A capability-based framework of utilising data-in-use to create business value in integrated solutions, advanced service, or PSS

Amara Cynthia Ajeagbu (a.ajaegbu1@aston.ac.uk), Victoria Uren & Andreas Schroeder
Aston Business School, Aston University, Birmingham, B4 7ET, UK

Abstract

Digitalisation is a crucial enabler of servitisation, with digital capabilities allowing interaction, integration, and aligning of processes that create value for both manufacturers and customers. We report of a multi case study of digital capabilities in the UK truck manufacturing industry. The fundamental components of digital capabilities are identified as data capturing capability, connectivity capability and analytical capability.The role of digital capabilities as a resource is explored from the perspective of the Resource Based View (RBV). It was found that digital capabilities enable data-in-use and in combination facilitate value creation, offer strategic potential and sustainable competitive advantage in the collaborative service network, through visibility of operations, information exchange and effective management of field knowledge.

Keywords: Resource-based view, digital capabilities, PSS

Introduction

The past decades have seen a rise in international competition from the low-cost manufacturers, and, in order to compete, leading manufacturers in the western world have added service offerings to their existing products to increase differentiation (Kowalkowski, 2013; Raddats, 2015). These services, termed integrated solutions, advanced services, or product-service systems (PSS), are tailored to support customers' requirements for the use of products. We will use the term PSS here.

Digital technologies act as a facilitator of PSS (Coreynen, Matthyssens 2017; Bjaradwaj et al 2013) through enabling new product-service offerings (Lerch and Gotsch, 2015) and increased competiveness. Digital technology provides a dynamic way for manufacturers to interact with their customers, and opens up value creation opportunities based on data-in-use (Porter and Heppelmann 2014, Opresnik and Taisch 2015). For the purpose of this study data-in-use is described as operational data being accessed, processed and updated by technological systems. While such studies agree that digitalisation is a catalyst to attain innovative performance and higher competiveness, and can have direct impact on PSS, the concept and is not yet stabilised in literature. Therefore, this paper aims to explore the concept of digitalisation, and identify the constituents of digital capabilities as a sustainable differentiator to create business value in PSS.

A collaborative service network (CSN) is described as a place where stakeholders within one or more related industrial sectors jointly interact and collaborate (Omta, 2004). It embodies the shared organisational entities, resources, business processes and business relationships (Jaakkola and Hakanen, 2013). CSN have numerous advantages which include complementarity of roles, resources optimisation, agility and innovation. Digital capabilities enable companies to use the resources embedded in CSN while interacting with each other to achieve mutual goals by sharing data, knowledge, risks and results (Porter and Heppelmann 2014, Lerch and Gotsch 2015, Opresnik and Taisch 2015).

This work explores two research questions. First, what are the digital capabilities necessary for supporting PSS? Second, how do digital capabilities support value creation in CSNs? This is done through extensive case studies of the CSNs of four leading truck manufacturing companies who between them serve 80% of the UK market.

This study will draw on the resource-based view (RBV) of the firm to explore the role of digitalisation in the provision and long term sustainable value of PSS. Barney (1991) introduced the RBV theory to analyse how sustainable competitive advantage can be created through valuable, rare, inimitable and non-substitutable resources (VRIN). Hence, the study will identify the constituents of digital capability as resourceswith potential to create competitive advantage

In this paper, a literature review is presented on digitalisation, digital capabilities and digital technological resources to identify how these are used to create sustainable competitive advantage and value within a CSN. The research methodology of the study is summarised. Findings concerning digital capabilities and their use for value creation in the cases are presented and the role of digital capabilities in value creation is discussed from the RBV perspective.

Theoretical background

Servitisation is defined as a process where manufacturers extend a traditional product-centric model to form a product-service model (i.e. PSS), which is more customer focused and relational in approach (Vandermerwe and Rada 1988, Baines, Lightfoot et al. 2009, Martinez, Bastl et al. 2010). This is a trend shared across many manufacturing industries, particularly heavy equipment manufacturers, such as the truck manufacturing industry.

Servitisation aims to develop a PSS, which incorporates manufacturers, suppliers (dealers) and customer resources (Spohrer and Maglio 2008), with the aim of achieving a customer's desired outcome and creating sustainable competitive advantage. PSSs provide outcome based solutions where the manufacturer provides customers with different capabilities, in place of just a product. When selling capabilities in place of products, key considerations are those of meeting customers' dynamic demands, and interactions with customers (Kohtamaki and Partanen 2016, Bustinza, Vendrell-Herrero et al. 2017). Research has emphasised the need for customer resources to be integrated into service innovation (Smith, Ng et al. 2012, Barnett, Parry et al. 2013, Jaakkola and Hakanen 2013).

There are various examples of PSS, such as Finning CAT offering monitoring and diagnostic service to support customers operation and maintenance of the equipment (Westergren and Holmström 2012), Rolls-Royce's 'power-by-the-hour' services, where payment for the servicing of the jet engine is based customers runtime in their context rather than repair (Smith, Ng et al. 2012, Green, Davies et al. 2017), and MAN's trucks and buses offering pence-per-kilo to offer maintenance support and to address customers' shipping requirements (West, Gaiardelli et al. 2018). Offering such services to the customer requires the integration of processes, products, and services through digital components and capabilities. In this perspective, Barney (1991) introduced the concept of Resource Based View as a means to understand the role and impact of digital resources.

RBV aims to determine the strategic resources an organisation can use to achieve competiveness (Barney 1991). The ability to evaluate and exploit individual resources strategically creates sustainable competitive advantage. Identifying the strategic prospect of a resource involves four attributes of RBV theory. This includes valuable, rare, inimitable and non-substitutable resources (Nevo and Wade, 2011). Barney (1991) underlined these four attributes as a necessity for individual resources to be deemed a source of sustainable competiveness.

IT resources are often categorised into two aspects, IT assets, described as technology based investments such as hardware, software infrastructure, etc., and IT capabilities, which are systems-based competencies that facilitate the use of IT (Aral and Weill, 2007). Research suggests that IT assets are the easiest to copy, and therefore have low strategic potential. IT capabilities are more likely to generate sustainable competitive advantage (Kindstrom, Kowalkowski and Sandberg, 2013; Piccolo and Ives, 2005). Past studies affirm that knowledge transfer mechanisms that actively encourage data and information exchange across organisational boundaries generate increased level of performance and have strategic potential (Piccolo and Ives, 2005). From this perspective, IT can be seen as digital tools which enable data and information exchange. Therefore, to remain competitive in the market, CSNs need to make use of external data and information resources to continuously maintain and improve competitiveness.

Reconfiguration of digital resources should enable new business opportunities, which often entail incorporating digital capabilities into physical products (Porter and Hepplemann, 2014; Huikkola, Kohtamaki and Rabetino, 2016). The ability to reconfigure internal and external data resources to address customers' changing demands is seen as a foundation of competitive advantage and sustainable value. While the VRIN characteristics may not be enough to remain competitive in a changing business context, identifying the constituents of digital capability and understanding the dynamics of these capabilities do enable firms to integrate, build and reconfigure data resources for sustainable value creation.

In PSS, asmanufacturers add more features to their services to create added value, there is a higher emphasis on understanding the customer's use context; what one customer finds useful may be totally different to the next. For servitising truck manufacturers, the pay-per-use contract is a popular PSS model in whichthey offer rental agreements or sells fleet management services. One customer may run a fleet of 5 to 10 vehicles in a specificregion, while another customer may have considerably more vehicles carrying out different operations across the country, going from rural areas to motorways etc. Offering PSS to different customers requires the integration of processes, products, and services through digital components and capabilities which help manufacturers to understand the use contexts of different customers.

Value creation can be much more effective if real-time data is exchanged on multiple levels within the CSN. According to Lee and Lee (2015), monitoring of products enables data gathering and analysis, which allows identification of operational patterns and areas of improvement, which in turn leads to better operational reliability, improved productivity and cost reduction. Operational reliability is particularly important in the case of PSSs designed to maintain specific levels of up time. In general, operational data can be used to enhance and optimise customer value by identifying patterns and creating value-added services that address them (Opresni and Taisch, 2015; Lee and Lee, 2015).

Following this theoretical understanding, this study identifies digital capabilities necessary for supporting PSS and examines how they can be used to support value creation in CSN.

3 Methodology

This study is based on four case studies of truck manufacturing companies and their CSNs. Carrying out multiple case studies increases confidence in findings, as it allows cross investigation and analysis of a phenomenon in different situations (Darke, Shanks et al. 1998). The use of multiple case studies allows replication of findings and cross-case analysis (Yin 2014) reinforces its accuracy (Benbasat, Goldstein et al. 1987) and captures useful emergent properties in an organisation (Yin, 2014).

A purposive sampling approach was taken, in which each CSN case was comprised of a manufacturer (TruckPro), at least one customer firm (TruckCus), and if appropriate, TruckDealers (TruckSup) who act as intermediaries in some networks, and in two cases a supplier of sector specific technology used in those particular CSNs (TruckTech). TruckCus4. TruckSup2 and TruckTech contributed to more than one case each. The companies in the cases are designated as shown in Table 1:

Tabe1: Summary of case organisations

Cases	**Name of organisations**
Case 1	TruckPro1, TruckCus1, TruckCus2, TruckCus3, TruckCus4, TruckTech.
Case 2	TruckPro2, TruckCus4, TruckCus5.
Case 3	TruckPro3, TruckSup1, TruckSup2, TruckCus4, TruckTech.
Case 4	TruckPro4, TruckSup2, TruckCus4, TruckCus6, TruckCus7.

A semi-structured interview approach was used for data gathering. The respondents came from people dealing with PSS and people using digital technologies across the participating organisations, which allow a good view of the phenomena under investigation. The interview questions where driven by the motive to understand digitalisation in PSS, its process and the opportunities for improving value proposition to customers.

Data analysis applied a thematic analysis method in order to identify the constituents of digital capabilities necessary for servitisation. In exploring the data, various steps were followed to ensure rigor, and the principles of thematic analysis were followed (Braun and Clark 2006). These steps comprised, first, familiarisation with the transcript, and noting initial ideas. Second, common and interesting phrases, words, or terms mentioned by the participants were coded. In the third step of the analysis, the initial codes were analysed further to ascertain relationships, patterns and links within the codes and thus to identify second-order themes, which allow various contextual factors and emerging relationships to develop, all through the process. In the last step, the precise focus of each theme was refined and related to the overall story of the analysis, as well as to literature. Compelling extracts from data were selected which related to the research questions and literature. The resulting aggregate dimensions correspond to digital capabilities identified from the cases.

Findings: What are the digital capabilities necessary for supporting PSS?

The presentation of the findings is structured around the themes and aggregate dimensions summarised in Figure 1.

Data capturing capability

Data capturing capability is an aggregate dimension that captures the alignment of hardware and software components to sense, monitor and collect information from product operations with low human involvement. In the context of servitisation, the analysis of the data indicates that the case companies begin with data capturing capability.

<u>Enabling intelligent functionalities</u> captures the real-time visibility of product operations and initial data processing. The case companies showed instances where manufacturers collect digitally recorded operational data on product usage through sensor devices. The

respondents explained how they upgraded the integral hardware aspect of the product with telemetry units to gather operational data that supports various service offerings:

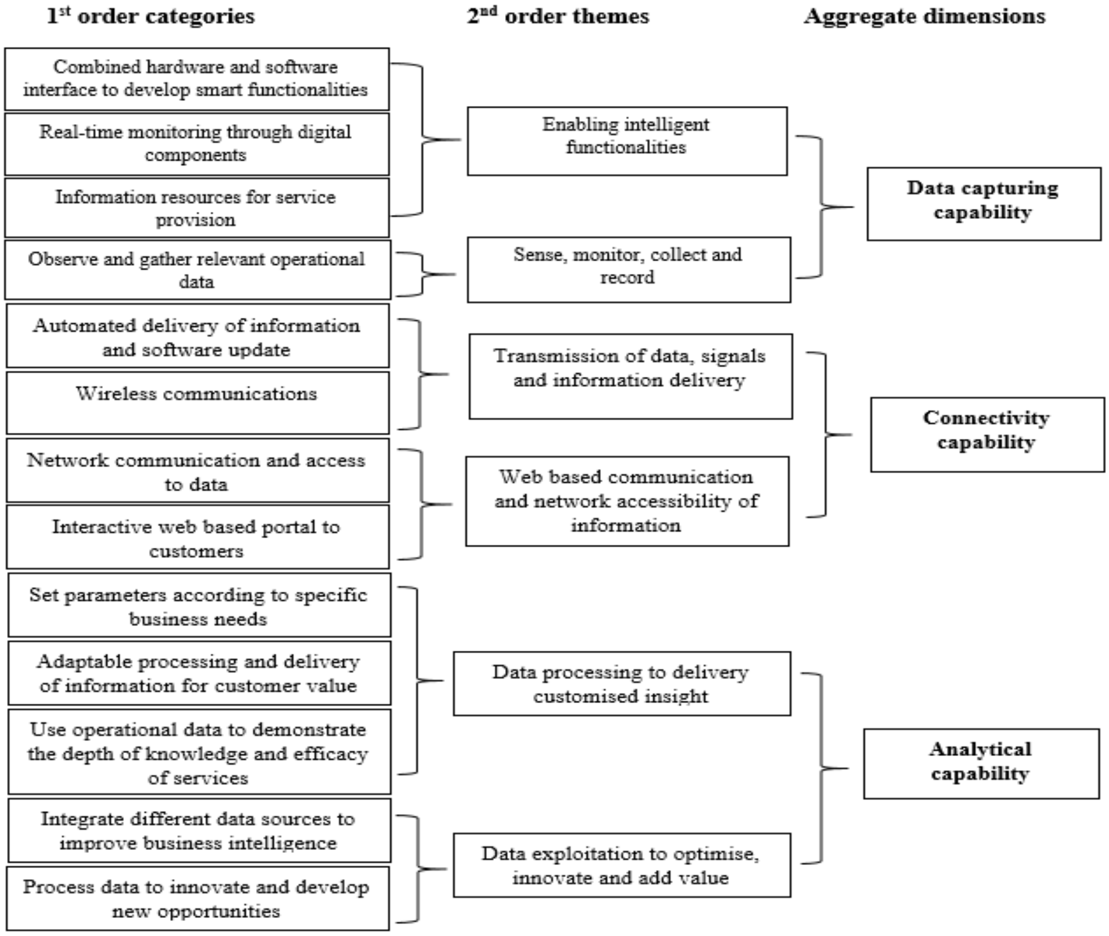
TruckPro2: *"Over the years, we've actually upgraded the product which is now based on integral hardware of the vehicle. So we actually build in the telemetry unit as part of the overall vehicle, so it is not just an add-on feature, the actual hardware is completely embedded within the vehicle product. And we then offer various telemetry services to the end user customer to help him manage his business effectively."*

Smart technological functions facilitate interactions and support the processing of real-time data about the product's condition. Gaining and advancing insight into the user's operations enables identification and understanding of customer needs:

TruckPro2: *"The factory are monitoring the vehicle performance in real-time across the globe, and they are able to come up, just like we get an update on our mobile phone, to improve things. So it's the case with vehicles now."*

The ability to capture data through embedded smart components is prevalent in the implementation of servitisation, as this enables intelligent functionalities and, equally, emphasises the foundational role of data-in-use and information services. The embedded tracking devices provide opportunities to observe products remotely and to acquire customer usage and operational data, necessary for service provision or product upgrades. In other words, data-in-use is one of the main resources used for service provision, and it enables deep insight into different customers' usage.

Figure 1: Data structure



Digitalisation of products supports the theme <u>sense, monitor, collect and record</u>.Devices on the products transmit various details of use data to the manufacturer's data centre through cellular networks.Participants were asked about the way that they capture and share information with members of the CSN. The respondents explained that data is at the core of their value propositions enabling them to communicate vital information to support customer operations:

TruckPro1: *"It [Telematics] monitors and knows the fuel consumption of the vehicle, the mileage driven, idling, which is wasting fuel. It also monitors things like if [the driver] is driving harshly, harsh braking or harsh steering and all those kind of things. So really it can detect if the vehicle is being driven properly or not."*

The case companies further explained that monitoring their products closely helps them to minimise risks on service contracts. For example, it facilitates the reduction of risks transferred to the manufacturer by being proactive in response to customers and supporting preventive maintenance. The collected and recorded data helps the companies provide an information service to customer organisations. Acquired product usage information is sent to the customers weekly or monthly and includes information about product utilisation, which motivates customers to perform better.

Connectivity Capability

Connectivity capability captures the ability to communicate and transmit signals from digitalised products through a wireless communication networkto the central data repository. This capability focuses on activities around data and signal transmission to various actors in the CSN. It focuses on service related support and improving business support overall.

<u>Transmission of data, signals and information delivery</u> concerns how data is transmitted from digitalised products to data processing centres available to actors in the CSN, for example, in the cloud environment. The case companies provide repair and maintenance for their customers, and supply spare parts as part of their advanced service package. Before telematics, in the event of a breakdown, the dealer would have to travel to the location and plug in their diagnostic tool to figure out the problem. Now, data is transmitted from the telematics system to the control centre (storage and processing centre) which the manufacturer can view in the cloud. TruckPro1 explains:*"Every two minutes it's sending us information, and it's sending information on the speed of the vehicle, the location of the vehicle, how it's been driven, the health of the vehicle all those things were being parcelled up and transmitted and [TruckTech] use a data management centre. It has guaranteed 99.9% availability of time, all backed up and secured."*

For PSS, this capability improves the efficiency of operations, such as repair and maintenance activities. Information flow between CSN partners saves resources and reduces the cost of maintenance. One of the dealer companies who perform repair and maintenance for TruckPro4 explained that wireless communications enable them to proactively plan for maintenance:

TruckSup3: *"We can proactively plan and schedule servicing, rather than taking the vehicle into the workshop and doing an inspection first, you can actually determine what the problems are before it arrives, so you are actually saving downtime, cost and improving uptime."*

Creating and integrating connected infrastructure allows the status of products to be monitored, predicts when components are likely to fail, and feeds this information to the CSN. The autonomous nature of connected systems allows the manufacturing firms to save time spent on error diagnostics and improves resources for maintenance.

<u>Web based communication and network accessibility to information</u> refers to the online portals provided to customers and other members of the CSN allow them access to view and track their vehicles in real-time. This provides opportunities to connect and exchange information between digitalised products, the operating environment and other systems on a

network level. Network communication and access to data places emphasis on the potential of connection between the smart products.Such communications at a network level optimise product function and provide a competitive advantage by delivering increased value to the customer operations.

Analytical Capability

Analytical capability refers to data processing ability in which available data are transformed to unlock valuable and actionable insights for various stakeholders. A massive amount of data is generated by digitalisation. In order to make sense of the data, manufacturers employ analytical capability to allow the firms in the CSNs to assimilate and exploit information to optimise business processes.

Data processing to deliver customised insight refers to the importance of making sense of historical data collected from digitalised products. Through data processing, the manufacturers acquire the understanding that provides the basis for critical decision making and market intelligence; basically, it enables operational value for the CSN firms. When participants discussed analytical capabilities, they focused on the process of converting raw data into meaningful insight: TruckPro1explains:*"What we have to do is to take that raw data, and we have to take it through a transformation process, to make it into meaningful information. And the way we do that is- we have a set of parameters [...] for things like harsh braking. Well, good look for harsh braking means you are getting less than 0.05 incidents per hour which to you and I means better than 1 in 20 hours."*

Insights from such parameters feed into services, for example, customisation of driver training programmes. For the customer companies, driver and fuel cost are seen as the key determinants of profitability. Therefore, driver training is of vital significance to their businesses. Customisation tunes services to suit particular business needs, which in turn enables value creation in a specific context; this emphasises user centricity and thecustomer's use context. For example, harsh braking parameters suitable for a customer whose drivers drive a lot on country roads may not suit another whose drivers mainly drive on motorways. Hence, the way in which data is processed and delivered to various customers is different and this has strategic implication for both manufacturers, customers and the CSN as a whole.

Data exploitation to optimise, innovate and add value concerns how, in their CSNs, manufacturing firms and their collaborating network partners can interact, with the option to access, exchange and combine resources (internal and external) for the optimisation of business processes. For example, the manufacturer can combine telematics data with factory data and maintenance data to generate business intelligence and help innovate and improve service outcomes.

The ability to assimilate and collaborate with other firms offers greater opportunities for value creation through knowledge acquisition from data. For example, the manufacturer can help dealers be more efficient, which feeds into the value stream of the CSN as a whole.

TruckPro4: *"We help the dealer analyse and make sure they understand what their areas of responsibility are. You need to have ten clutches on your shelf because on average you sell ten a month. Typically, when you are heading to March, you sell more. So rather than having ten on the shelf, you need to have twenty on the shelf."*

There were numerous instances in which the case organisations emphasised feeding accumulated information into their innovation processes, making the next set of products and services better for added value. This is all based on a constant inflow of data coming from digitalised products that monitor and transmit customer use data. For example:

TruckPro2: *"the speed limit in the UK is 56mph, so you gear the vehicle that runs 56mph because that's theoretically right. The only problem is, if you look at the average maximum* *speed in the UK of truck today, it's about 43. So, we are building a truck that is actually over geared for the UK market."*

Digital Capabilities from the RBV perspective

We have shown that digital capabilities identified enable data-in-use and information to be exchanged by monitoring, sharing and facilitating knowledge flow within the CSN. These digital capabilities are now further examined in regards to the VRIN framework.

According to Vargo et al., (2008) value creation describes the ultimate purpose of economic exchange. For solution providers in a CSN, value is derived from services, service opportunities and service capacity. Visibility of operations emerged as the main characteristic of data capturing capability in the cases studied. Insight into customer operations helps manufacturing firms understand how their products fit within different contexts. The focus is on providing manufacturers with the capability to respond to the customers' environment.

Data capturing capability gathers real-time data-in-use fromcustomer operations. This enables service differentiation through identification of customers' unmet needs, and stronger relationships within the CSN. Literature on servitisation highlights the role of data as a vital antecedent for the effective provision of servitisation (Bastl, Johnson et al. 2012; Opresnik and Taisch 2015). The study's findings extend prior understanding by showing that data capturing capability allows manufacturers to observe and identify areas of improvement, which provides the basis for morecollaboration and value creation.

Madhani (2010) suggest that the rarity of resources is subject to its unavailability to potential rivals. Examining the rarity of data-in-use, findings shows that connectivity capability creates value through information flow and exchange, within the CSN. As suggested by Lee and Lee (2015), digitalisation offers the basis for multi-level collaboration, such as between systems, things (products), and collaborating actors within the CSN. Connectivity capability enables product-service data to be sharedwith the necessary party for service improvement, which would not have been possible outside the network. This information flow improves customer value by enabling insight into their current situation.

Barney (1996) described inimitability as resources that are costly and difficult to duplicate. Barriers to duplication of data-in-use are determined by the effort involved in repetition, dependent on past experience, ownerships rights etc. Data capturing capability enables data-in-use to be captured in real-time and accumulated over a time period, thus time density and dependencies on past experiences create major boundary to replication. As such, competitors would face significant difficulties in an effort to obtain or duplicate data.

Madhani (2010) defined non-substitutability as the lack of a strategic equivalent of a resource. PSSs are mainly about creating innovative know-how to support the customers' businesses and add more value. The intensity of these business relationships and level of customisation required necessitates knowledge acquisition more than data, which calls for strong analytical competence, integration and effective management of knowledge. For example, the cases above demonstrate that manufacturers provide specific training to customers depending on their needs. Analytical capability facilitates domain and contextual knowledge of products, customers' contexts and market opportunities because it has been created over a long period through continuous tailoring and refinement algorithms used for data analysis.

A previous study by Davenport, Barth et al. (2012) examined the role of data-in-use for business decision making; a process where software enables managers to convert data into knowledge, and knowledge into results. The cases demonstrated a recurring process, where the results produced further information which was converted into knowledge and again into further results. The empirical findings showed that manufacturers increase expertise by leveraging and managing knowledge discovered from accumulated data for valuable insight and will be hard to substitute.

Conclusion

This study aimed to identify the constituents of digital capabilities, and how they support PSSs and help create business value. The analysis shows there are three constituents of digital capability which are data capturing capability, connectivity capability and analytical capability. Using the theoretical lens of Resource-Based View (RBV) and its VRIN attributes, the discussion indicates that these capabilities unlock data-in-use and enable value creation.This is achieved through visibility of operations, information exchange and effective management of domain knowledge.

In the cases reported here, data delivered through digitalised products, offers information about various components in the truck, patterns of failure and their causes, which allows value to be created by reducing downtime for the customers and providing operational efficiency. This data-in-use is further processed to provide additional information upon which product and service lifecycle cost and availability are assured. Importantly, information is proactively shared within the CSN to improve PSS. Respondents from the case organisations see this as an important step towards creating added value for them, their customers and the dealers. By underlining the intrinsic value of data-in-use, the case organisations articulate it as an advantage in their competitive space.

This study proposes that digital capabilities offer a strategic tool that enables data-in-use and has strategic potential for servitising manufacturers. With the identified capabilities, CSNs are able to create sustainable value propositions. The study contributes to the stream of research into the strategic implications of digitalisation and its benefits in servitisation (Coreynen et al., 2017; Lenka et al 2017). The use of data-in-use and analytical capability work as unique resources to servitising firms, offering, positive results, which enhance knowledge. Such capabilities enable organisations to modify their resources base with the aim of adjusting to changing environment thereby leads to a sustainable competitiveness (Coreynen et al., 2017; Schroeder and Kotlarsky, 2015).

Our findings highlight the importance of digital technologies and digital capabilities in servitisation (Lerch and Gotsch, 2015; Schroeder and Kotlarsky, 2015; Kohtamaki, et al, 2019). These authors highlight the complementary roles of digital resources. In such context, understanding how analytical capability translates data-in-use to improve knowledge may have vital consequences for competitive advantage, innovation and performance.

References

Aral, S. and Weill, P. (2007). IT assets, organisational capabilities, and firm performance: How resource allocations and organisational differences explain performance variation. Organisation Science 18(5), p. 763-780.

Baines, T., Lightfoot, H., Benedettini, O. and Kay, J. (2009). The servitization of manufacturing: a review of literature and reflection on future challenges. Journal of Manufacturing Technology Management 20(5): 547-567.

Barnett, N., Parry, G., Saad, M., Newnes, L. and Goh, Y. (2013). "Servitization: is a paradigm shift in the business model and service enterprise required?" Strategic Change 22 (3-4): 145-156.

Barney, J. (1991). Firm resources & sustained competitive advantage. Journal of Management, 17(1). p. 99-120.

Bastl, M., Johnson, M., Lightfoot, H, and Evans, S. (2012). "Buyer-supplier relationships in a servitized environment." International Journal of Operations and Production Management 32 (6): 650-675.

Benbasat, I., Goldstaein, D. and Mead, M. (1987) The case research strategy in studies of information systems." MIS Quarterly 11(3): 94-109.

Bharadwaj, A., El Sawy, O. A, Pavlou, P. A. and Venkatraman, N. (2013). "Digital Business Strategy: Toward a next generation of insights." MIS Quarterly **37**(2): 471-482.

Braun, V. and V. Clark (2006). "Using thematic analysis in psychology." Qualitative Research in Psychology 3 (2): 77-101.

Bustinza, O., Vendrell-Herrero and Baines, T. (2017). "Service implementation in manufacturing: An organisational transformation perspective." International Journal of Production Economics 192(1-8).

Coreynen, W., Matthyssens, P. and Van Bockhaven, W. (2017). "Boosting servitisation through digitization: Pathways and dynamic resource configurations for manufacturers." Industrial Marketing Management **60**: 42-53.
Darke, P., Shanks, G. and Broadbent, M. (1998). "Successfully completing case study research: combining rigour, relevance and pragmatism." Information system journal 8(4): 273-289.
Davenport, T. H., Barth, P. and Bean, R. (2012). "How 'Big Data' Is Different." MIT Sloan Management Review 54(1): 43-46.
Green, M. H., Davies, P. and Ng, I.C.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.
Huikkola, T., Kohtamaki, M. and Rabetino, R. (2016). Resource realignment in servitisation. research-Technology Management, 59(4), p. 30-39.
Jaakkola, E. and T. Hakanen (2013). "Value co-creation in solution network." Industrial Marketing Management 42(1): 47-58.
Kindstrom, D., Kowalkowski, C. and Sandberg, E. (2013) "Enabling service innovation: A dynamic capabilities approach." Journal of Business Research **66**(8): 1063-1073.
Kohtamaki, M. and J. Partanen (2016). "Co-creating value from knowledge-intensive business services in manufacturing firms. the moderating role of relationship learning in supplier-customer interactions." Journal of Business Research 69(7): 2498-2506.
Kohtamaki, M., Parida. V., Pghazo, P. Gebaurer, H. and Baines, T. (2019). Digital servitisation business model in ecosystems: A theory of the firm. Journal of Business Research. 104, p. 380-392
Kowalkowski, C., Kindstrom, D. and Gebauer, H. (2013). "ICT as a catalyst for service business orientation." Journal of Business & Industrial Marketing **28**(6): 506-513.
Lee, I. and K. Lee (2015). "The internet of Things (IoT): applications, investments, and challenges for enterprises." Business Horizons 58(4): 431-440.
Lerch, C. and M. Gotsch (2015). "Digitalised product-service systems in manufacturing firms: A case study analysis." Research-Technology Management 58: 45-52.
Madhani (2010) Resource Based View (RBV) of Competitive Advantage: An Overview. Journal of Indian Management Research and Practices. 1(2), p. 2-12.
Martinez, V., Bastl, M., Kingston, J.&Evans, S. (2010). "Challenges in transforming manufacturing organisation into product-service providers." Journal of Manufacturing Technology Management 21(4): 449-469.
Miles, M. B. and A. M. Huberman (1994). Qualitative data analysis: An expanded sourcebook. Thousand Oaks, California, SAGE Publications, Inc.
Nevo, S. and Wade, M. (2011) Firm-level benefits of IT-enabled resources: A conceptual extension and an empirical assessment. The Journal of Strategic Information Systems, 20(4), p. 403-418.
Omta, S. W (2004). Increasing the innovative potential in chains and networks. Journal on Chain and Networks Science, 4(2) p. 75-81.
Opresnik, D. and M. Taisch (2015). "The value of Big Data in servitization." International Journal of Production Economics 165: 174-184.
Piccolo, G. and Ives, B. (2005), Review: IT-dependent strategic initiatives and sustained competitive advantage: a review and synthesis o f the literature. MIS Quarterly, 29(4), p. 747-776.
Porter, M. E. and J. E. Heppelmann (2014). "How smart, connected products are transforming competition. ." Harvard Business Review 92: 11-64.
Raddats, C., Burton, J. and Ashman, R. (2015). "Resource configurations for services success in manufacturing companies." Journal of Service Management **26**(1): 97–116.
Schroeder, A. and Kotlarsky, J. (2015) Digital resources and their role in advanced service provision: A VRIN Analysis. Proceedings of the Spring Servitisation Conference (SSC2015).
Smith, L., Ng, L. And Maull, R. (2012). "The three value proposition cycles of equipment-based service." Production Planning and control 23(7): 553-570.
Spohrer, J. and P. P. Maglio (2008). "The emergence of service science: toward systematic service innovations to accelerate co-creation of value." Production and Operations Management 17(3): 238-246.
Vandermerwe, S. and J. Rada (1988). "Servitization of business: Adding value by adding services." European Management Journal 6(4): 314-324.
Vargo, S. L., Maglio, P. and Akaka, M. (2008). "On value and value co-creation: A service systems and service logic perspective." European Management Journal**26**(3): 145-152.
West, S., Gaiardelli, P. and Rapaccini, M. (2018). Exploring technology-driven service innovation in manufacturing firms through the lens of Service Dominant Logic. INCOM 2018. Bergamo, Italy.
Westergren, U. H. and J. Holmström (2012). "Exploring Preconditions for Open Innovation: Value Networks in Industrial Firms." Information and Organization 22 (4): 209-226.
Yin, R. K. (2014). Case study research: Design and Methods. Thousand Oaks, CA, SAGE Publications.