



**HAL**  
open science

# Barriers to digital servitization in French manufacturing SMEs

Sophie Peillon, Nadine Dubruc

► **To cite this version:**

Sophie Peillon, Nadine Dubruc. Barriers to digital servitization in French manufacturing SMEs. 11th CIRP Conference on Industrial Product-Service Systems, May 2019, Hong Kong, China. pp.146-150, 10.1016/j.procir.2019.04.008 . emse-02319604

**HAL Id: emse-02319604**

**<https://hal-emse.ccsd.cnrs.fr/emse-02319604>**

Submitted on 25 Oct 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License



ELSEVIER

ScienceDirect

Procedia CIRP 00 (2019) 000–000



[www.elsevier.com/locate/procedia](http://www.elsevier.com/locate/procedia)

11th CIRP Conference on Industrial Product-Service Systems, IPS<sup>2</sup> 2019, 29-31 May 2019,  
Zhuhai & Hong Kong, China

## Barriers to digital servitization in French manufacturing SMEs

Sophie Peillon<sup>a\*</sup>, Nadine Dubruc<sup>a</sup>

<sup>a</sup> Mines Saint-Etienne, Univ Lyon, Univ Lumière, Univ Jean Monnet, EA 4161 COACTIS, Institut Henri Fayol, F - 42023 Saint-Etienne France

\* Corresponding author. Tel.: +33-477-426-642; fax: +33-477-426-633. E-mail address: [sophie.peillon@mines-stetienne.fr](mailto:sophie.peillon@mines-stetienne.fr)

### Abstract

The importance of digitalization is widely recognized, but digital transformation is not commonplace, and companies often struggle to face the challenges it entails. Digitalization and digital transformation are even more challenging for manufacturing SMEs. In this paper, we aim at investigating the barriers to digital servitization faced by manufacturing SMEs. We build on a literature review on barriers and obstacles to digital servitization, and present a set of case studies that enable us to identify the main barriers these French manufacturing SMEs face in their move toward digital servitization. Our findings show that digital servitization is at a very early stage in these SMEs, and that the main barriers they face are both organizational and customer-related.

© 2019 The Authors. Published by Elsevier B.V.

Peer-review under responsibility of the scientific committee of the 11th CIRP Conference on Industrial Product-Service Systems.

*Keywords:* digitalization; servitization; PSS; SMEs

### 1. Introduction

Digitalization can be defined as “the use of digital technologies and of data (digitized and natively digital) in order to create revenue, improve business, replace/transform business processes (not simply digitize them), and create an environment of digital business, whereby digital information is at the core” [1: 6]. Digitalization has been identified as one of the major trends that will change both society and business in future years [2]. Some authors even assert that digitalization services will dominate most industrial sectors in the near future leading manufacturing companies to the so-called fourth industrial revolution [3].

The importance of digitalization is widely recognized, but digital transformation is not commonplace, and companies often struggle to face the challenges it entails [2]. Digitalization and digital transformation are even more challenging for manufacturing SMEs, who need to follow suit large firms or risk being left out of digital supply chains [4]. Even though digitalization can offer vast opportunities for SMEs to enter new markets, the digital transformation path is

not obvious, and manufacturing SMEs face major barriers and obstacles to digital servitization.

In this paper, we aim at investigating the barriers to digital servitization faced by manufacturing SMEs. We build upon a literature review on digital servitization and related concepts such as smart/digitalized PSS (section 2) and on barriers and obstacles to digital servitization, and suggest classifying them into four categories: technical/technological, organizational, human resources-related, and customer-related (section 3). We then present a set of case studies in order to identify the main barriers French manufacturing SMEs face in their move toward digital servitization (section 4). Our findings show first that digital servitization is at a very early stage in these SMEs, since only a minority use ICT solutions to improve their existing service offerings. Moreover, the main barriers they face towards digital servitization are both organizational and customer-related.

2212-8271 © 2019 The Authors. Published by Elsevier B.V.

Peer-review under responsibility of the scientific committee of the 11th CIRP Conference on Industrial Product-Service Systems.

© 2019 published by Elsevier. This manuscript is made available under the CC BY NC user license

<https://creativecommons.org/licenses/by-nc/4.0/>

## 2. Digital servitization

### 2.1. Digitalization as a driver and enabler of servitization

Digital technologies appear as both a driver and an enabler of servitization [5,6,7].

The digitalization of users, things, manufacturers and service providers in the cloud-based environment provides potential service innovation opportunities [3]. Digital technologies such as analytics, mobility, social media and smart embedded devices lead to changes in customer relationships, internal processes, and value propositions [8,9]. Digitalization unlocks new sources of value, and supports the transformation of existing business models and the development of new ones [9,10]. Digital transformation can lead to increased sales and productivity as well as innovations in value creation and customer interaction [11]. Moreover, the merging of services and digital technologies enables new opportunities such as allowing more efficient processes, supporting improved managerial decisions with richer, faster and sounder information, developing deeper relationships with customers, adding value to products, personalizing the offerings, and value co-creation [12].

The integration of digitalization and servitization is called ‘Digital Servitization’, defined as the provision of IT-enabled (i.e. digital) services relying on digital components embedded in physical products [7]. Some authors also refer to digital, digitalized, or smart product-service systems (PSS). Digitalized PSS are “an integrated bundle of physical products, intangible services, and digital architectures designed to fulfill individual customer needs via automated, independent operation, with the goal to significantly improve customer outcomes” [13: 47]. For some authors, smart PSS can be considered as a unique type of PSS, relying on the use of smart, connected products [14] that enable various e-services [3].

### 2.2. Pathways to digital servitization

Coreynen et al. [15] examine how firms can employ digital technologies to pursue different pathways in their servitization journey. They suggest three different servitization pathways (industrial, commercial and value servitization), depending on the specific digitization chosen options (back-end and front-end digitization).

Paschou et al. [12] assume that there is a positive relationship between the degree of digitalization and the level of servitization, and conclude that a higher service orientation with more complex offerings lead to a greater need for digital solutions. They propose a transformation model encompassing four stages: 1) Manufacturer: standard ICT solutions are used to support basic product-related services (e.g. installation, maintenance, repair). 2) IT-based services: ICT solutions are used to improve existing service offerings, (e.g. monitoring of machines over distance). 3) Pure digital services: services are enabled by ICT systems, (e.g. simulation, virtual/augmented reality). 4) Digitalized PSS: ICT solutions are incorporated as

a novel component in the PSS, in order to optimize operations or availability.

## 3. Barriers to digital servitization

### 3.1. A number of barriers and obstacles

The interplay between digitalization and PSS or servitization is not obvious. PSS are complex and digitalization adds another level of complexity and abstraction [9,15]. A number of barriers and obstacles to digital servitization have already been highlighted in the literature.

Lerch and Gotsch [13] identify a set of factors that may hinder or stimulate the digitalization of industrial services : the complexity of services offered (advanced services are more likely to require or benefit from ICT solutions), the complexity of the core product and production batch size (complex products or small batch sizes foster individualization and digitalized services), and company attributes, especially company size (availability of internal resources and competences) and the share of sales from exports (favoring digital and remote-controlled services). Raja et al. [16] explore the managerial dilemmas encountered by advanced analytical equipment providers in developing service-led growth strategies. They identify three major dilemmas: closeness to customer, technological simplification, and organizational capabilities. Klein et al. [17] identify a number of non-technical barriers for smart services in the capital goods industry, which they classify into four factors: internal resources and capabilities, customers and information, value proposition and adaptability. According to von Leipzig et al. [18], typical barriers mentioned by companies themselves include insufficient IT structures, lack of technical skills, inadequate business processes and high implementation risks and costs. From a more global point of view, digital transformation and Industry 4.0 may require a drastic change in the organizational culture of a company as it involves adopting new technologies, learning skills, etc. [19].

### 3.2. Barriers for SMEs

Building on previous literature, we propose a classification of possible barriers to digital servitization for SMEs.

- Technical/technological barriers

First, technologies that are core to the digital servitization are both varied and complex, since they encompass Internet of things (IoT), big data and analytics, cloud computing, cyber security, mixed and augmented reality, advanced manufacturing solutions, additive manufacturing, simulation of connected machines, and artificial intelligence [12]. SMEs are financially constrained, do not have the technical resources readily available, and cannot easily upgrade and adopt digital technologies [19].

Moreover, digital service offerings must be supported by a stable and reliable technical infrastructure in order to be offered economically [13]. Finally, SMEs could face technological problems related to their product offerings, since

the inclusion of digital technologies into their offerings may necessitate a different and specific (re-)design.

- Organizational barriers

Strategy, not technology, should drive digital transformation: the strengths of digital technologies do not lie in the technology itself, but rather on how companies integrate them to transform their business and exploit its benefits [20]. Digital transformation involves the application of digital technologies with the aim of a change of key business operations, products, processes, organizational structures and management concepts [11]. For instance, digitalized PSS will increase the number of actors participating in the value creation process, the complexity of the products, and the resources and competencies required to create and support them [13]. Often, these new offerings will require totally new competencies, resources, and collaborations. This will call for changes in innovation management, from traditional R&D toward an integrate approach of services and IT systems, new management systems, and a powerful customer service function [13].

Digitalization represents a radical change; people’s unwillingness to change, or their indifference to the need to change may be the most important cultural barrier and is often underestimated and usually not recognized by companies [18].

Servitization often implies major cultural changes in SMEs [21,22]. The move towards PSS is complex for manufacturing SMEs, and digitalization adds another level of complexity, thus reinforcing the depth of the needed cultural transformation.

- Human resources related barriers

Many authors mention issues related to competences and skills. For instance, for Lerch and Gotsch [13], a major barrier to the digitalization of services is a lack of qualified employees to develop and provide such services. Digitalization significantly increases the complexity, abstraction, and problem-solving skills needed by all employees. Further, those employees directly providing the services need a technical qualification profile that includes knowledge of engineering, mechatronics, and IT. Digital competence, as the ability of using digital technology in an effective way, can be regarded as a prerequisite for the enhancement of digitalization in PSS [23]. Lack of digital competences may be then an important barrier for SMEs. Coreynen et al. [15] also identified the development of new sales competences or customer interfacing skills as possible barriers to digital servitization.

- Customer-related barriers

Ambiguous customer needs, hazy value propositions and difficulties conveying benefits to customers are among the major barriers identified by Klein et al. [17].

Another important barrier is customers fear loss of control over information, that is privacy violations, security concerns and security of access to production and corporate systems [17].

Moreover, Raja et al. [16] identify closeness to customer as one of the managerial dilemmas encountered by companies in

developing service-led growth strategies: providers need customer insights in order to develop complex service offerings, whereas customers are reluctant to provide the necessary access to information needed for developing such insights.

#### 4. Digital servitization in French manufacturing SMEs

##### 4.1. Data and research method

This study’s purpose is to identify the main barriers to digital servitization that French manufacturing SMEs face. That is why we conducted an exploratory research study of eight manufacturing SMEs, consisting of multiple-case and participatory action research methods [24]. A variety of data gathering methods were used: focus groups, in-depth interviews with companies, company workshops.

More precisely, the data were gathered through a number of research projects we carried out with SMEs in the Auvergne-Rhône-Alpes Region in France from 2012 to 2018. All these projects were conducted from an action research approach. They related to servitization, aiming at supporting manufacturing SMEs in their strategic reflections on the pathway to service. Digitalization was not at the heart of these reflections, but it has often emerged as either a lever or an obstacle to servitization and development of PSS. For the purpose of this study, we have selected and analyzed the data related to digitalization. Table 1 presents a brief overview of the cases.

Table 1. Description of the cases.

SME	Observation period	- Business, market, staff - Servitization/digitalization issues
A	2012-13	- Design and production of machine tools, international market, 120 employees. - Aiming at developing PSS offerings. Remote maintenance, securing data exchanges with customers, monitoring of customer production.
B	2012-13	- Automation and electricity, French market, 18 employees. - Beginner in services. Partnership with software suppliers, securing data exchanges with customers, monitoring of customer production.
C	2013-14	- Repair of household appliances, local market, 24 employees. - Beginner in services in the B2B sector. Customer relationship management, spare parts tracking, monitoring of service delivery.
D	2014-15	- Industrial blades, French market, 8 employees. - Beginner in services. Securing data exchanges with customers, wide range of data / interoperability.
E	2014-17	- Production of showerheads, French market, 1 employee. - Aiming at developing a use-oriented PSS. Management of customer requests and files.
F	2014-15	- Design and production of machine tools, international market, 200 employees. - Aiming at developing service revenues. Customer relationship management, monitoring of customer

		production.
G	2015-18	- Design and production of agricultural sprayers, international market, 250 employees.  - Aiming at developing service revenues. Customer relationship management, wide range of data and interoperability, smart connected products, lack of digital skills.
H	2016-18	- Design and production of machine tools, international market, 300 employees.  - Aiming at developing service revenues. Customer relationship management, securing data exchanges with customers, monitoring of customer production, traceability of internal manufacturing processes, lack of digital skills.

#### 4.2. Main findings

The exploratory research allowed us to identify the digitalization stage and the main barriers to digital servitization faced by these SMEs.

- Digital servitization stage

If we refer to the four stages mentioned by Lerch and Gotsch [13], the companies we studied were still mainly pure manufacturers, offering “obligatory” services such as installation or maintenance and repair, and using only standard ICT solutions to support services. The companies use ICT solutions mainly in their daily work but not yet to differentiate their offerings in the market.

A few companies can be considered as providers of product-related services (F, G, H), who offer IT-based services such as teleservices, monitoring and controlling of machines over distance, and use ICT solutions to improve their existing service offerings. We can notice that these companies are also the bigger ones.

None of the studied companies can be considered as providers of PSS offering pure digital services or truly digitalized PSS.

The companies we studied correspond quite well to what West and al. [25] call “niche OEMs”, who focus primarily on supporting the development of quite basic product-based services, rather than really smart services.

Even if our sample is very limited, it tends to show that French manufacturing SMEs in traditional industries risk running late since offerings comprising digital services remain scarce. This also mean that SMEs do not consider yet digitalization as a strategic issue, and as an opportunity to improve their offerings and create new business models.

Nevertheless, some of the companies we worked with had begun to consider integrating digital technologies to improve and enlarge their offerings. This is especially the case of medium-sized companies G and H.

- Digitalization issues and barriers

The most significant issues that emerged regarding digitalization are customer-related: how to deploy and use efficiently a CRM software; how to monitor the customer use of their equipment within its production process; how to secure data exchanges.

All the companies who were offering teleservices mentioned customers fear loss of control over information as a major barrier: privacy violations, security concerns and security of access to production and corporate systems. For instance, company H offers remote maintenance services, but does not yet succeed selling them. Its customers are still reluctant to give their supplier an access to what they consider sensitive data, regarding their production process.

Some of the companies started to use a CRM software (G, H), but this gave rise to technical and organizational difficulties. From a technical perspective, the deployment of a CRM leads to interoperability issues with other software such as ERP. From an organizational perspective, using a CRM software leads companies to question their internal processes: who is going to have access to customer information? Who is going to provide input to the database? What are the customer information and data that need to be integrated in the database? Thus the implementation of a CRM software is still challenging for an SME.

Furthermore, the introduction of digital services has also organizational consequences for SMEs. More and more, customers expect very quick feedbacks on their demands. For instance, hotlines are often expected to be open 24/24, 7/7; service technicians who provide technical support must intervene very quickly on customer site, etc. This is very demanding for SMEs who often do not have enough human and material resources to do so.

#### 4.3. Discussion

Our literature review led us to identify four types of barriers to digital servitization: technical/technological, organizational, related to human resources and to customers.

Ours findings show first that the French manufacturing SMEs we studied are at a very early stage in digitalization and digital servitization. This possible delay tends to confirm that digital transformation and servitization are not considered yet as strategic goals for manufacturing SMEs. Thus, organizational and cultural barriers may be the first that should be overcome; SMEs should become aware that there is no way around digital transformation, and consider digital servitization as a driving force for their development.

When focusing on SMEs that started to digitalize their offerings, we can notice that they face two main difficulties, internal and external. The first one is internal and organizational since they often struggle with the practical organization either of the tools they implement (CRM), or of the digitalized services they offer (teleservices). The second one is external and customer-related: their customers are often reluctant to give them access to their data, due to privacy and security concerns.

Technical/technological and human resources-related barriers did not appear as major issues in the studied cases. However, it may be due to the early stage of digitalization of these SMEs; they may not be advanced enough to face this kind of problems.

Nevertheless, these results should be considered with caution and need to be confirmed since some data were gathered several years ago, and digitalization has become a

hot topic only recently. Thus the SMEs we studied could have evolved a lot since then.

## 5. Conclusion

Nowadays, companies cannot remain unaware of the opportunities offered by both digitalization and servitization. This is even truer for manufacturing SMEs who are struggling to survive in a more and more competitive environment. There is a real opportunity to make digitalization and servitization strategies converge, but this implies for traditional manufacturing SMEs to overcome a set of major barriers.

To do so, SMEs more than ever need to be supported in their pathway toward digitization and servitization, in order to be able to build digital servitization strategies. French government should not miss this unique opportunity and support initiatives that aim at fostering both digitalization and servitization in SMEs. French policies such as Industry of the Future, and accompanying structures such as clusters could be of a great help in this context.

## References

- [1] Schallmo D, Williams CA. Digital transformation now! Guiding the successful digitalization of your business model. Cham: Springer; 2018
- [2] Parviainen P, Tihinen M, Kääriäinen J, Teppola S. Tackling the digitalization challenge: how to benefit from digitalization in practice. *Int J Information Systems and Project Management* 2017;5(1):63-77.
- [3] Zheng P, Lin TJ, Chen CH, Xu X. A systematic design approach for service innovation of smart product-service systems. *J Cleaner Production*, 2018;201:657-67.
- [4] European Commission. [https://ec.europa.eu/growth/industry/policy/digital-transformation\\_en](https://ec.europa.eu/growth/industry/policy/digital-transformation_en). Consulted on Nov. 2018.
- [5] Kamp B, Parry G. Servitization and advanced business services as levers for competitiveness. *Industrial Marketing Management*, 2017, 60, p. 11-16.
- [6] Perona M, Saccani N, Bacchetti A. Research vs. Practice on Manufacturing Firms' Servitization Strategies: A Gap Analysis and Research Agenda. *Systems* 2017;5(1).
- [7] Vendrell-Herrero F, Bustinza OF, Parry G, Georgantzis N. Servitization, digitization and supply chain interdependency. *Industrial Marketing Management* 2017;60:69-81.
- [8] Westerman G, Calmèjane C, Bonnet D, Ferraris P. Digital Transformation: A Roadmap for Billion-Dollar Organizations, MIT Center for Digital Business and Capgemini Consulting; 2011.
- [9] Pagoropoulos A, Maier A, McAloone TC. Assessing transformational change from institutionalising digital capabilities on implementation and development of Product-Service Systems: Learnings from the maritime industry. *J Cleaner Production* 2017;166:369-80.
- [10] Vendrell-Herrero F, Myrthianos V, Parry G, Bustinza OF. Digital dark matter within product service systems. *Competitiveness Review* 2017;27(1): 62-79.
- [11] Matt C, Hess T, Benlian A. Digital Transformation Strategies. *Business & Information Systems Engineering* 2015;57(5):339-43.
- [12] Paschou T, Adrodegari F, Rapaccini M, Saccani N, Perona M. Towards Service 4.0: a new framework and research priorities. *Procedia CIRP* 2018;73:148-54.
- [13] Lerch C, Gotsch M. Digitalized Product-Service Systems in Manufacturing Firms: A Case Study Analysis. *Research-Technology Management* 2015;58(5):45-52.
- [14] Porter ME, Heppelmann JE. How Smart, Connected Products Are Transforming Competition. *Harvard Business Review* 2014;November: 1-23.
- [15] Coreynen W, Matthyssens P, Van Bockhaven W. Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management* 2017;60:42-53.
- [16] Raja JZ, Frandsen T, Mouritsen J. Exploring the managerial dilemmas encountered by advanced analytical equipment providers in developing service-led growth strategies. *Int J Production Economics* 2017;192: 120-32.
- [17] Klein MM, Biehl SS, Friedli T. Barriers to smart services for manufacturing companies – an exploratory study in the capital goods industry. *J Business & Industrial Marketing* 2018
- [18] von Leipzig T, Gamp M, Manz D, Schöttle K, Ohlhausen P, Oosthuizen G, Palm D, von Leipzig K. Initialising Customer-orientated Digital Transformation in Enterprises. *Procedia Manufacturing* 2017;8:517-24.
- [19] Mittal S, Khan MA, Romero D, Wuest T. A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs). *J Manufacturing Systems* 2018;49:194-214.
- [20] Kane GC, Palmer D, Phillips AN, Kiron D, Buckley N. Strategy, not Technology, Drives Digital Transformation, *MIT Sloan Management Review* 2015;Summer.
- [21] Dubruc N, Peillon S, Farah A. The Impact of Servitization on Corporate Culture. *Procedia CIRP* 2014;16:289-94.
- [22] Peillon S, Dubruc N, Mansour M. Service and customer orientation of corporate culture in a French manufacturing SME. *Procedia CIRP* 2018;73, 91-5.
- [23] Süße T, Wilkens U, Hohagen S, Artinger F. Digital competence of stakeholders in Product-Service Systems (PSS): Conceptualization and empirical exploration. *Procedia CIRP* 2018;73:197-202.
- [24] Kemmis S, McTaggart R. Participatory Action Research. In: Denzin NK, Lincoln YS, editors, *Strategies of Qualitative Inquiry*. London: Sage; 2007. p. 271-330.
- [25] West S, Gaiardelli P, Rapaccini M. Exploring technology-driven service innovation in manufacturing firms through the lens of Service Dominant logic. *IFAC-PapersOnLine* 2018, 51(11):1317-22.