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Data Analytics Capabilities for Digital Service Development: A Case Study

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Completed Research Paper

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Abstract

Data analytics capabilities (DAC) have become important for business organizations in delivering successful digital services to their customers. The success of digital services depends on how efficiently business organizations can deploy DAC in association with other organizational capabilities. Prior information systems (IS) literature has also argued the importance of IS capabilities for digital service development. However, few studies have examined how DAC and IS capabilities will work together for digital service development. To address the research gap, we conducted a case study in a forest machine manufacturing organization. The research findings revealed that IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles facilitated DAC's technical, managerial, and organizational dimension for digital service development. This study contributes to the DAC literature by investigating the role of DAC and IS capabilities in developing digital services in business organizations.

Keywords: Data analytics capabilities, digital service development, information systems capabilities

Introduction

Development of digital services are essential for business organizations in transitioning towards service-oriented business models, enhancing customer experiences (Warner & Wäger, 2019), addressing customers' demands through service innovation (Barrett et al., 2015), etc. Data and data analytics have become important for organizations in developing digital services to serve customers and to enhance competitive advantages (Park & Mithas, 2020). For instance, Nike has transitioned from its role as a shoe manufacturer to providing data-related fitness services via digital platforms based on data and data analytics to achieve competitive advantages in the market (Günther et al., 2017). Prior literature have argued that DAC is needed for organizations to successfully compete in delivering good digital services (Levkovskyi et al., 2021) and to enhance customer experiences (Baskerville et al., 2020).

DAC is related to the ability of an organization to deploy its data-related resources (Gupta & George, 2016). Prior literature has highlighted how DAC can help generate value in business. Anton et al. (2021) found that DAC's technical, managerial, and organizational dimensions lead to organizational performance. Park and Mithas (2020) argued that successful digital business requires a configuration of DAC and other organizational capabilities such as leadership, strategic planning, customer orientation, and process management, which could help achieve high financial or customer performance.

In addition, IS capabilities have also been suggested to be important for digital service development (Riera & Iijima, 2019). IS capabilities has been found to influence the development of digital platforms and plays an evolutionary role in the process (Tan et al., 2015). For example, in the health care context, high investments in IS capabilities are positively associated with organizations' digital capabilities thereby enhancing their digital business strategy (Van de Wetering et al., 2018). Riera and Iijima (2019) found that organizations having high levels of maturity with regards to IS capabilities achieved high digital business value.

Though both DAC and IS capabilities are important in digital service development in organizations, little research has explored how DAC and IS capabilities will work together for digital service development. There is lack of knowledge on how DAC and IS capabilities should be applied for successful digital service development together. Therefore, this study aims to address the above discussed research gap by answering the following research question: *How can DAC and IS capabilities work together for digital service development in business organizations?*

To answer this research question, we conducted a single case study in a forest machine manufacturing organization to investigate how business organizations can deploy DAC together with IS capabilities in the specific context of customer-oriented digital service development (hereafter digital service development). Specifically, we explore the role of organization's IS capabilities in facilitating DAC's technical, managerial, and organizational dimensions, and the role of DAC's technical, managerial, and organizational dimensions in digital service development. This study aims to contribute to DAC literature by investigating the role of DAC and IS capabilities in developing digital services in business organizations.

The paper is structured in the following manner: First, we discussed the theoretical background for this study, including digital services, IS capabilities, and DAC, based on the prior literature. Then we introduced the research method applied in this study, such as the research approach, research case, data collection, and data analysis. Afterward, we explained the findings from the case study and proposed a theoretical framework to understand how DAC and IS capabilities work together for successful digital service development in business organizations. Finally, the theoretical and practical implications of this study are discussed along with the limitations and future research directions.

Theoretical Background

Digital services

Williams et al. (2008) defined digital services as services that are facilitated via digital means. On the other hand, when organizations embed digital technologies in their services, it could be referred to as digital services (Nambisan et al., 2017; Pagani, 2013). Digital services aims to transform traditional business activities to address the opportunities and challenges brought forth by digital technologies (Barnir et al., 2003). In this regard, digital services affect how organizations conduct business activities such as production, selling, marketing, services, etc. For example, in the case of Tesla, car-related maintenance services are provided via over-the-air software updates (Steininger et al., 2022).

Service offerings based on digital asset like data are shaped by the extent of utilizing DAC in organizations (Tilson et al., 2010). For example, an ecommerce retailer like Amazon is now providing cloud-based web services by leveraging the power of DAC technical components (Bharadwaj et al., 2013). According to Lusch et al. (2015), digital platform, an important DAC infrastructure component, is vital for fulfilment of digital services and facilitates value exchange between actors (e.g., producers and consumers) (Constantinides et al., 2018).

Customers are one of the key foci in business, and organizations are providing digital services to customers. Digital services are a part of competitive strategic actions taken by organizations to leverage opportunities

provided by data (Woodard et al., 2013). On the other hand, customers are becoming active participants or co-creators in digital services and customer service performance is determined by the extent of organization's customer orientation (Setia et al., 2013). IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles (e.g., IS-enabled customer orientation) have been found to be important for digital service development (Haffke et al., 2016; Teubner & Stockhinger, 2020). DAC has also been argued to be important for digital service development in the data era (Bharadwaj et al., 2013) . However, there is a lack of knowledge on how DAC and IS capabilities could be applied in business organizations for successful digital service development.

Information systems capabilities

Amit and Schoemaker (1993) defined capabilities as the ability of an organization to deploy or utilize its resources. The utilization of resources is facilitated by organization-specific processes that are both tangible and intangible in nature (Barney, 1991). Capabilities allow an organization to be strategically flexible by acting as a link between resources and outcome (performance) because capabilities are created by deploying organization-specific resources and is deeply embedded in organizational routines (Day, 1994). As a result, capabilities define the direction in which organizations are headed toward, and distinctly differentiates organizations from one another (Leonard-Barton, 1992). There are different types of organizational capabilities such as DAC, IS capabilities, strategic capabilities, management capabilities, supply chain capabilities, etc.

Bharadwaj (2000) defined IS capabilities as the ability to deploy IS-based resources in combination with other resources. IS capabilities have been positively associated with organizational performance (Bharadwaj, 2000; Powell & Dent-Micallef, 1997). IS research have published different taxonomies of IS capabilities. For example, managerial IS skills are related to the ability of a manager to understand the needs of all stakeholders, develop solutions to address those needs, coordinate processes, and anticipate future needs of the stakeholders (Mata et al., 1995). Whereas technical IS skills are related to programming and systems analysis (Bharadwaj, 2000). IS infrastructure is related to technological hardware components (Wade & Hulland, 2004). An integrated IS infrastructure has been found to enable synergies in the context of supply chain (Rai et al., 2006). IS-enabled customer orientation is a key IS capability that allows an organization to equip itself to provide digital services that satisfy customers. Prior literature has argued that IS-enabled customer orientation is essential in business as it is closely linked with organizational performance (Bharadwaj, 2000; Park & Mithas, 2020). On the other hand, organizations should be capable of managing relationships or aligning processes between different functional areas via applying different IS resources, and this is commonly referred to as IS-enabled synergy (Bharadwaj, 2000). Such IS-enabled synergies could lead to better alignment between departments for development of digital services (Wade & Hulland, 2004). Therefore, in addition to IS skills and IS infrastructure, organizations need intangibles such as IS-enabled customer orientation and IS-enabled business synergy to inflict change, respond to market needs, and to coordinate processes in the context of digital service development. IS capabilities have been found to be useful in supporting organizational core competencies (market access and functional competencies) for organizational performance (Ravichandran & Lertwongsatien, 2005). In addition, IS capabilities have been positively linked with organizational agility (Lu & Ramamurthy, 2011) related to market capitalizing and operational adjustment.

Data analytics capabilities

DAC is defined as the ability of an organization to deploy data and data-related resources (Gupta & George, 2016) and involves successful orchestration of data, data-related technologies, and data-related human resources (Shuradze & Wagner, 2016). Organizations develop DAC to extract the value of business data from different points of view, such as enhancing customer experiences (Elia et al., 2022) and business performance (Krishnamoorthi & Mathew, 2018).

DAC is comprised of technical, managerial, and organizational dimensions (Anton et al., 2021). The technical dimension of DAC involves the use of sophisticated technological tools and expertise related to data acquisition and data storage (Lehrer et al., 2018), data software and data visualization (Elia et al., 2022), and different types of data analytics (Chang et al., 2022). The managerial dimension involves human knowhow regarding data and data analysis, including managerial-, domain- and organizational-specific knowledge and expertise (Garmaki et al., 2016; Gupta & George, 2016). For instance, business analysts need

to have both data and business knowledge to find data-driven solutions for business problems (Popovič et al., 2018), managerial knowledge related to data is needed to drive business initiatives with regards to data analytics (Zhu et al., 2021), and managerial knowledge about user experience is needed for developing customer experience based on data and data analysis (Shollo et al., 2022). The organizational dimension of DAC is related to organizational structure, learning, and culture (Anton et al., 2021). Organizational culture has been found to influence the role of DAC in organizational outcomes (Gupta & George, 2016; Hyun et al., 2020). Organizational data-driven culture is deemed to be an important antecedent for DAC's success in business organizations (Zhao & Kamioka, 2022).

Prior literature has studied DAC from different perspectives. Dremel et al. (2020) utilized socio-technical systems theory and affordance theory to explore the affordances of DAC in establishing customer-focused marketing, provisioning and developing vehicle-data driven services, and optimization of production processes. Using information processing theory, Chen et al. (2021) explored the impact of DAC on decision making. They found that using DAC for supply chain learning helps foster internal integration, which is associated with DAC-enabled decision-making capability. Bharadwaj et al (2013) emphasized the need for DAC in digital service development and highlighted that organizations should find ways to harness the value of large amounts of data in areas related to digital services. In this regard, digital service development also requires data collection, data analysis, and utilization of data in business (Schumm et al., 2022; Xing et al., 2020). Prior literature has also shown that DAC is vital for developing or providing data-related services for fulfilling customer needs (Vial, 2019).

IS capabilities is more IS management and operation oriented, which facilitate business management and operation, such as email or ERP (Cui et al., 2022; Simonsen & Hertzum, 2022). While DAC is related to utilizing data generated by different IS for decision support, solving business problems, achieving strategic goals, and for identifying new problems or solutions from data which are not usually seen by the business in their normal operations. Therefore, DAC is related to higher level of management capabilities and strategic thinking (Côrte-Real et al., 2020; Oesterreich et al., 2022) and can be utilized to achieve goals that cannot be achieved using IS capabilities. IS capabilities have their limitations with regards to what it can and cannot do. Even though DAC and IS capabilities overlap with regards to the technology infrastructure, skills, and knowledge, there are some differences between the two. For e.g., not all the IS (e.g., email systems) are related to DAC. However, systems like ERP or Azure are related to both IS capabilities and DAC, as Azure can facilitate data analytics for achieving competitive advantages (Battleson et al., 2016). In this regard, the two capabilities have similarities and differences. This study aims to explore how the two capabilities interact to develop digital services in organizations.

Research Methodology

In this study, we used a qualitative research approach to understand how DAC and IS capabilities lead to digital service development in a forest machine manufacturing organization. Qualitative research is exploratory in nature and gives room for interpretation and understanding of a research phenomenon (Erikkson & Kovalainen, 2008). Qualitative research works with the perspective that reality is socially constructed through meanings ascribed by actors (Creswell, 2007). A qualitative approach could provide a rich understanding of how DAC and IS capabilities could be applied in business organizations for digital service development.

Specifically, we took a case study research approach in this study. According to Creswell (2007), case study research takes place within a particular context or a 'bounded system'. In a case study, the data is gathered from multiple data sources within a particular case. The data can be from reports, interviews, audio visual material, and could enrich the findings in a particular context. Case studies can be used to discover (exploratory), to explain (explanatory), and utilizes empirical evidence from real people in real life organizations (Myers, 2019). Case study provides the means to answer 'how' and 'why' questions related to a research phenomenon.

This case was selected because the case organization have set digital services as important for their customer offering, in supporting their organization's sales function, and to provide competitive services in the forest machine manufacturing industry. In this regard, the case organization have invested a lot on digital service development to help achieve their strategic targets. The organization has applied digital services for efficient management of machines. Thus, this case could be a good example as it combines physical machines, data,

and IS components for the provisioning of digital services. In this study, we try to understand how a forest machine manufacturing organization develops digital services through DAC and IS capabilities. Since the boundary between DAC and IS capabilities is not well established, the exploratory nature of the case study is important for revealing the boundary between DAC and IS capabilities, which could otherwise be difficult to establish using quantitative methods. The following subsections provide details regarding the case background, the data collection, and data analysis in this study.

Research setting

To understand the development of digital services, we investigated a forest machine manufacturer in Europe. The organization ManuCo (the organization's name is kept anonymous) provides harvesting solutions internationally and most of its sales comes from exports. It has received the ISO 9001 quality certificate. The organization ManuCo took a journey towards digitalization/digital transformation with the introduction of digital services a couple of years ago. However, the journey intensified in the past two years with the change in organizational structure and introduction of a dedicated department (digital services and IT department) to further develop the digital services for their customers. One responsibility of the digital services and IT department is to bridge the gap between IT and business with digital service development.

The digital services and IT department consists of different teams such as data, analytics, and API team (data & analytics as one sub-team and API as another sub-team) and digital experience team. On the other hand, ManuCo's business teams related to digital services include user experience (UX) design team, product management of information systems (team), digital marketing team, and digital services sales team. The objective of all the teams is to cater to the needs of the customer through digital means and DAC. Each team keeps customers at the center of their organizing and service delivery. The digital services to customers vary, including providing operational data (including forest machine data) for customers' business operations, offering machine related predictive maintenance services through data platform, visualizing different performance related information regarding the machines and their operators, etc. Therefore, the organization is an appropriate case for understanding how IS capabilities can facilitate DAC for digital service development and how DAC could be deployed for digital service development.

Data collection and data analysis

The primary data collection method was semi-structured interviews. The interviews were conducted with employees associated with digital services at ManuCo. The interviewees were from different teams and have varied expertise (See Table 1). The interviews were conducted in English in the month of June and July in 2022 via both online and face-to-face means. The duration of each interview was around 60 minutes. All the interviews were recorded and transcribed. The transcripts were checked carefully against the recordings to maintain the quality of data.

The interview conversation was related to value creation from digital services; utilization of data, data-related technology, and data-related expertise for the development of digital services; the conversations also included the coordination of activities between different teams for the development of digital services; the role of organizational culture in developing digital services, etc. In addition to semi-structured interviews, we gathered additional secondary data about the case organization from its website and annual reports between 2016 and 2021 (latest) to gather more information regarding digital service development at ManuCo.

In this study, we conducted a thematic analysis and used an inductive approach. According to Myers (2019), thematic analysis is a process of 'identifying, examining, and recording' themes that are occurring in the dataset. Thematic analysis provides a flexible, rich, and detailed explanation of qualitative data and helps in the process of creating patterns from the data (Braun & Clarke, 2006). Myers (2019) suggested that coding qualitative data could help researchers formulate themes related to the research phenomenon. Thus, we developed codes for sentences and paragraphs in the qualitative data to help formulate themes in this study. In the data analysis, we identified codes related to DAC's technical, managerial, and organizational components as well as IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles. These codes were used to create themes related to the interworking of IS capabilities and DAC for digital service development.

The data analysis of the case study was performed via qualitative data analytics software, Atlas. First, an initial coding was performed to identify codes related to individual dimensions of DAC, IS capabilities, and digital services. For example, all the data-related technical aspects such as data availability, data gathering, different types of data analytics, different means of data delivery to the customers were grouped under DAC's technical dimension.

Interviewees	Role in the organization	Industry experience (up to May 2023)
1	Data, analytics, and API team leader	8 years of experience on information and IoT systems in traffic and machinery sectors, with current focus on software development, data analytics, and API solutions.
2	Business analyst (and scrum master)	11 years of experience in telecommunication and machinery sectors, focusing on business analysis of digital systems design and development.
3	Business analyst	13 years in the case company working on the specification and UX of different business systems, such as sales and marketing, and digital services.
4	Digital experience team leader	6 years of experience in telecommunication and machinery sectors on digital service development, customer experience and service design.
5	UX design team leader	20 years of experience regarding product design and management, as well as user interface design in industries such as consumer electronics and machinery.
6	Digital marketing specialist	8 years of consultancy and in-house experience of digital marketing, focusing on marketing automation, marketing analytics development, and online marketing campaigns.
7	Director of digital services and IT	Over 10 years of experience in developing new services, products, and technologies, working in different roles in projects across industries with high complexity, familiar with different solutions, architectures, and technologies.
8	Product management and information systems team leader	12 years of experience on product management in manufacturing industries focusing on information systems within R&D.
9	Digital services, sales team leader	Experienced sales manager with 26 years of history working in logistics, supply chain, and machinery. Currently focusing on the sales planning, operations, and negotiations around digital services.

Table 1. List of Interviewees and Their Industry Experience

The managerial dimension included managerial aspects such as knowhow with regards to data-related digital design, digital marketing, and collaboration between different functions related to deployment of data for digital services. The organizational dimension aspects included attitudes, beliefs, expectations, and decision making regarding the use of data for developing digital services. With regards to IS capabilities, IS infrastructure components were related to organizational use of different IS systems for connectivity (e.g., visual conferencing tools, E-mail), customer relationship management (CRM), IS architecture, connectivity technologies (including machine related components). IS skills were related to developing and maintaining software (including machine-related research & development), development of software architecture and implementation, website and webinar management, IS planning (e.g., steering the development of IS deployment). IS-enabled intangibles were related to developing and fostering customer understanding through combination of IS technologies and IS knowhow, organizational knowledge and experience related to forest machine manufacturing (e.g., knowledge regarding different markets gathered through different

IS), and deployment of IS for achieving synergy between organizational members. Digital services were categorized with regards to how the organization is able to provide end points to the customers for efficient access to all machine-related data, predictive analytics solutions, and enhanced user experience via data platforms (for e.g., customized widgets showing important user metrics). Second, we revisited the data to check for interactions between DAC and IS capabilities. A network map was developed between each component of IS capability and DAC. The network map allowed clear visualization and mapping of ideas. According to (Friese, 2012), networks assist in 'detailing the entire structure of an idea'. Finally, network maps allowed us to visualize the interaction between IS capabilities and DAC for digital service development in the case organization. The details of coding logic in this study can be found in Appendix A.

Case Study Findings

IS capabilities facilitating DAC-technical dimension for digital service development

The findings in the case study show that data, data analytics, APIs, and data platforms are related to the DAC's technical dimension. The IS capabilities such as IS infrastructure, IS skills, and IS-enabled intangibles facilitate DAC-technical dimension for development of digital services at ManuCo.

Data, data analytics, and APIs

At ManuCo, there are dedicated teams that are responsible for deploying data, data analytics, and API solutions. There are five ManuCo employees in the data & analytics sub-team and three ManuCo employees in the API sub-team. The sub-teams also get support from enterprise architect from IT team. In addition, there are 16 external consultants working in these teams including data architects. The data, data analytics, and API sub-teams utilize different IS infrastructure components for digital service development tasks. The IS infrastructure and IS skills of both the sub-teams develop IS-enabled synergy needed for building data solutions. Statements from Int.1 is as follows:

> *The data is not, of course the only thing, it's obvious that we need integrations and connections between the systems and between the solutions, so that's why the work of API team is crucial. You usually need both [teams] when you build something. If you need data, you need integrations and if something needs to be changed, then integrations [API team] are needed to make the changes and so on….*
>
> *We are customer of a big cloud service provider (name changed), so we are utilizing their cloud systems. We are using data visualization software (name changed) to build our reports. We are utilizing data warehouse from another company (name changed) and then we are utilizing databases for different kinds of presentation layers….*
>
> *The data and analytics team are receiving the data, or they are building the pipelines. API team is more like building up those APIs between the systems, let's say from when we fetch the data from cloud systems to data warehouse, then we need API team in there to build the pipeline, but the data engineers are there to ensure that the all the data is in one place. I mean in the database, in right tables and in right columns and so on. So that's more like their responsibility as well as building these reports on top of the data. (Int. 1)*

According to Int. 8, ManuCo has a digital service offering called DAPI (name changed), which involves data and APIs. The DAPI service is due to the collective effort of both the sub-teams and is developed for addressing customers' business needs. For example: DAPI allows ManuCo's customers to analyze their forest machine data with high precision. Thus, customers' harvesting operations are supported by the DAPI service by acting as an important data source. The DAPI service also assists customers in real-time for planning their logistic operations. Overall, the DAPI service makes data-based management available for their customers.

Thus, the case organization leverages third party IS infrastructure as well as IS data-related expertise (internal and external) to facilitate DAC for digital service development. The interaction between these resources fosters synergy. Data alone is not enough for facilitating DAC for digital service development, the support of different IS components for creating integrations is also needed for developing digital services.

Based on the interaction, the case organization developed and monetized a particular digital service offering with which customers can efficiently manage their business operations.

Data platform

ManuCo's IS infrastructure consists of technology related components which help in gathering data from ManuCo's machines. According to ManuCo's annual report, data transmission unit (DTU - name changed) collects different types of data such as data related to machine movements, machine-related operations, and machine- & operator-related performance from the forest machines. The organization utilizes a data platform called DataPlat (name changed) which is developed in-house to gather data via DTU and machine sensors.

> *If we look at, for example some diagnostic data from the machine, it tells the basic parameters related to machine behavior. What are the engine hours or engine rounds per minute. Such sets of values, and the machine sensors bring the values to our data platform and then we can offer this data as a raw data back to the customers. (Int. 1)*

The DataPlat is an important DAC component needed for developing digital services. DataPlat allows ManuCo to scale their digital services offerings. The application contains various machine parameters and services such as predictive analytics and visualizations.

> *There are some dashboards that are built in our DataPlat application, which is again a product for our customers so they can follow the productivity and efficiency of the machines, but there is also possibility to have these kinds of predictive analytics for some parts. So basically, visualizing the situation. (Int. 1)*

The digital services aim at enabling customers to be proactive with regards to their machine health.

> *We have this prediction that this part won't last anymore very long, so it should be changed before it breaks down. I would say complex analytics from the diagnostic or telemetry information what we receive from the machines…. It's also about the service level and if we talk about this industry level customers, it's important for them that the machines are running all the time or there won't be any breakdowns [machine related]. (Int. 1)*

The above points highlight the importance of data platform in delivering important machine related data which are utilized by ManuCo's industrial customers. In addition, the data platform (as a digital service offering) allows the customers to follow the productivity of their machines, as it can have big impact on customers' business operations. However, the data platform needs to be supported by IS components specifically developed by the organization. This highlights the importance of IS capabilities and DAC for business organizations in developing digital services.

IS capabilities facilitating DAC-managerial dimension for digital service development

The findings in this study show that digital experience design, cross-team collaboration, and digital marketing competencies are related to the DAC's managerial dimension. The IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles facilitate DAC-managerial dimension for development of digital services at ManuCo.

Digital experience design

ManuCo has a user experience (UX) design team comprising of knowledge and expertise related to UX design. The UX designer's IS skills related to UX design is vital for developing digital services.

> *In short, my purpose in ManuCo is to give design thinking in the ways I've been taught. So, because I'm an industrial designer… my approach is always to think about the user [customer] and then look at what they're saying or what they're needing and try to interpret that and use the skills that I have as a designer and give the best possible answer to those questions. (Int. 5)*

The UX design is responsible for the design elements such as visual thinking and product design, aimed at enhancing user experience.

> *We've been looking at reporting in the DataPlat [new version], so there what I've been sort of involved is to try to look at how do we arrange the information in a meaningful way for the customers or how do they perceive that you need to look at the production, the working hours and how do you get reports out of those that are beneficial for the user [customers]. (Int. 5)*

The IS skills facilitate DAC's managerial dimension for digital services. This is done by enhancing the user experience through DataPlat. According to Int. 5, with the understanding of the technical capability in relation to DataPlat, the UX designers could bridge customer needs with the digital services through modular design. In DataPlat, the user interface on the customer side is made customizable based on customers' needs and DataPlat's user interface is designed to serve customers with differing roles. Statements from Int. 5 are as follows:

> *Each of the customers can customize one part to the software where they can sort of build these widgets that meet the area that's a particular interest for them….*
>
> *You can customize the widgets [in the DataPlat], no matter who you are. We have this different set up, sort of like, one for the owner of the company, one for the operations manager, who is kind of running the show for the owner quite often, and then we have the normal operators who are driving the machines and then we have the repair guys or maintenance guys and then we have what's called the guys [transport truck drivers] who move machines from one place to another. (Int. 5)*

According to ManuCo's annual report, DataPlat helps the machine operator by providing information that is needed by the operator while performing his/her task, thereby contributing to the economy and safety of the machine in addition to helping customers with their logging activities. This shows that organizations require expertise that can bridge both IS and DAC related aspects related to digital services design, which allows them to create better user experiences for their customers.

Cross-team collaboration

ManuCo, has a virtual design team (VDT - name changed) which is a cross-functional team consisting of IS expertise from different functional areas and includes two business analysts, an enterprise architect, a UX designer, a quality assurance (QA) lead, and data architects. The VDT was established to overcome issues related to incomplete specifications, to tackle misalignment of scope, and to avoid delays with regards to the delivery of digital services.

> *We had functionalities where the functional specification was very complete in one area and completely incomplete in another area…things were not aligned. (Int. 2)*

The VDT assembles IS skills from different areas of ManuCo and acts as a medium for collaboration. The scope alignment is addressed by developing IS-enabled synergy through VDT.

> *Yeah, we work together in the part of the process where we define the functional specifications on a higher level which we then hand over to implementation [teams] and we work together with the product management to define the business requirements and then we work together with the enterprise architect, UX designer, QA lead to kind of coordinate tasks and to share the same priority and the functionalities that we want to hand over to the implementation teams. (Int. 2)*

The collaboration provides visibility and understanding into what each team is doing, which drives the development work related to digital services.

> *But they [implementation teams] have an understanding of the high level of different areas for the functionality…. For the next month or two, they can organize their work and we try to freeze that scope for one implementation cycle so that the businessperson is not continuously pressing on the button up more and more. Every time there's an interaction between the business and the implementation team, we [VDT] try to be kind of a buffer. (Int. 2)*
>
> *The VDT helps to make the business requirement more concrete and going into more detail how they would apply on the product itself… they will make suggestions and try to understand the requirements… by asking questions. So basically, refining the requirements and making it more towards the actual service or product. (Int. 8)*

Via VDT, IS-enabled synergy, an important IS capability, fosters the generation of customer understanding and process visibility for data, analytics, and API teams. This provides clarity for the data, analytics, and API teams while creating solutions towards developing digital services.

> *So, they prepare the data, analyze the data, they do the architecture of the data. But they desperately want to know more about the why behind. So, one mission of VDT is combining different aspects, from functional design to UX design, and then to architectural design. So, all three parts are kind of combined together in one view in the VDT. Let's say when we invite those data architects in the workshops in VDT, they could also understand. Ok, so how does it look like on the UX side? How does it work on the functional side? (Int. 4)*

VDT prioritizes the needs of the customers and facilitates deployment of data-related solutions. This process is to help customers in their business, thus, facilitating DAC's managerial dimension for digital service development.

> *It might be that the product management finds or identifies a trend in their customers for new features in the applications and then that they talk with us, and we try to do a good description of those functionalities on how software should behave to accommodate those needs and then we communicate with the implementation teams and then we add those new features in the application. So that's one way to add value to our customers, is to make our applications fulfil their needs. (Int. 2)*

> *When they [customers] are making their core business, they are producing lots of data and then we need to visualize that and make that understandable and visualize that data to customers so that they can run their business better and then they will get more value from our machines, from our services, and from our digital services. (Int. 3)*

The findings show that organizational members and departments should utilize different IS and DAC-related expertise to develop data-driven solutions for developing digital services. However, this only occurs when the case organization can foster efficient collaboration across its different teams and members. The findings reveal that through efficient use of IS technologies, the organizational members can generate synergy. IS-enabled synergy is needed for ensuring cross-team collaboration for developing digital services that can fulfil specific needs of the customers.

Digital marketing competencies

ManuCo has a digital marketing team that takes care of customer-related communications. Int. 6 is a digital marketing manager whose tasks include development of ManuCo's website, supporting global marketing network, deploying marketing automation, and product information management tools.

> *I work with various systems, and I'm also taking care of our data analytics to ensure how we can better utilize our data. (Int. 6)*

According to Int. 4 and 6, digital marketing competencies are established based on IS-enabled customer orientation capability. The aim of digital marketing team is to generate better customer understanding through digital means.

> *So, at ManuCo, customer is the key. I can say that we are quite close to the customer, and we know the customer quite well, but also with the digital marketing means we try to know the customer even better and then cater personalized marketing to that customer. (Int. 6)*

> *We have a tradition of customer centricity in ManuCo, but in a very personalized and qualitative way. Let's say we have knowledge here and there in the marketing people, salespeople, our other colleagues, when they are interacting with customers, but then with the digital means and the data we are aiming to have more precise view on our customer and then we are able to segment and do more automation and do more precise marketing and relationship-building with the customer. (Int. 4)*

The marketing department is in collaboration with the digital services and IT department for their resourcing needs (IS skills and IS infrastructure). The collaboration also leads to IS-enabled customer orientation capability.

> *We have IT specialists who work hand-in-hand with Int. 6 as business specialists; so, that worked very well regarding resourcing. In addition to the resourcing of Int. 6's team, IT also provide resources for example licenses. We also provide budget for external consultancy, to configure and work on the system from technical point of view. So, Int. 6 as business owner of those systems, is in close collaboration with us. (Int. 4)*

> *We noticed that there was a big drop in the traffic, which seemed not realistic. We noticed that the problem was the cookie consent and that we needed to make some UX design [website related] improvements to better affect the customer behavior so that it's easier to select the preferences related to cookies. Earlier, the cookie consent banner was in the background that you could easily ignore it, and still continue using our website, but now it's more like a pop-up in the middle of the window, and then you really need to make the selections before you continue browsing our website. That has affected positively into the traffic in Google Analytics. (Int. 6)*

The IS capabilities discussed above facilitate DAC's managerial dimension for digital service development.

> *We are just improving the process; so, on ManuCo's website, you can subscribe to our newsletters, and then there, we are collecting some data of the subscriber. Let's say, being a customer or anyone, and then we are improving this process to make it, of course, easier, but also to provide better quality data. (Int. 4)*

> *We have marketing campaign related analytics, social media, and marketing cloud analytics, so my goal is to improve how we utilize data…. One area of improvement is that we collect data about customer interest, what kind of interest the customer has, for example, when the customer subscribes to our marketing communications. Then, we collect that information and, in the future, provide more personalized content to that customer's question. (Int. 6)*

The above findings revealed that the digital marketing team require support from different IS personnel (including externals) who can deploy the IS infrastructure and knowhow for capturing relevant and better-quality data from multiple sources. The data is needed for the digital marketing team to deploy different types of DAC applications mentioned above. This allows them to cater better services to their customers.

IS capabilities facilitating DAC-organizational dimension for digital service development

The case study findings show that data-driven culture is related to DAC's organizational dimension. The IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles facilitate DAC-organizational dimension for development of digital services at ManuCo.

Data-driven culture

At ManuCo, data is often an important part of customer interactions and establishing a common language with the customer regarding data is important.

> *Mostly, understanding customer cases comes from visiting the customers in the forest where the operation happens and interviewing the customers and talking about data and digital services and how they would benefit, how it would benefit their daily operations, and based on those interviews, I will draw up the requirement map for customers and prioritize what we should do next. (Int. 8)*

> *We see also the generation change amongst our customers and now with the young people, who are starting to run their companies, they know what to do with data, they want to have the figures rather than guesswork, and it's really dangerous if we don't speak the same language, because then it means that they don't want to talk with us and that is a huge risk for us and that's one of the reasons why we really need to make that change happen quickly. (Int. 9)*

According to Int.4, IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles drive the data-driven culture in the organization.

> *In ManuCo, we have this software team in the R&D team that is designing and developing software inside the machine and then there is this digital service and IT, our department that is based on the data that is produced from the machine, and then we're building applications and*

> *capability outside of the machine to enable our customers' day-to-day work. So that's why in this sense, all the capabilities that we have been talking about…is very much data based…. For example, my team will contribute more on the application and user experience side, but that is also very much driven by what kind of data we have and match that with the business understanding and customer understanding and then the data and API team are more explicitly relevant on the data topic. But then we also have the core IT that is overseeing the whole architecture and connecting with all the hardware and infrastructure as well. Then we have the project portfolio and quality analyst team to ensure that everything is going on very well. So, as you see, the whole organization, it's very much built on data. (Int. 4)*

The IS capabilities facilitate DAC's organizational dimension for developing digital services. The organization has been building DAC for the last four years for developing their digital services. According to Int.7, due to an increasing demand for different kinds of digital services from customers, developing digital services has become ManuCo's strategy for sustaining competitive advantages. Int. 7 discussed that certain markets for forest machines necessitates the requirement of specific digital services. For example, in making data available, and deploying data for creating solutions to address customer requirements has become a necessity.

> *It's at the same time not that big of a change and at the same time it's quite a big revolution in forestry [with regards to] handling data…. For example, the forest companies have been utilizing [data] almost 20 years now, so there's basically nothing new in the data content wise. But the big difference what we do now is that we actually solve a big problem for our customers. So far, all the customers have built their own solutions on how to transfer the data from the forest machines, how to extract the data, and how to transform the data in the usable format. Now, we have taken all the complexity away from the customers. We can actually provide the data already in usable format, saving a lot of time, lot of complexity, a lot of money for our customers so that they can directly integrate, and they then for example build the use cases that actually helps in their core business. For example, optimizing the wood logistics…can save huge amounts of money. (Int. 7)*

The findings reveal that the ManuCo's customers want data-driven services. The organization also aligned itself towards customers' needs. To meet these customers' needs, the organization made some structural changes, such as setting up a dedicated department for developing digital services. This helped the organizational teams and members involved in creating the data-driven culture needed for developing digital services at ManuCo.

Discussion

In this study, we examined the deployment of DAC for digital service development in a forest machine manufacturing organization. The case findings revealed that ManuCo leveraged IS capabilities to facilitate DAC's technical, managerial, and organizational dimensions. In addition, the findings show that IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles (e.g., customer orientation and IS-business synergy) are needed for facilitating DAC for digital service development. Together, DAC and IS capabilities work together for developing digital services at ManuCo.

First, we found that IS capabilities such as IS infrastructure, IS skills, and IS-enabled intangibles facilitates DAC's technical dimension for digital service development. The findings further revealed that data, predictive analytics, APIs, and data platforms are related to the DAC-technical dimension. These components help ManuCo in developing digital services. For instance, predictive analytics-enabled customer service help customers to monitor their productivity and manage their machines' health in proactive ways. Moreover, API-based data platform provides customers with access to different data, data products and data services to support their machine management. Figure 1 shows the deployment of IS capabilities and DAC for digital service development in the case organization.

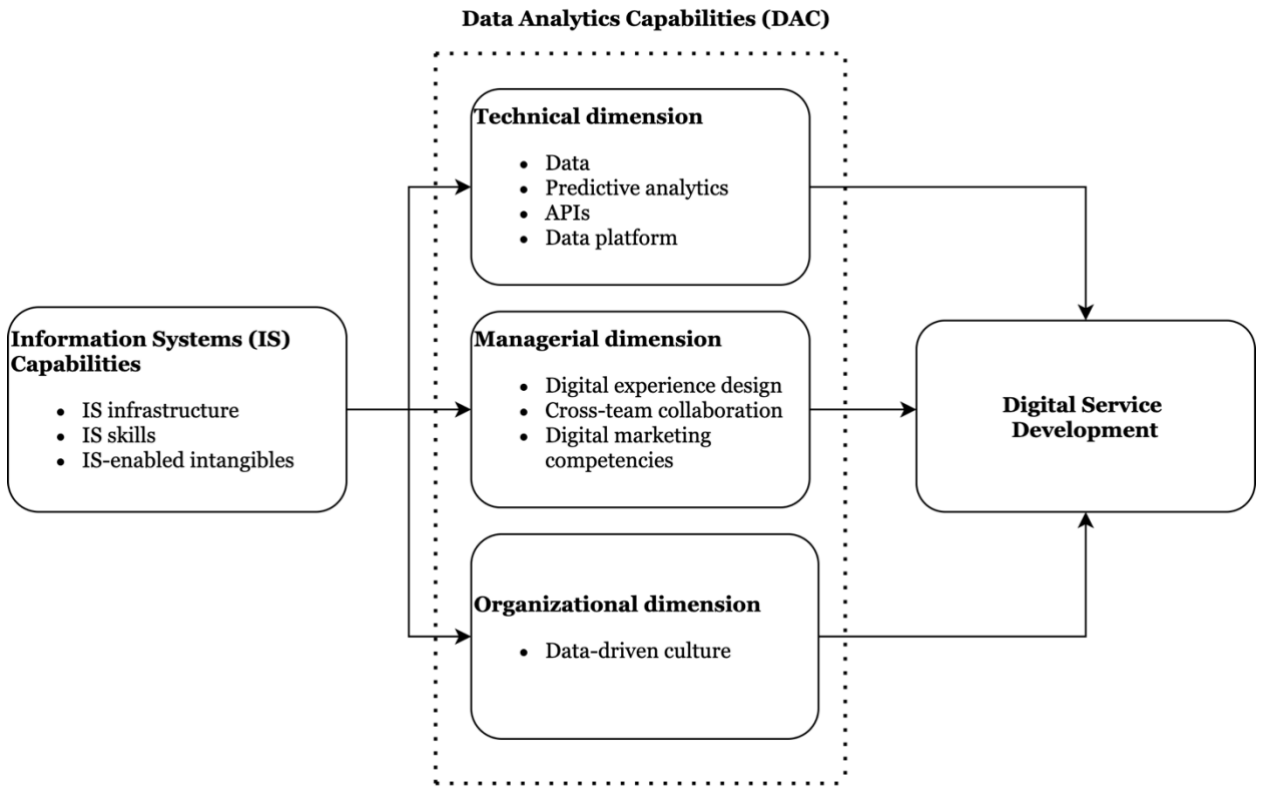

Figure 1. Deploying IS Capabilities and DAC for Digital Service Development

Second, we found that IS capabilities such as IS skills, IS infrastructure, and IS-enabled intangibles facilitates DAC's managerial dimension for development of digital services at ManuCo. Digital experience design, cross-team collaboration, and digital marketing competencies were related to the DAC-managerial dimension. Digital experience design enabled ManuCo to deliver personalized customer experience. The cross-team collaboration aligned actors and goals associated with digital services together. Whereas customer-related communications via digital means helped in generating customer understanding for personalized marketing.

Third, the findings show that IS capabilities such IS skills, IS infrastructure, and IS-enabled intangibles facilitates DAC's organizational dimension for digital service development. Data-driven culture was related to the DAC-organizational dimension. At ManuCo, data-driven culture was fostered through changes in organizational structure, hiring of expertise in data field (in-house and external), orienting the teams and members towards customers' needs based on data and digital technologies. The data-driven culture helped ManuCo to develop and deliver digital solutions to meet customer needs.

The findings in this study indicated that IS capabilities facilitates the deployment of DAC for digital service development from the perspective of DAC's technical, managerial, and organizational dimension. Clearly, ManuCo have deployed both IS capabilities and DAC for its customer-oriented digital service development to meet the needs of its customers.

Theoretical and practical implications

This study makes contributions to the literature on DAC for value creation, especially in the field of digital service development. First, the study extends the understanding of the role of IS capabilities in facilitating DAC for digital service development in business organizations. Specifically, this study enriches the knowledge on how different IS capabilities, such as IS infrastructure, IS skills, and IS-enabled intangibles,

facilitate DAC's technical, managerial, and organizational dimensions for digital service development by providing the explanation of the link between IS capabilities and DAC for digital service development.

Second, this study contributes to the DAC literature by exploring the role of different components of DAC's technical, managerial, and organizational dimensions for digital service development. For instance, data, predictive analytics, APIs, and data platform are important components of the technical dimension of DAC, digital experience design, cross-team collaboration, and digital marketing competencies as important components of the managerial dimension of DAC, and data-driven culture as an important component of the organizational dimension of DAC for developing digital services which meet customer needs.

Overall, this study strives to establish the distinction and relationship between IS capabilities and DAC in the context of digital service development addressing the call by Lyytinen et al. (2023) as an important topic in the digital era, especially, for IS curriculum development, and the requirement of skills and competencies related to IS and DAC. Our research contributes to a deeper exploration on the boundary between IS capabilities and DAC, which allows organizations to utilize IS and data-related resources efficiently, thereby, providing a clearer guidance for organizations' digital business strategy (Bharadwaj, 2013).

This study offers some practical guidelines for manufacturing organizations that seek to deploy data to improve their customer-oriented digital service development to enhance customer services. First, the findings from the study show that organizations should utilize their IS capabilities, including IS infrastructure, IS skills, and IS-enabled intangibles to help develop DAC, which could help them understand their customers better and develop digital services that could meet customers' needs. Second, organizations should develop their DAC from the three angles that were explored in this study. They should develop DAC by placing importance on the components that make up the technical, managerial, and organizational dimensions of DAC. In addition, organizations should understand the importance of IS capabilities and their association with the three dimensions in facilitating DAC for digital service development.

Limitations and future directions

This study comes with few limitations. First, a single case study was conducted in the manufacturing context in this study. Future studies could consider conducting cross-industry multiple case studies to explore DAC for value creation in digital service development. Second, the study only examined DAC deployment for digital service development. However, there are other concepts related to value creation from DAC. Therefore, future research can consider other value elements such as digital innovation, digital transformation, product development, etc. Third, this study has applied a single case study to explore how DAC could be applied in digital service development together with IS capabilities, future research could examine the configurations of DAC with other organizational capabilities for value creation and apply mixed methods or quantitative methods to understand DAC for value creation in business organizations.

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Appendix A

Interview quotes	Coding related to IS capabilities	Coding related to DAC's individual dimensions	Coding related to DAC	Coding related to digital services	Pattern or themes related to development of digital services
Statements from interviewee/secondary data sources	Identifying IS capabilities related to IS infrastructure, IS skills, IS-enabled intangibles	Identifying DAC related technical, managerial, or organizational components	The ability of an organization to deploy data-related resources	Services delivered to the customers via digital means	The identification of themes or patterns related to IS capabilities facilitating DAC's individual dimensions for digital service development

Table A. Thematic Analysis Logic