**DIGITAL CAPABILITIES FOR ADVANCED SERVICES: A MULTI-ACTOR PERSPECTIVE**

Chris Raddats, Jamie Burton, Vicky Story & Judy Zolkiewski

**ABSTRACT**

**Purpose:** To create a framework to investigate the digital capabilities required by manufacturers and other actors

**Design/Methodology/Approach:** Conceptual study

**Findings:** Thedigital capabilities required by manufacturers for advanced services have been investigated through some exploratory research but those required by other actors (customers, intermediaries) have not so far been addressed in the literature. This study provides the first attempt to classify digital capabilities using an existing framework

**Originality/Value:** The first study is to consider the digital capabilities required by multiple actors.

**KEYWORDS:** Advanced services, digital capabilities, multi-actor, servitization

1. INTRODUCTION

There is growing recognition of the opportunities that digital servitization offers (Sklyar et al. 2019). However, manufacturers require new capabilities to develop digitally-enabled advanced services, leveraging digital technologies in order to co-create new forms of value constellations with customers; for example, the ability to capture, interpret and use data about product operations to develop new outcome-based business models (Zolkiewski et al. 2017). These are described as *digital capabilities* (Ardolino et al. 2018); that is, capabilities to deploy digital technologies to provide value-creating and revenue-generating opportunities as part of digitalisation. The capabilities for digitalisation are more wide-ranging than those required to digitise data (Sklyar et al. 2019); for example, capabilities for the latter could include coding sales data for use in a company’s enterprise resource planning system (Salonen 2011).

Manufacturers’ digital capabilities for servitization are starting to be considered (e.g., Ardolino et al. 2018), although those required by other actors such as customers and intermediaries have not, other than one study on intermediaries by Reim, Sjödin, and Parida (2019). However, understanding what the digital capabilities required for advanced services are, and their inherent form and nature, is likely to be critical for their uptake given that actor capabilities need to complement each other (Story et al. 2017). Thus, this paper investigates the digital capabilities required by manufacturers, customers, and intermediaries.

In section 2 the paper sets out the capabilities for advanced services (both those required by manufacturers and other actors), while section 3 considers the application of digital technologies to servitization research. Section 4 identifies the digital capabilities required for advanced services and section 5 provides a conclusion to the paper.

1. **MULTI-ACTOR CAPABILITIES FOR ADVANCED SERVICES**

It is recognised that certain capabilities are required by manufacturers and other actors such as customers and intermediaries to successfully deliver advanced services (Story et al. 2017). Given the inherently manufacturer-centric nature of servitization and service infusion (Raddats et al. Forthcoming), these capabilities are often seen as internal or external to the manufacturer (Salonen and Jaakkola 2015) or ‘mixed’ (a combination of internal and external capabilities) (Paiola et al. 2013). Most research to date has focused on internal capabilities; for example, Parida et al. (2014) identify business model design, network management, integrated development, and service delivery management. Valtakoski and Witell (2018) set out the front- and back-office capabilities required by SMEs, while Lenka et al. (2018) focus on how individuals (rather than companies) deploy resources and competencies to overcome organisational resistance to servitization.

Despite the prevalence of a manufacturer-centric approach, some research has focused on the perspectives of other actors in this field. Spring and Araujo (2014) identified indirect capabilities, accessed by, but not possessed by, the manufacturer for procuring complex performance offerings. Story et al. (2017) specified ‘competitive’ capabilities required by intermediaries (coordinating and integrating third-party products/services) and ‘complementary’ capabilities required by customers (co-creating innovation and having processes that support service outsourcing) for advanced services. Some capabilities are created via interaction between the manufacturer’s and other actors’ complementary capabilities (Helander and Möller 2007; Raddats et al. 2017). Equally, the capabilities customers possess for service infusion may be more important than those of their suppliers (Forkmann et al. 2017); and a lack of understanding of what a partner’s capabilities are (from either side) can lead to relational uncertainty (Kreye 2017). Indeed, customers may delay the introduction of technology-based advanced services if this uncertainty exists, so their capability (and willingness) to accept the introduction of advanced services is critical (Neu and Brown 2005). Thus, it is important to investigate (digital) capabilities from a multi-actor perspective to determine those necessary for advanced services.

**3. APPLICATION OF DIGITAL TECHNOLOGIES IN SERVITIZATION**

The application of digital technologies as part of servitization has been recognised over recent years. For example, digitised ‘smart’ product-service systems (PSS) addressing different aspects of the product lifecycle (i.e., maintenance/repair; production; R&D/design) to improve its performance and efficiency (Lerch and Gotsch 2015). Allmendinger and Lombreglia (2005) also extolled the value of ‘smart services’, developed through networking and management of connected devices. The application of remote management technology within servitization research has generally focused on either a way to improve the efficiency of operations (Baines and Lightfoot 2013) or to develop new value propositions (Grubic 2018). Indeed, it is the delivery of advanced services, in particular, that requires the application of such remote management technology (Penttinen and Palmer 2007).

The importance of digital servitization goes beyond suppliers’ service offerings and manufacturers may progress towards a digital transformation of their entire business model. Coreynen, Matthyssens, and Bockhaven (2017) find there are three digital servitization pathways: *industrial servitization* (knowledge from the manufacturer’s internal process optimisation is translated into value-added customer services), *commercial servitization* (the alignment of the manufacturer’s value-creating routines with the customer’s internal processes) and *value servitization* (the creation of new digital products that impact customer processes). It is value servitization, in particular, that provides a fundamental renewal of the customer value chain and has a disruptive effect on customer/supplier relations (Coreynen, Matthyssens, and Bockhaven 2017). Taking an ecosystem perspective, different approaches by manufacturers as a result of digitalisation are also apparent; with standardised processes and centralised decision-making about technology introduction leading to a smoother path for digital servitization than an approach where local business units have a high degree of autonomy, although this approach might stifle innovation (Sklyar et al. 2019).

The alignment of digitalisation and servitization can bring about new digital business models (DBMs) and value-creating opportunities (Martín‐Peña, Díaz‐Garrido, and Sánchez‐López 2018). For example, the Internet of Things (IoT) may bring about opportunities for new DBMs (Rymaszewska, Helo, and Gunasekaran 2017; Suppatvech, Godsell, and Day 2019). Equally, ‘big data’ could lead to enhanced revenue generating opportunities for manufacturers, with information about product operations becoming increasingly valuable for firms (Opresnik and Taisch 2015). Indeed, for advanced services information is a key component of these new DBMs, alongside products and services (Cenamor, Sjödin, and Parida 2017).

**4. DIGITAL CAPABILITIES FOR ADVANCED SERVICES**

The digital capabilities required to develop and deliver advanced services have so far mainly been identified from the product manufacturer’s perspective. For example, utilising integrated data systems and connected machines (Sjödin, Parida, and Kohtamäki 2016); developing pay-per-use pricing metrics based on IoT technology (Heinis, Loy, and Meboldt 2018). Ardolino et al. (2018) identify eleven digital capabilities underpinned by IoT, predictive analytics (PA) and cloud computing (CC) technologies. The particular relevance of each technology is aligned to Kowalkowski et al.’s (2015) service transformation trajectories: IoT for an ‘availability provider’, offering products on an availability basis; PA for a ‘performance provider’, offering solutions to solve customer-specific problems; CC for an ‘industrialiser’, providing more standardised offerings (Ardolino et al. 2018).

Coreynen et al. (2017) envisage specific operational and dynamic capabilities aligned to the three digital servitization pathways. For the industrial servitization pathway, a ‘design-to-service’ capability allows manufacturers to create new hybrid offerings based on manufacturing assets, such as consultancy service offerings. Dynamic capabilities focus on value visualisation and value-based sales. For the commercialisation pathway, operational capabilities include linking front- and back-office processes to capture customer needs and involving customers in this process. Dynamic capabilities focus on using digital platforms to deploy hybrid offerings and the ability to capture customer needs. For value servitization, in addition to those operational capabilities previously outlined, additional ones centre on execution risk assessment and mitigation, while additional dynamic capabilities concern service-related data processing and interpretation in order to gain intimate knowledge of customers’ processes (supporting Ulaga and Reinartz 2011).

Some work is starting to consider digital capabilities beyond the product manufacturer, which are seen as critical for establishing and maintaining a network or ecosystem (Martín‐Peña et al. 2018). Service network orchestration using a platform approach is a way of discovering and analysing the resources and capabilities in an inter-firm network, making them visible for network actors to leverage (Eloranta and Turunen 2016). Thus, digitalisation can be used to align ecosystem actors and foster greater collaboration between them, although to be successful manufacturers must balance the centralisation of digital capabilities (to maintain availability) and local adaption (to allow service innovation) (Sklyar et al. 2019). Based on a study in the publishing industry, Vendrell-Herrero et al. (2017) find that upstream actors are able to maintain value network dominance through control of digital resources, despite the common servitization trajectory of going downstream (Wise and Baumgartner 1999), through which this dominance is diminished as part of the value creation process.

Despite this recent focus on networks and ecosystems, research to date on the digital capabilities for advanced services is still very manufacturer-centric, with these capabilities either presented as those the manufacturer needs itself or those needed by the manufacturer to orchestrate or dominate its network. Moving away from this manufacturer-centric position, the benefits of digitalisation for servitization are being recognised from the perspective of distributors, who can reorganise delivery processes through digital platforms such as telematics (e.g., to overcome a lack of physical service infrastructure in some territories) (Reim, Sjödin, and Parida 2019). Despite this single study, there is a lack of research that considers the required digital capabilities of other actors in the servitization value chain (e.g., intermediaries and customers).

To provide guidance for studying this topic the framework set out by Story et al. (2017) will be used, with these authors proposing six unique and critical capabilities for advanced services from manufacturer (M), intermediary (I) and customer (C) perspectives. Table 1 shows these capabilities and how they are related to digital capabilities, based on the literature or our interpretation of what digital capabilities might be needed in this context.

**Table 1: Digital capabilities for advanced services**

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| **Unique and critical capability for advanced services** **(Story et al. 2017)** | **Related digital capability** |
| Balance product and service innovation (M)  Co-creating innovation (C) | Develop new offerings based on digital technologies (Ardolino et al. 2018)  Customers need to retain a technology innovation capability and not just rely on suppliers to offer digitally-enabled advanced services without the knowledge to assess their utility |
| Customer-focused through-life service methodologies (M)  Processes supporting service outsourcing (C) | Linking front- and back-office processes to capture customer needs (Coreynen et al. 2017)  Utilising technology to streamline internal processes and methodologies to ensure they are potentially outsourceable to suppliers.  The ability to interpret, assess and manage digitally-enabled advanced service contracts. |
| Distinct, yet synergistic product and service cultures (M) | Digitalisation by the manufacturer can help to align ecosystem actors and get partners to collaborate (Sklyar et al. 2019) |
| Coordination and integration of third-party products/services (I) | Reorganise delivery processes to improve efficiency through digital platforms (Reim et al. 2019)  Develop technology-related capabilities that can enhance service delivery beyond those capabilities possessed by the manufacturer |

**5. CONCLUSION**

Digital servitization is likely to be an important part in the development of servitization, presenting manufacturers and other actors with new opportunities and challenges. An aspect of servitization that has received considerable attention in the extant literature is that of capabilities, particularly those required by manufacturers, but increasingly those required by other actors such as customers and intermediaries. Digital capabilities have started to be considered in the literature, but almost exclusively from the manufacturer’s perspective, despite the fact that digital capabilities are likely to be important for customers and intermediaries too. The digital capabilities required by manufacturers are often leveraged from technologies such as IoT, big data or remote monitoring, and focus on either those capabilities required in-house or those required to manage a network or ecosystem.

Digital capabilities for servitization required by customers are likely to centre on having sufficient technical knowledge to be able to improve internal processes and methodologies so that they can be outsourced as part of an advanced service offering. Equally, a technology-based solution may be required to manage these contracts and assess whether what is being provided is competitive with in-house provision. Those digital capabilities required by intermediaries are likely to centre on having technology know-how that exceeds that of the manufacturer, in terms of applications to deliver customer-focused solutions. This way the intermediary will remain an essential part of the manufacturer’s value chain.

In terms of managerial implications, managers within manufacturers need to understand the capabilities required for advanced services and how digitalization could enhance existing offerings or help to develop new offerings. Equally, managers need to understand the perspectives of distributors and customers in terms of the digital capabilities they might need if advanced services are offered and procured.

The paper’s main limitation is its theoretical nature and future research should seek to uncover, by empirical means, the digital capabilities required by customers and intermediaries for advanced services.

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| **AUTHORS** |  | |
| Dr. Chris Raddats  Management School, University of Liverpool, Liverpool, UK, L69 7ZH.  +44(0)151 795 3706  Chrisr@liverpool.ac.uk | | Professor Jamie Burton  Alliance Manchester Business School, University of Manchester, Manchester, UK, M15 6PB  +44(0)161 275 6508, Jamie.Burton@manchester.ac.uk | |
| Professor Vicky Story  School of Business and Economics, Loughborough University, Loughborough, UK, LE11 3TU  +44(0)1509 228301  V.M.Story@lboro.ac.uk | | Professor Judy Zolkiewski  Alliance Manchester Business School, University of Manchester, Manchester, UK, M15 6PB  +44(0)161 306 3470  Judy.zolkiewski@manchester.ac.uk | |
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