typically on a pay-per-use or pay-per-outcome basis and in many cases, this goes together with launching leasing schemes and de facto pre-financing the use of goods. This implies a change to a company's cash flows and its treasury management.

This can particularly pose problems to companies that do not have deep pockets or big cash reserves and who do not possess an internal funding mechanism (as in the form of GE Capital and other company-own financial services), but run their (financial) business in a rather traditional manner. I.e., based on own resources and loans from classical banks.

Against this backdrop we analyze the financial implications of introducing advanced services that 4 industrial firms (from the railway, automotive, industrial vehicle and valve industry) have witnessed and with what kind of external partners (financial entities,

industrial asset management firms) they sought to make use-based and performance-based services feasible.

We conclude that advanced services incentivize companies to amplify their scope for entities and instruments to finance and manage servitized market propositions, and to look beyond the traditional ways and sources for financing business operations. Companies that do not diversify their financial sourcing strategies run a bigger risk of not getting pay-per-use or pay-per-outcome services off the ground.

Keywords: Servitization, pay-per-use, advanced services, industrial asset management, financial entities.

This book of abstracts summarizes the proceedings of the **8th International Conference on Business Servitization (ICBS 2019)**, held at Deusto Business School, university of Deusto, San Sebastian, Spain. On this edition, the conference places a special emphasis on the focal theme: **New and Emergent approaches in servitization research**.

This year's conference aims to discuss what are the future challenges of the servitization research field, and how can the servitization community develop the domain further. In the conference were exposed current research on the emerging field of servitization, which focuses both on theoretical developments and on practical applications of the methods and techniques. The conference aimed to provide a platform to the researchers and practitioners from both academia as well as industry to meet & share the cutting-edge developments in the field of servitization.

In this 8th edition of the ICBS we have brought together 55 researchers from 30 Universities and Research Institutes located in 15 different countries across Europe and America. In summary, the conference is organized in twelve different parallel sessions that seek to fuel the academic debate around the different aspects of new and emergent approaches in servitization research.

Additionally, this conference welcomes relevant keynote speakers as Prof. Vinit Parida (Lulëa University of Technology) and Prof. Yipeng Liu (Henley Business School, University of Reading).

Deusto
Universidad de Deusto
Deustuko Unibertsitatea

ISBN: 978-84-120643-4-6
www.omniascience.com

OmniaScience