Jukka Sirkiä

LEVERAGING DIGITALIZATION OPPORTUNITIES TO IMPROVE THE BUSINESS MODEL

ACTA UNIVERSITATIS LAPPEENRANTAENSIS 923

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Abstract

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The opportunities of digitalization and the digital revolution are opening up completely new ways of doing business, producing and distributing services, and creating a significant threat to incumbent businesses that remain attached to the old business models. Expertise, business processes, and analytics are increasingly automated, and the skills and competences of employees and subcontractors are becoming increasingly important. Almost all information is going digital, services are going electronic, and data can be processed into new business. The digital transformation and disruption will lead to organizational shifts toward a more data-driven business model and processes.

The study's research focus was to identify how digitalization could influence business model and process development. The study's empirical data were collected through an online survey in 2015. The data were also collected in theme interviews and a series of in-depth semi-structured interviews with selected data-intensive Finnish companies. The data were analyzed using both qualitative and quantitative methods. The dissertation includes a collection of four mutually supportive scientific journal and conference articles. The articles are presented in the publication section of this dissertation. The first article discusses the current state of data utilization and opportunities in the Finnish water supply industry. The second article concludes the big data research by presenting the role of innovation capabilities in the big data value creation process and business model. The third article examines digital financial management innovations and digitalization opportunities from a blockchain perspective. The fourth article describes how e-service businesses use cloud-based information technologies to support virtual organization and enable different strategic choices for the business model.

The dissertation illustrates the current state of data utilization and digitalization opportunities in selected areas, and develops frameworks for further study and analysis. The leverage of digitalization is also reviewed from the perspectives of servitization and service-dominant logic on value creation. The results indicate that there is much room for improvement in the utilization of both open and big data. Data-intensive and agile management approaches definitely require new leadership and data management skills and competences. Solid and enthusiastic leadership is essential to succeed in efficiently developing data-intensive approaches and data-driven innovations in the business model.

Keywords: big data, business model, business process, blockchain, digitalization, information systems, open data, servitization, value creation

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Finally, I would like to thank all the great individuals and organizations who were willing to be interviewed for my dissertation.

Jukka Sirkiä
April 2020
Lappeenranta, Finland

To my daughter and son:
Learning and understanding is a lifelong process

Contents

List of publications

This dissertation is based on the following papers. The rights to include the papers in the dissertation have been granted by the publishers. Some papers were written in cooperation with other authors, and a statement of this author's contribution to each publication is included.

PUBLICATION I

Sirkiä, Jukka, Laakso, Tuija, Ahopelto, Suvi, Ylijoki, Ossi, Porras, Jari, and Vahala, Riku (2017). Data utilization at Finnish water and wastewater utilities: Current practices vs. state of the art. *Utilities Policy*. 45, pp. 69-75. http://dx.doi.org/10.1016/j.jup.2017.02.002

PUBLICATION II

Ylijoki, Ossi, Sirkiä, Jukka, Porras, Jari, and Harmaakorpi, Vesa (2019). Innovation Capabilities as a Mediator between Big Data and Business Model. *Journal of Enterprise Transformation*. https://doi.org/10.1080/19488289.2018.1548396

PUBLICATION III

Perälä, Kari, Sirkiä, Jukka, Kemppainen, Liisa, and Hallikas, Jukka (2017). Conference article. E-Business and Digital Processes – Blockchain in Insurance. VI International Symposium. New Horizon 2017 of transport and communications 17–18 November 2017. University of East Sarajevo, Faculty of Transport and Traffic Engineering, Doboj. pp. 685-693.

PUBLICATION IV

Kemppainen, Liisa, Sirkiä, Jukka, Jukka, Minna and Hallikas, Jukka (2017). Conference article. Virtual organizations as a strategic choice – multiple case study. The IMKSM Conference paper 2017, International May Conference on Strategic Management – Book of Proceedings. IMKSM17 May 19-21, 2017, Bor, Serbia, pp. 161-169.

Author's contribution

Jukka Sirkiä is the corresponding author and investigator in Publications I and III.

Publication I. The present author was the principal and corresponding author. The author defined the research plan, designed and implemented the survey and data collection, selected the methods, searched the literature and was responsible for the writing process. The conclusions were created in collaboration with the co-authors. The author wrote the vast majority of the article.

Publication II. The present author was the corresponding co-author. The author played a significant role in the design and idea of the article and in collecting and analyzing the data and searched the literature. The research plan, method, survey, and interviews for data collection were done in cooperation with the co-author. The author wrote important parts of the article.

Publication III. The present author was the corresponding author. The author was creating the idea and the structure for the article and searched the literature. The research plan, method, survey, and interviews for data collection were planned in cooperation with the co-authors. I wrote the majority of the article and especially enhanced leveraging the digitalization and novel technologies perspectives of the article.

Publication IV. The present author was the corresponding co-author. The author played a significant role in the research plan and research method and was co-designing the idea, structure and content of the article and searched the literature. The conclusions were reached in collaboration with the co-authors. The author wrote important parts of the article and especially reinforced the strategic thinking and digitalization perspectives of the article.

Nomenclature

Term	Definition
Big data	Big data refers to volume, velocity, and variety in data assets. Volume refers to the exponential amount of data. Velocity refers to the need to capture data at high speed in real time. Variety refers to different types of information (Laney 2001).
Blockchain	A blockchain is defined as a digital public ledger that records online events and transactions
Business model	A business model describes how a company or an organization creates, produces, captures and shares value in an economic, social, cultural or other context.
Data	Data refers to facts, characters, or symbols that represent properties of objects, events, and their environment (Ackoff 1989).
Datafication	Datafication is defined as information technology and a data-driven intelligent process (Lycett 2013).
Digitalization	Digitalization is the utilization of digital technology to change the business model and provide new revenue and value creation opportunities. Digitalization is the process of moving from traditional to digital business (Gartner, 2015).
Digitization	Digitization mainly means the process of converting analogue material, such as paper-based information, into digital form.
Emerging technologies	Emerging technologies are characterized by radical novelty, relatively rapid growth, consistency, high potential to impact the business and social environment, as well as uncertainty about growth.
E-service	The provision of a service over the Internet.
ERP system	Enterprise resource planning system

GIS	Geographical information systems.
Insurtech	Insurance technology designed to increase the efficiency and efficacy of insurance companies.
IoT	Internet of Things.
IS	Information systems.
MRR	Monthly recurring revenue.
Open data	Open data are data anyone can access, use, or share.
SaaS	Software as a service. Customers subscribe applications instead of purchasing them.
SCADA	Supervisory control and data acquisition systems.
Servitization	A process of change in which a company moves from a manufacturing or product-based business to an increasingly service-centric business model.
Smart contract	A contract that is stored, verified, and executed on a blockchain.
Smart meter	A device connected to the Internet that measures the consumption of electricity, water, district heating, or natural gas in a building.
Subscription model	A business model in which the customer must pay a recurring price at regular intervals for access to a product, service or application.
Value creation	By making better use of the resources available to organizations that increase the value of services or goods. Value can be created for customers and at the same time also for the company's shareholders.
VO	Virtual organizations and potential members of a virtual organization are perceived and treated as service providers.

1 Introduction

Digitalization will revolutionize, transform, and streamline the business model and processes. It has been suggested that the ongoing digitalization is almost as significant a revolution as industrialization, significantly changing the fabric of society as a whole (Frey and Osborne, 2013). Digitalization has enabled new ways of doing business, as well as threatened traditional ways of doing business with old operating models and legacy business processes. Digitalization and data management have great potential to revolutionize business models and provide new sources of revenue and possibly other new value-added opportunities. Despite the process of digitalization, the goals of too many companies and organizations, such as improving profitability, lowering costs, maintaining return on capital and market share, and improving profits, remain traditional and predominantly economic. For example, technology-driven innovations are transforming manufacturing and services sectors through the increasing incorporation of automated processes and artificial intelligence (AI). The business landscape is becoming turbulent across the world, and the gradual disruption of many current and incumbent business models has already begun (Weill & Woerner, 2015). In addition, to avoid confusion, the term digitization is commonly used, which mainly means the process of converting analogue material, such as paper-based information, into digital form.

Opportunities for digitalization and business model changes resulting from digitalization lead to a situation in which companies that have been operating too long in the past need to innovate their business model, and develop new abilities and skills to remain competitive in the business ecosystem. Business models and process development should be supported by information systems and automated system integrations. It is essential to share or integrate data via technology-based platforms with customers and suppliers, and produce effective integration of the use of data in value-adding processes (Peppard and Ward, 2016). Legacy and outdated systems offer weak support for integrations and real-time data sharing, and can also pose security risks. Cost savings are achieved through digitalization and automation, which greatly reduces manual work. Legacy systems and their limitations may harm a business's ability to gain a competitive advantage and even prevent business growth. Many companies still rely on systems developed almost 30 years ago. Investments that were previously seen as strategic decisions have now become part of an expensive and complex legacy (Peppard and Ward, 2016).

The business model defines how companies succeed in creating, sharing, and generating more value through their operations (Osterwalder and Pigneur, 2010). Magretta (2002) suggests that a business model answers four questions: "Who is the customer, what does the customer value, how to make a money and what is the underlying economic logic". The development of a business model is therefore significant, because different business models define different value promises and ways to generate value for a company (Wei et al., 2014). Business model innovation is one path to a competitive advantage if the

business model is sufficiently different, and existing and new competitors find it difficult to imitate (Teece, 2010).

Both sufficient analytic competences and data skills, and sufficient organizational resources are vital in developing the utilization of data. Utilizing digitalization and data may also require changes in decision-making processes. Data-intensive management demands new management practices and leadership skills, as well as data management skills. Managing the changes and challenges mentioned above requires training and new learning in data collection, storage, analysis, and reporting, as well as the skills to use data to make better, innovative, and forward-looking decisions. In addition, a data-driven organizational culture is needed to exploit the data (e.g. Shen and Varvel, 2013; Dutta and Bose, 2015).

Digitalization can be utilized to improve service-dominant value creation. Service-dominant value creation and customer thinking are now widely discussed from the perspective of service development. Vargo and Lusch (2004) argue that the shift in value creation and formation practices often involves creating value in the interaction between a customer and a service company by making better use of available resources. The services themselves do not have own value, but value is created in the cooperation networks of several actors and in the contexts of the utilization and use of services. However, the definition of customer value and the processes of value co-production are still in many ways inconceivable and are also evolving in scientific discussions. It is not entirely clear how different issues are valued in complex and multi-stakeholder networks and how these actors are involved in value creation processes. It is worth looking at the issue critically and it is important to try to understand for whom value is produced and why value is produced.

The concept of servitization can be roughly simplified to be a process of change in which a company moves from a manufacturing or product-based business to an increasingly service-centric business model which focuses on services (Vandermerwe and Rada, 1988; Kowalkowski et al., 2013). With digitalization, servitization is usually created with a subscription model that works and is billed to customers on a monthly or other time basis. Servitization can be applied in many different ways to most different industries such as music, movies, applications, books, vehicles and various products, etc. and can be billed in Euros per month for the entire contract period of the customer. Digital platforms such as Netflix and Spotify are well-known examples of them delivering music, movies, and other media as a service instead of their customers buying traditional vinyl, CDs, or DVDs etc. On the other hand, and on the contrary, there are many examples of incumbent business models that should have been renewed before digitalization brought new competitors, at least video rental companies and very traditional department stores, of which Stockmann, the most well-known branded department store chain in Finland, is currently in financial difficulties as online stores capture more and more customers and sales. In addition, new technology applications are increasingly disrupting companies and the whole industry. Incumbent service providers are easily replaced with solutions for a better customer experience. It is very common for companies to lead to failure when

technology changes. Eastman Kodak, Nokia, BlackBerry and Yahoo are just a few examples of companies that did not adapt and thus failed (Aaslaid, 2018). Later, the study returns to these perspectives in more detail and also from the perspective of the knowledge-based view (KBV) of the firm.

1.1 Motivation and background of the study

The research's background is atypical, because the entire research is undertaken alongside IT service industry business management. The research therefore mirrors the researcher's own career, practical knowledge, and experience over a long period.

Digitalization is one of the most influential global megatrends, causing major changes in business processes, strategic planning, and future skill requirements. Brynjolfsson and McAfee (2014) propose that "everything that can be digitized will be digitized and everything that can be automated will be automated." This can be taken a step further by claiming that everything that can be digitized profitably and by streamlining business processes should be digitized. This requires investment not only in information technology, but in leadership and competences. In modern working life, skills in the 2020s are widely discussed (Frey and Osborne, 2013). The importance of the customer perspective has increased with globalization and the Internet. As a business moves online, its service is also affected by sales and distribution channels, and the cost structure of the service to be sold. Dependence on information technology and data, and their associated transactions, has increased (Bhimani and Willcocks, 2014). If whole processes and work are not to be automated, the partial automation of key processes will affect many and almost all jobs. The impact will not only affect the performance of manufacturing work: Increasingly services and products will be digitized.

The research topic is relevant to utilizing the opportunities of business processes' digitalization more smoothly and gradually. The EU (2017) calls for empirical research on the exploitation of digitalization and disruptive innovations. Business processes will increasingly be digitally redesigned. It is estimated that humanity will spend less time in future on productive work. Machines and robots perform many tasks more quickly and reliably than humans. According to Graetz and Michaels (2018), the increased use of automation and robots is associated with increased labor productivity, and this may reduce the employment of low-skilled workers. Universities and teaching are changing in response to the demands for new skills due to the changes in working life and society as a whole. The research topic is very personal, necessary, and timely.

1.2 Research structure, objectives and research questions

This dissertation consists of two main parts. The purpose of the first part is to summarize how the second part, consisting of the individual articles, forms a managed and coherent whole. Part two contains the original articles. The summary consists of five chapters.

The first chapter describes the background of the research, justifies the research gap and the purpose of the research, and presents the research questions. The second chapter discusses the theoretical framework and key concepts of the research. The third chapter discusses the research approach and methodological choices used in the study, and examines the implementation of qualitative analysis. Chapter Four consists of abstracts of the publications, their key results, and their relation to the whole. Chapter Five presents and summarizes the discussion, results, and conclusions. Finally, the limitations of the study and topics for further research are evaluated.

The objective of this study was to find out, through research questions and reflections on published articles, how the leverage of digitalization can improve business models to better serve customers, prolong customer relationships and generate better returns for the company. First, the current state of digitalization and data utilization in the selected and traditional industry (basically a monopoly industry) has been investigated, and an extensive survey has also sought future opportunities to develop the business model with utilization of digitalization and data. Second, the impact of competencies and innovation capabilities on (big) data utilization in the value creation process has been studied, and two articles have considered how the implementation of new technologies can streamline the business model and make available new services independent of place and time.

From the point of view of the research gap, the literature on the evaluation of digitization and data utilization can be found quite well, but the utilization of digitalization in the selected, water supply industry has been relatively little studied and the published article was followed with interest by experts in the field. Second, the role of innovation capabilities as an intermediary between big data and business models is a relatively new topic in research, and the results of the research appropriately complement this area. Streamlining the business model of novel technologies such as blockchain solutions in the insurance business and enabling virtual organizations through digitalization has not been particularly much studied in the past.

The aim of this dissertation is to provide answers to the following questions and the primary research question (RQ) is: How can the leveraging of digitalization improve the business model? This issue is focused on through the research sub-questions found in detail in Figure 1.

Figure 1 shows the progress of the research toward the completeness of the research dependencies between articles through the research questions. The dissertation is structured as follows and the research responds to the following questions in Figure 1.

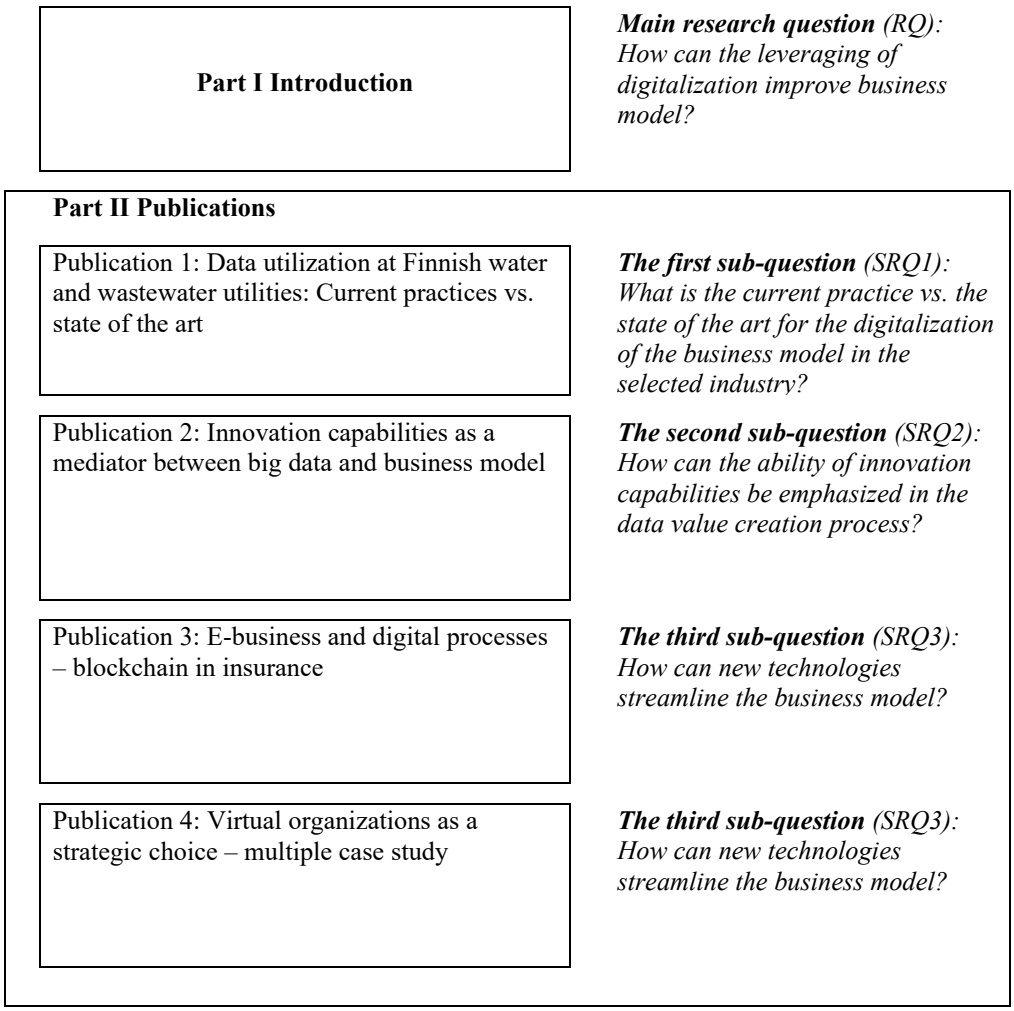

Figure 1. The structure of the dissertation

1.3 Research process and philosophy

The whole research process began in March 2014, and the decision on the right to undertake postgraduate studies was received on April 10, 2014. In the fall of 2016, a major review was made of the research plan according to the requirements of the research. The research work started from the perspective of the business benefits of open data. In

the context of the major review, the research was extended to the benefits of digitalization in the development of the business model and processes, especially taking into account open and big data. In October 2016, the right to undertake postgraduate studies in economics alongside postgraduate studies in technology was recognized by LUT University.

Research philosophy is understood as the philosophical assumptions a researcher has in relation to their research. Underlying assumptions affect research and should therefore be identified well (Creswell, 2013). With regard to research philosophy, the researcher can be identified as a practical expert. The research's philosophical trends can be considered moderate constructionism and naive realism.

According to Järvensivu and Törnroos (2010), moderate constructionism takes better account of multi-threaded realities and alternatives in which e.g. case studies are addressed. Moderate constructionism produces critically new knowledge. In line with the division proposed by Järvensivu and Törnroos (2010), the philosophical approach of this study is mainly moderate constructionism, combined with naive relativism.

1.4 Research design and methods

There are three main approaches to conducting research: quantitative, qualitative, and mixed methods (Creswell, 2013). Mixed methods research (MMR) combines qualitative and quantitative research methods and approaches. Johnson et al. (2007) claim that the mixed methods research movement produced a third research paradigm which offers a good alternative to purely qualitative or quantitative research. Mixed methods research has become increasingly popular in the last 25 years (Creswell, 2015).

The use of mixed methods, especially in business research, can play an important role in the development of the field, because the results of different methods can enrich understanding of various business issues and problems. Mixed methods research can bring added value and contribute to the development of research in various business areas (Molina-Azorin and Cameron, 2015).

In using both quantitative and qualitative approaches, mixed methods research affords a better understanding of the research problems and phenomena than would be obtained by either of these approaches alone (Creswell and Plano Clark, 2007). The researcher should decide which research design best supports the research being conducted. For the purpose of this research, the research design and methods with the best solution and judgment for the problem were selected in each case.

Publication I explored the data utilization at Finnish water and wastewater utilities. The publication also explored the current state versus the state-of-the-art utilization of data. The topic was explored through a literature review and a large web-based online survey (Webropol tool), conducted by a Finnish water utilities researcher.

Publication II examined the role of innovation between big data and business models. The research was based on the existing literature and in-depth case interviews. The design science research method (DSRM) approach defined by Peffers et al. (2007) was used in this paper.

Publication III surveyed the added value blockchain technology could produce in e-business and the increasing understanding of blockchain technology. The study the question through a literature review and an empirical blockchain pilot project. The design thinking method was used as a working method in the blockchain solution pilot project.

Publication IV examined and illustrated how a virtual organization could be configured using new information technologies. The qualitative multiple case study approach was chosen to examine how virtual organizations could be configured alongside information technologies to produce e-accounting services, how they would operate, and what the challenges of strategic management in a virtual context would be.

Rigor is a key element of the research process. The entire research process of the dissertation is designed with well-grounded research questions and approaches, literature reviews, surveys, in-depth and semi-structured interviews, and a pilot project. Relevance has been considered an objective in accordance with a rigorous procedure. Some of the articles published in this dissertation have been widely read, and were the subject of good discussion and source citations in other research projects.

1.5 Data collection and analysis

The research data were collected using several methods. The major academic literature databases (Ebsco, Google Scholar, and Scopus) were important sources. All the dissertation articles used a literature search and the University Science Library books and information service.

For Publication I, a web-based online survey was implemented using the Webropol query system. An online survey was sent to 314 water professionals working at Finnish utilities and a total of 150 utilities in February 2015; altogether, 113 completed questionnaires were received. The collected data were analyzed in Excel data analysis, as graphs, and in SPSS statistical analysis software. Data reliability was tested with SPSS software.

For Publication II, data were collected through personal and semi-structured interviews in March 2016. The data were collected from three different companies. As orientation material, we sent a set of preliminary questions to the interviewees before the interviews. The duration of each interview was around two hours, and all the interviews were recorded and noted. Both verbal and written feedback was sought after the interviews. The notes were subsequently analyzed and outlined in memos. Unclear points were checked in the recordings. The interviewees reviewed the memos.

Publication III was a case study with a pilot project. Data and practical case information were from a proof-of-concept (POC) city of Imatra pilot project case, based on decentralized ledgers. The pilot project's aim was to replace specific parts of traditional insurance processes to shorten the process cycle and reduce the risks associated with insurance processes.

Publication IV was a qualitative multiple case study. The data were collected in a series of in-depth and semi-structured interviews, which were transcribed and analyzed with the team of researchers using an inductive analysis method. The data consisted of four interviews. One interview was conducted with each company, except for case Company A, where two were conducted. The duration of each interview ranged from 50 minutes to 1 hour 15 minutes. The interviews were conducted between March 2015 and March 2017. The data collection continued until data saturation was reached. The qualitative data used were transcripts of the recorded interviews. The data were analyzed throughout, using a systematic two-phase analysis procedure. The inductive analysis method included two coding phases from first-order concepts to second-order themes. To increase the objectivity and reliability of the analyses, the first-order concepts were categorized by a research team consisting of three researchers. The first-order concepts were elicited using an open-coding technique. The second-order themes were based on joint axial coding by the above-mentioned team.

Table1. Publications, research methods, analysis used, outcomes and contributions

Publication	**Research methods**	**Analysis used**	**Outcomes and contributions**
Data utilization at Finnish water and wastewater utilities: Current practices vs. state of the art	Literature review and large online survey of Finnish water utilities.	The collected data were analyzed in Excel data analysis, as graphs, and in SPSS statistical analysis software.	Utilization of data in business and service development in a traditional industry. Utilization of open data and big data in the water supply industry offers many opportunities to develop a business model by measuring the customer experience, developing online services and communications, utilizing smart meters to detect water leaks and move towards preventive maintenance.
Innovation capabilities as a mediator between big data and business model	Existing literature and in-depth semi-structured case interviews. The design science research method approach was utilized.	Interviews were recorded and noted. Verbal and written feedback was sought. The notes were analyzed and outlined in memos and recordings.	As the case companies in the study were data-intensive companies, the degree of utilization of big data was low for these as well. In the article, the researchers have presented a multi-disciplinary framework that explaining the role of innovation capabilities as a mediator between big data and the business model.
E-business and digital processes – blockchain in insurance	Literature review and an empirical pilot project (POC). The design thinking method was utilized.	Analysis was conducted based on the source literature, the design of the practical pilot project, and the data obtained from it.	How new emerging technologies such as smart contracts and blockchain can be applied while creating new growth as well as less fraud-prone new business to gain a competitive advantage. New technologies requires decisions on new IT investments, the various processes of the business model can be implemented in a more streamlined, cheaper way and increase profit, reducing manual work and reduce errors as well as improve security.
Virtual organizations as a strategic choice – multiple case study	Qualitative multiple case study, using a series of in-depth semi-structured interviews.	Data were analyzed throughout, using a systematic two-phase analysis procedure. The inductive analysis method included two coding phases, from first-order concepts to second-order order themes.	The publication highlights how new and virtually organized business models can be promoted or implemented using new technologies. Digital platforms and service providers enable virtual organizations and provide flexible strategic choices for employees, as well as a broader opportunity for subcontracting.

2 The Digitalization of Business Processes

Digitalization, including the Internet of Things (IoT), is a very significant and growing global megatrend, affecting every industry. It will bring major changes to business models, corporate strategy, and employee competences and skill requirements in the near future. It is forecast that the ongoing digitalization will be as significant a revolution as the social change brought by industrialization, and its impact on the division of labor and employment (Frey and Osborne, 2013). Digitalization and the digital revolution are launching new ways of doing business, as well as posing a threat to frozen businesses that persist in relying on old business models. In future, expert work and analytics will increasingly be automated, and the importance of new skills will continue to grow. Increasingly, all the information stored and shared will become digital, and it will be possible to use data to develop new business or sell data directly.

Despite the process of digitalization, the objectives of the company, such as the improvement of profitability, the development of quality, market share, return on capital, and the improvement of the result, are traditional. Business processes, especially orders, invoicing, payment transactions, banking and insurance, distribution channels, and various directory services, are developing in leaps. Digitalization advances and collaborates with organizational customer relationship management (CRM), sales, orders and marketing, process automation and robotic process automation (RPA), document management, maintenance data, and information management. Bharadwaj et al. (2013) state that traditional business and digital business strategies will converge in the near future. The digital business strategy is a management challenge that requires managers to understand data transparency, strategic implications through digital transformation, and the growing challenge of ecosystems. This requires entirely new forms of digital collaboration (Bharadwaj et al., 2013). According to Dinter et al. (2010), information logistics will provide added value, not only benefits, throughout the enterprise network, as well as the reduction of costs and risks, and the reduction of harmful errors. Bharadwaj (2013) maintains that over a period, as businesses and industrial processes become increasingly digital, and increasingly based on knowledge and communication between systems, the digital business strategy will become the only strategy.

2.1 Ecosystems

The concept of the digital business ecosystem (DBE) was first introduced in the field of business research in March 2000 during the Lisbon process and summit (Nachira, 2002). The European Union finances the digital business ecosystem environment, which provides businesses with a structure. SME software companies code software to act as components of the ecosystem. The goal is to improve the potential of SMEs to compete with larger and global software companies, and this goal has continued to evolve (Nachira, 2002). A known ecosystem in the industry is RosettaNet. RosettaNet is a non-

profit consortium of major software, electronics, telecommunications, and logistics companies. The companies work together to create an industry standard for the sharing of business information. The RosettaNet standard gives message guidelines, and it is based on XML interfaces for business processes to facilitate integration between companies. Standards are primarily applied in the supply chain, but there is also scope for manufacturing, product, and material information, and data (RosettaNet, 2016). In addition to the above, several new digital business ecosystems have emerged, such as the very recently established and media-published ecosystem for real estate data, which seeks to improve the productivity, smart buildings, and environmental friendliness of real estate. For example, companies and organizations such as KONE, Nokia YIT, Caverion, Halton, Netox, and VTT in Finland have established a real estate data ecosystem and platform called the KEKO ecosystem which different actors can join. The ecosystem enables digital solutions that can leverage and combine both the property's own and external data.

The Internet of Things (IoT) ecosystem enables a range of collaboration. Some innovative companies are collaborating with academic and industry leaders to develop effective integrated Internet solutions. As more and more devices connect, new opportunities for smart product innovation open up (Attaran, 2017). Cheaper Internet and sensor devices (IoT) will bring new opportunities for business processes, as well as new challenges with data management. IoT solutions are used by three major sectors of the economy: businesses, government, and consumers. Companies use Internet solutions most, because they have the potential to reduce operating costs, increase productivity, expand into new markets, and develop new products (Meola, 2016). Various definitions and descriptions for big data have been suggested in the literature (Ylijoki and Porras, 2016). According to Mayer-Schönberger and Cukier (2013), there is no clear concept and definition of big data. These researchers have therefore developed a new term, datafication, in the context of big data. According to the Open Data Institute (2016), "open data is data that anyone can access, use or share." When open data and non-personal information is provided by major companies, government, or municipalities, it can enable different ecosystems, SMEs, and citizens and researchers to develop resources, such as online services, that make good improvements for their communities.

2.2 Data-driven approaches

Data-driven companies from varying industries have been found to perform better than their competitors (McAfee and Brynjolfsson, 2012). Water and wastewater utilities could benefit from a data-driven approach compared to traditional approaches. Smart water consumption meters could provide customers with new and very important services, such as automatic leakage alarms. Britton et al. (2013) have explained that smart meters can easily detect leaks.

Another sector in which water utilities work is water safety planning (WSP) and risk management for drinking water suppliers. Thompson and Kadiyala (2014) have presented

and encouraged a continuous water quality monitoring system. Changes in technology and software architecture require new skills in the field of data management. Existing and legacy information systems and data management platforms will require significant changes due to the increased volume, variety, and velocity of data. Additionally, an analytics platform is required to derive value from data. Analytics is essential to gain value from big data. The results need to be presented in a visual and easily understood form. All these fields require expertise in analytics, software systems, software engineering, and cloud computing. These skills need to be found either inside the utility or to be bought from a reliable service provider (Gartner 2015).

Plant management, planning, decision-making processes, and data-intensive approaches offer many new opportunities for water utilities. Utilizing big data requires a data-driven organizational attitude. Other studies have reported challenges in the area of decision making, such as the lack of a data-driven organizational culture (e.g. Shen and Varvel, 2013; Dutta and Bose, 2015). The successful utilization of big data requires responsible leadership (Davenport 2014). McDaniel and McLaughlin (2009) have strongly raised the issue of security in smart grids, and their research also addresses the water supply industry. In their view, software vulnerabilities are especially attractive to hackers, who may attempt to profit financially or simply cause damage by attacking infrastructure management systems. Similarly, privacy issues must be dealt with.

2.3 Defining big data

The notion of big data has attracted huge attention in recent years. According to Laney (2001), the 3V definition contains three dimensions of big data: volume, velocity, and variety. These dimensions are widely used in big data. Volume is linked to ever-increasing data volumes. Velocity refers to the ability or need to capture and process big data in real time. Variety includes different types of data (unstructured or structured), such as different transactions, social media, and video. In recent years, researchers and experts have developed numerous big data definitions, and several vendors have developed their own concepts of big data, as well as the 4V and 5V definitions of big data, which also take into account the veracity (data reliability) and value derived from data. Figure 2 shows Laney's (2001) definition of big data.

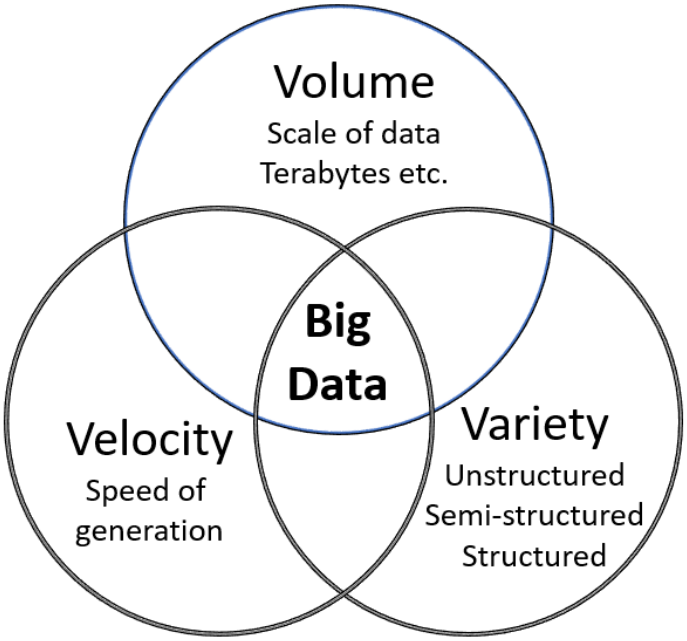

Figure 2. A visualization of Laney's (2001) 3V definition of big data.

In recent years, business model innovations have given rise to several companies competing against traditional business models. Why the amount of data is growing so quickly is a complex issue. Of course, there are many types of data-generating source, such as social media, the entertainment industry (Netfix, HBO, Viaplay etc.) and advertising, security systems and security cameras, access control, productivity-based information like computer files and databases, and various log files from embedded devices and computers. This results in an increase in data as traditional media is digitized, and video and audio resolution are constantly improving. The utilization of data from a variety of sources and technologies that produce business-useful data has become a new business model (Hartmann et al., 2016).

More growth comes from the many "embedded devices" on which we increasingly depend. Embedded devices, which include RFID readers, smart meters and sensors, home appliances, digital toys, cellular networks, smart cars, and vending machines, are producing more and more data as they interact with cloud-based (public, private, or hybrid) Internet applications. IoT devices are now broader and becoming cheaper by the day. Sensors and readers use less and less power, are faster and operate over longer distances, and can withstand interference. This means better system and service

performance, even without programming (Attaran, 2017). Concerning big data, all data sources will provide a better perspective of the business and allow an understanding of how data affects a company's business model. Traditionally, data sources consisted of structured data, managed by the company in a relational database. However, data must now consider a much wider set of data sources, including unstructured sources.

2.4 Defining open data

Tim Berners-Lee (the inventor of the web and originator of the linked data project) has defined a widely known five-star deployment scheme for data. This data system is cumulative. Each star in the next category assumes that the data meets the conditions of the previous steps. Tim Berners-Lee suggests five stars for linked open data from a social perspective and five stars for open data engagement. Both these "star systems" have been widely adopted and are a real success in the open data ecology. However, there are currently no clear guidelines for an open data portal that aims to promote data reuse and improve data quality. Tim Berners-Lee's five-star rating for open data is as follows:

★ Available on the web (whatever the data format – such as pdf format), but with an open license or as open data

★★ Available as structured and machine-readable data (such as Excel format)

★★★ A non-proprietary form is used (e.g. CSV format instead of Excel format)

★★★★ All the above, plus the use of open standards from W3C and Uniform Resource Identifiers (URI) to express things to enable people to point to open data

★★★★★ All the above, plus the provision of links to other similar materials in the same context

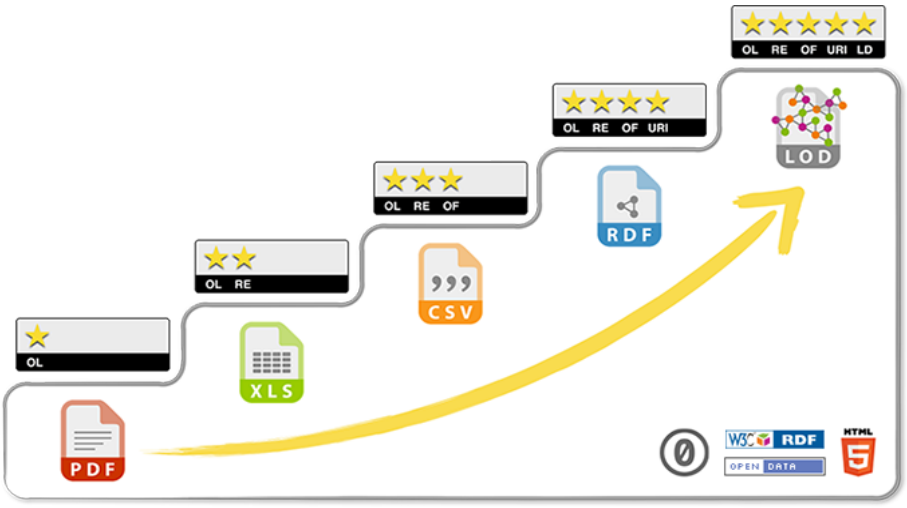

Figure 3. Five-star deployment scheme for open data, from Berners-Lee (2006).

The Open Data Institute (2016) suggests that "open data is data that anyone can access, use or share. When big companies or governments release non-personal data, it enables small businesses, citizens and medical researchers to develop resources which make crucial improvements to their communities." Government, municipalities, and the public sector are increasingly producing and publishing open information for everyone to use. In the European Union, for example, the INSPIRE Directive (Directive 2007/2/EC) makes spatial data available. Social media channels also increase the amount of available information. These are mainly used by different companies for customer service and feedback, but they also offer potential for data collection. Big data and open data are partly overlapping concepts. Several open data sources actually produce big data. Similar to an open data license, some organizations publish big data under that license.

2.5 Importance of data strategy

Davenport (2007) suggests that companies need and benefit from a data strategy and governance to gain a competitive advantage over other companies. On the other hand, Rantala et al. (2018) highlight challenges related to business development and strategy in utilizing data to support strategic decisions. Systematic business development requires the creation of a data strategy. A data strategy is a strategic plan that is designed to improve corporate practices in effectively acquiring, storing, managing, sharing, analyzing, and utilizing data in accordance with identified business needs. Adapting to previous definitions, a data strategy can also be understood as a plan and vision for utilizing data in a business model. A data strategy considers data an important corporate asset, and it provides a sustainable competitive advantage. It is essential for startup

companies – even if they do not know it. In future, data can serve to open additional and new potential monetization channels. Unlocking the value of data is a challenge because of the volume of data and the resulting challenges, associated with collecting, organizing, and activating data. Deploying a data strategy can help companies overcome these challenges and utilize resources efficiently, while accessing their data's value. Utilizing the growing amount of data brings companies new opportunities to develop current and completely new business models.

The company's data strategy provides common goals for all projects and projects. Clearly defined goals in the strategy ensure that data are utilized both efficiently and effectively. With a data strategy, every unit, department, and individual has guidelines and instructions to follow, related to the recommended format and use of data. Eliminating data silos also makes data more accessible, and promotes cooperation between different units and departments within an organization. One of the goals of a data strategy should be to integrate all data within an organization into a single system that people across the company can use. As the business environment is constantly moving, and there is a risk that the work done on the data strategy will become obsolete, it should be an ongoing process or action plan that is updated and reviewed semi-annually, for example. A data strategy can be used to create and plan IT investments that maximize the return on investment from data (Davenport, 2007).

A data strategy is often confused with data governance. Davenport (2007) states that they are separate but closely related. The scope of a data strategy is broader, including data management and data governance. Data governance refers to setting standards and rules for how individuals and groups within an organization manage data – for example, in compliance with security rules. Data governance is an important component in any company data strategy, and it determines how data are used, protected, and managed as an asset. Data governance can be understood as the defined collection of policies, processes, and technology decisions to create and achieve a consistent use of data. Wende (2007) argues that data governance is not just a subset or subheading for IT governance, and that it needs more "close collaboration among IT and business professionals who understand the data and its business purpose."

Overall, data strategy and data governance should serve as an encouragement, and the goal should involve all the company's employees to "efficiently manage data properly and incorporate them into decision making processes" (Buhl et al., 2013). Research into the data governance and data strategy, as well as an awareness of the need for it, is constantly growing in information systems (IS), as more companies today regard data as a valuable asset. All in all, several studies help us to understand and develop corporate data governance and data strategy (Khatri and Brown, 2010; Tallon et al., 2013).

2.6 Digitalization and servitization

Digitization creates new opportunities to generate value and revenue and this effect is enhanced together with the leveraging of servitization (Parida et al., 2015). The concept of servitization was originally introduced in 1988 by scholars Vandermerwe and Rada (1988). According to them, manufacturers needed a way to differentiate themselves from their competitors and, most importantly, to increase the degree of differentiation and increase the customer base. Servitization can also include complete product and service systems for customers (Kastalli and Van Looy, 2013). The first applications of the servitization can be traced back to the 1960s, when Bristol Siddeley and its successors Bristol Siddeley and Rolls-Royce offered "Power By The Hour" concept for their Viper aircraft engines, where operators paid a fixed hourly rate to the engine supplier. Instead of buying an engine, you bought the performance and energy produced by the engine, which gives customers better forecast accuracy and frees them from the cost of capital. Vandermerwe and Rada (1988) suggest "Servitization is happening in almost all industries on a global scale. Swept up by the forces of deregulation, technology, globalization and fierce competitive pressure, both service companies and manufacturers are moving more dramatically into services".

According to Neely et al. (2011) servitization creates a foundation and helps many companies' revenue to relative stability. The company's sales revenue does not depend on the quantity of products manufactured. There is therefore a need for a better understanding of the transformation into services, especially with to the business models that best enable companies to change and capture value by providing services.

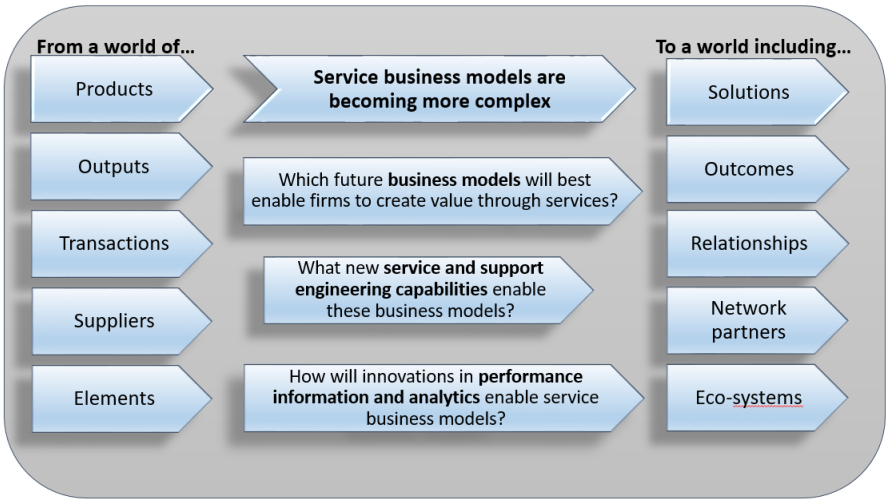

Figure 4. The shift from manufacturing towards collaboration and services, modified from Neely et al. (2011).

Saccani et al. (2005) notes that the manufacturing business model has several options to shifting their business model towards servitization, such as providing various after-sales services, continuous condition monitoring and diagnostic or performance measurement systems. Product maintenance brings a constant source of income to the manufacturer. In addition to this, there have been advanced services, which in many cases are delivered with the subscription business model where the consumer pays for the end result - such as the time-based use of a particular product or, for example, printer-printed pages. It is also possible to provide technical support by phone and email or on-site support and maintenance. In addition financial services, an extended warranty or training, consulting and webinars may be sold as part of an annual contract. This succeeds in converts delivery and project-type invoicing towards Monthly Recurring Revenue, commonly abbreviated as MRR invoicing and predictable cash flow. Alexander et al. (2002) suggest that after-sales sales can generate more than three times the total turnover of normal product sales over the life cycle of the product, and also generate higher profitability than product sales. The subscription model is growing fast. Growth is driven by a number of factors, including advances in digitalization and the subscription model improves incentives on both sides of the equation by providing affordable services to customers and stability for businesses and recurring revenue.

Digitization and advanced manufacturing techniques make it possible simultaneously tailoring and personalizing a product or service for customers (Koc and Bozdag, 2009). On the other hand, if the product manufacturer modifies the business model to be a service provider, then it is their responsibility to keep the service up and running. Of course, the service is only a constant source of income as long as your service is reliable and continuous. The Internet of Things (IoT) and embedded sensors play a very important role in servitization. The sensors in the devices are able to send information to the manufacturer or service provider about the condition of the parts and the overall product, which should mean solving the problems before the real problems arise. If something breaks unexpectedly, the device automatically notifies the service provider or manufacturer.

Digital platforms, platform economics and software as a service (SaaS) are closely linked to servitization, and these technologies enable companies to offer new ways to offer their products and services to service users regardless of location and time. On the other hand, purchasing services is often referred to as XaaS acronym, Everything as a Service or Anything as a service. XaaS business model is a global megatrend and defined widely. In general, it means that everything can be a service. Brito (2017) defines XaaS as “the concept translates as everything being abstracted as a service”. Subscribing to a service is indeed an alternative to buying or investing in a product. In the SaaS model, the software is delivered to the customer as a service over the Internet and using a specific pricing method such as pay-as-you-go or subscription-based payment (Stavrinides and Karatza, 2020). Services can also be delivered to customers via the Internet, enabling unhindered access for all. SaaS allows the business model to self-service on demand. On-demand self-service models create new digital services for consumers such as Spotify for music, Netflix for movies, or Uber offers a taxi service. SaaS also enables location-

independent customers, broader access to customers and good scalability - as it seems Facebook, Gmail or WhatsApp work with unlimited resources. In addition to the SaaS acronym, servitization is associated with acronyms such as DaaS (Data), IaaS (Infrastructure), PaaS (Platform) and MaaS (Mobility), etc. DaaS provides data as a service, IaaS provides virtualized computing resources, PaaS offers hardware and software tools over the internet and MaaS promises ability to optimize transportation to meet demand - offering the right vehicle at just the right time.

Understanding emerging technologies depends on and varies from the scholar's perspective. Rotolo et al. (2015) defines emerging technologies through five characteristics features: anomalous novelty, relatively rapid growth and prominent socio-economic impact, coherence, uncertainty about the future. Some researchers may see the same technology as emerging technology while others see it as a natural extension of current technology. Emerging technologies can be anticipated and predicted in a variety of ways, such as by the number of different publications and patent applications data in the industries to be investigated for a given year (Bengisu et al., 2006). It is predictable that with digitalization and servitization, increased self-service and subscription business models will bring in the future more and more novel, interesting and fast-growing emerging technologies to consumers. Emerging technologies have always played an important role in manufacturing just like in the industrial revolution. The adoption of emerging technology shows which company or service rises to the top. Companies ultimately choose technology that streamlines processes, optimizes sales, and improves company performance. The dissertation articles have highlighted and discussed several emerging technologies, digital platforms such as Netflix, IoT in a broader role, Smart meters, GIS platforms, Smart Contracts and Blockchain technologies.

There is also a need to consider the challenges of moving to servitization, not just the benefits and the opportunities it offers. Neely (2008) argues that a study of over 10,000 companies in 25 countries, highlights and analyzes that traditional product based companies that have been servitized generate better revenues than traditional manufacturing companies, but at the same time they achieve lower net profit margin than pure manufacturing companies. Also, the number of reported bankruptcies of companies that have moved to the servitization business model is higher compared to companies that have not moved to the servitization model. An important note regarding this warning is that developing servitization takes time and resources, and this change will not happen overnight. In the servitization model, a lot can also go wrong if pricing, product or service, positioning, or other incentives are not consistent. When a manufacturing company makes the decision to shift to a servitization model, then companies face challenges mainly because the service culture is very different to a traditional production culture. Service design are different from product design, and it requires a change in the company's philosophy for a change or implementation of this model to succeed. Industrial services companies are considering a change in business model to servitization in pursuit of sales growth (Kohtamäki et al., 2013). However, uncertainty in profitability is one additional challenge for companies moving to a servitization business model. Outsourcing of non-critical services can also be considered in the production of products and services, but

there are also challenges in maintaining customer relationships (Kastalli and Van Looy, 2013). In addition to this, the literature refers to the cognitive and cultural bias of product-centric practices that occur at all levels of the organization and especially in the sales process. Salespeople accustomed to selling tangible and expensive products find it difficult to sell intangible services (Gebauer et.al., 2005; Oliva and Kallenberg, 2003).

There are number of added values and benefits for companies adopting a servitization model, one of the most important of which is to meet customer requirements, which will ultimately lead to longer customer retention and strengthen that product-service providers will serve their customers for more years than just product vendors (Kastalli and Van Looy, 2013; Vandermerwe and Rada,1988). A business cannot just rest on its laurels and assume that production and product sales alone will sustain the business. Customers are becoming more demanding and this creates needs for additional services that can meet the requirements. In the servitization business model, customers pay only the value they receive, while the supplier grows a profitable business through continuous additional revenue. In addition, the manufacturer can gain useful insights into future research and development processes by analyzing the data and performance sent by the products delivered to the customer, and then using this data and striving for continuous product improvements.

3 Theoretical Background

This chapter summarizes and focuses on the research's theoretical background.

3.1 Business and organizational analysis frameworks

Penrose, whose 1959 book "The Theory of the Growth of the Firm" introduces concepts that later influence the modern, resource-based view of the firm (RBV). Her view was that company experience, managerial leadership skills, and technological expertise were key to the success of a company. According to Penrose, firms were administrative entities that controlled potentially valuable resources. The purpose of Wernerfelt's (1984) RBV framework is to combine the external and internal views of previously developed models. In the RBV, resources and capabilities are the key concepts that constitute a company's competitive edge. Wernerfelt also explores the relationship between resources and profitability. RBV publications and literature focus mainly on the internal resources and capabilities that support strategy development. The RBV model shows that companies in the same industry can choose a completely different organizational structure but still thrive (Wernerfelt, 1984; Barney, 1991).

A company's competitive advantage is the result of its valuable and unique resources (Gooderham et al., 2004). The RBV assumes that companies are the sum of their resources, and if these resources are valuable, rare, inimitable, and irreplaceable, a competitive advantage can be obtained. The more a company's resources are the basis of its success, the more the company depends on them (Teece et al., 1997). Teece (2010) explains that dynamic attributes are a means to integrate and shape internal and external competences in a rapidly changing environment. The RBV framework outlines how a competitive advantage can be gained by focusing on the development of an organization's strengths (Døving et al., 2008). The RBV model also recognizes that the limited capabilities and resources of small businesses require them to purchase resources from companies as outsourcing services (Benett and Robson, 2003; Kamyabi and Devi, 2011). In the early stages of a business, entrepreneurs need a lot of outside professional advice (Bennett and Robson, 2003). Startup companies do not yet have the necessary skills and competences, so they use external consultancy services (Dyer and Ross, 2008; Devi and Samujh, 2010).

According to Barney (1991), the resources of an organization should be valuable, rare, imitable, and in no way substitutable for these factors to provide a source of sustainable competitive advantage (commonly known as VRIN criteria). The resource-based view implies that organizations need to develop unique company-specific core competences to help them outperform their competitors by doing things differently.

The selected resources can give the company a clear competitive edge. These resources have "VRIN" characteristics that can be found by focusing on four essential qualities.

- **Value**: Resources that generate direct value provide a competitive advantage.
- **Rare**: Unavailable to other competitors.
- **Imitability**: Not easily implemented by others.
- **Non-substitutable**: An ideal resource cannot be substituted

Barney (1991) evolved the VRIN framework to a broader VRIO framework. The letter O (O means Organized) refers to an organization that can utilize a resource or capability. Resources that meet all four of these criteria can give the company a competitive edge. The VRIO framework is important in analyzing and comparing internal resources, and a company's ability to leverage those resources to gain a competitive advantage. The VRIO model, or the identification of resources that provide a competitive edge, is one of the models used in strategy development. In a nutshell, it is the job of a company to find, develop, and utilize the most valuable resources in its strategy. Resources are used to gain a competitive advantage and at best, a sustainable competitive advantage. Companies that compete for a sustainable competitive advantage cannot copy or imitate. A competitive edge is not eternal: It can become a weakness as the business environment changes.

3.2 Knowledge-based view of the firm

An organization can be understood as a wide range of organizations, both private and public, and as a network of interactions with a common goal. The assumption of knowledge-based management of the firm is based on the existence of a certain amount of predictability (Snowden and Boone, 2007). The knowledge-base of organizations serves as a source of value creation of the firm, and its basis is built on the strategy and goals of the organization. The primary role of an organization is to coordinate the activities of individuals and other resources of the company. The goal of knowledge-based value creation is to integrate experts 'knowledge into services and products or combinations of these. An organization's performance is linked to how it manages and increases its understanding of the operating environment and the future needs of customers. The resource-based model can be extended with the idea that the internal conditions of companies are ultimately created through the possibilities of the environment. On the other hand, it should be remembered that in addition to external opportunities, there are also external threats (Barney, 1991).

The knowledge-based view (KBV) is a further refined from the resource-based view (RBV) (Kogut and Zander, 1992; Grant, 1996). Knowledge is seen as a strategic resource that does not depreciate in the way traditional investments are and can generate growing turnover and earnings. Proponents of the theory believe that knowledge-based resources are difficult to copy from others, knowledge and capabilities are key factors for sustainable competitive advantage. Knowledge is built through organizational individuals and includes organizational culture, identity, practices, data and information systems. In the management literature, the perspective expands the resource-based view (RBV),

originally promoted by Birger Wernerfelt (1984) and later by Jay Barney (1991) and other researchers. KBV of the firm brings a conceptual lens to many areas, including human resources, organizational culture, innovation, and information systems (Bontis, 2001). The nature of most knowledge-based resources is largely dynamic and intangible and related to learning organizations. KBV also provides a diverse theoretical foundation for scholars in organizational learning and intellectual capital.

The decision-making potential of an organization is based on the ability to gather and transfer information within the organization for decision-making (Barney, 1991). It can be stated that in a company, the value of information is realized when it is shared and utilized. One of the key challenges in managing a knowledge-based firm and work is management communication, interaction, and the principles for directing work (Heaton and Taylor, 2002). This has contributed to changes in organization and an increase in self-directed work, decentralization of decision-making and responsibilities in the organizational structure (Greenberg and Baron, 2003). In the future, more and more often, employees will also be co-owners in smaller companies, and the number of remote works and short-term gig jobs has increased, and the platform economy is growing in terms of employment. Utilizing the virtual organization of work, the new information technology is described in more detail in one dissertation publication. Work is no longer an obligation but often a privilege.

Proponents of the knowledge-based view claim knowledge as the company's most significant resource. Barney (1991) notes that competitors have difficulty copying knowledge-based sources, and capabilities and knowledge bases are key factors in competitive advantage. Knowledge is seen as a strategic resource that does not deteriorate or depreciate compared to the economic factors of production. As a critique of the subject, knowledge and knowledge-based resources require constant effort, ongoing training, and enthusiastic leadership on the subject - an advantage that will not be achieved without ongoing actions.

3.3 Service-dominant logic on value creation

Vargo and Lusch (2004) claim that "The customer is always a co-creator of value". Service-dominant logic (SDL) outlines the relationship between services and goods, where goods are part of the provision of a service combined with value co-creation. The Service-dominant logic can be characterized by value creation with customers and value through use, and secondly, the term cogeneration could be used, for example, for joint service design or production in collaboration with customers and other value networks or partners (Lusch and Vargo, 2006).

Driven by digitalization, information systems (IS) enable wider networks between different actors and stakeholders, beyond their organizational and regional boundaries. Blascke et al. (2019) states that with the help of digital technology, information systems

enable the integration of decentralized stakeholders into resources in order to implement value creation. The term digital value creation network (DVN) can be used. The concept of DVN is, in a way, a service ecosystem in which IS-compatible stakeholders and networks create the service digitally (Breidbach and Maglio 2016; Davis et al. 2011). Blascke et al. (2019) notes, for example, Microsoft (Azure), Apple (iOS), and Alphabet (Android) are good examples of DVN concepts and platforms. These platforms form DVNs, complemented by customizations and coding by third parties, consultants and subcontractors to provide digital services to their customers. DVN can be defined as complex service ecosystems that create and deliver digital and location-independent services for customers (Breidbach and Maglio 2016).

Originally related to service and marketing, service-based thinking has evolved over the decades around the world. In the past, the basic idea has been that the production of goods created by the service is at the heart of everything. The change of mindset took place after the turn of the millennium and the emphasis was placed on the service perspective as a complement to the production of goods. The central goal was no longer the goods as a whole, but the service process as a whole. From the perspective of the service perspective, it became revolutionary and was considered to integrate and support all social activities (Virtanen, 2018).

Organizations can no longer think - what do we want to sell, but should we think about what the customer wants to buy and why does the customer do business with us at all? (Lindroos ja Lohivesi, 2010). In the change of the service process, it has been important that the stakeholders involved in the service process, both producers and customers, together create added value for the service and the service product during the process. Strategic competitive advantage arises precisely from cooperation between different actors. It is no longer worth making any product and then relying on customers to buy it. Today and in the future, the opinions of service users and customers as well as the user experience in the service process should be taken into account, as it is a vital prerequisite for all business (Virtanen, 2018). Due to the interdependencies of organizations, value creation ecosystems are increasingly being discussed instead of value chains. The success of an organization depends on their ability to leverage different actors and stakeholders flexibly. The concept of ecosystem is useful here as it provides a holistic perspective on increasingly interactive business. The concept facilitates the understanding of the co-development of interacting actors. An ecosystem describes the survival of an entity with a common goal and highlights the relationships between the organization and also its competitors and customers.

3.4 Business model canvas and innovation method

Furr and Dyer (2014) have defined a simplified and light version of the business canvas framework. Within the framework, the various business model components are part of the solution, broken down into: customer value proposition (CVP); the cost structure of

resources; pricing strategy; customer acquisition; and various channels. The business canvas version focuses on the components that are relevant to innovation and provides a suitable tool for assessing the impact of big data. Using a tool template such as a business canvas helps you to stay focused on the issues at hand. For example, a tool to compare an alternative business model with an existing model or company, or a competitor's own model reveals differences and potential weaknesses.

The innovation process developed by Furr and Dyer (2014) may seem simple. The billions of dollars spent each year on failed innovation projects indicate that it is less easy to implement. Innovation is often messy. Innovation can start from somewhere else on the figure (a readymade solution or business model innovation), but the figure serves as a reminder that even in these obvious cases, every element must be tackled before you try to scale a business.

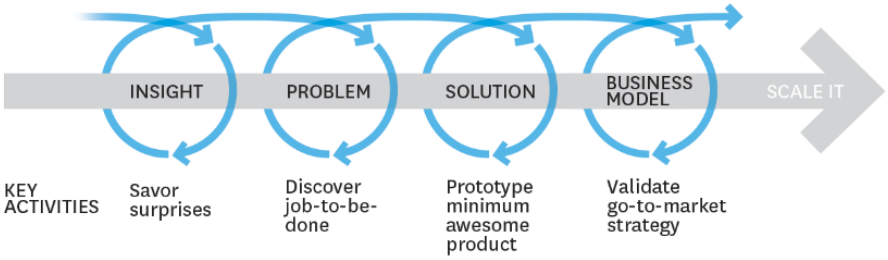

Figure 5. The innovator's method (Furr and Dyer 2014).

Innovation always starts with a potential need or a solution to the problem. These are sources of inspiration for perceived and existing challenges, and possibly also surprises that overshadow the world around us.

3.5 Innovation research

Traditional types of innovation relate to new products, services, materials, processes, or possibly new forms of organization (Ettlie and Reza, 1992). Zahra and Covin (1994) define "Innovation [as] … widely considered as the life blood of corporate survival and growth." Baregheh et al. (2009) propose a definition of innovation as a process that incorporates strategic aspects: "Innovation is the multi-stage process whereby organizations transform into new/improved products, service or processes, compete and differentiate themselves successfully in their marketplace."

Scholars often equate **sustaining innovation** with **incremental innovation**, and similarly equate **disruptive innovation** with **radical innovation** (Sandberg, 2002, Raulerson et al., 2009). In contrast to disruptive innovation, Christensen (2013) defines sustaining innovation as innovation that improves the performance of established products or services with a set of dimensions that have always been appreciated by mainstream

customers. Disruptive innovation is a completely different approach that may change current business models and thus disrupt traditional businesses. For example, Amazon, Airbnb, Uber, and Tesla show that digital technologies and the platform economy are capable of enabling disruptive innovation. Innovation is one of the key factors contributing to economic wellbeing. The Apple iPhone, and before that, the iPod, are good examples of how companies can exploit innovation to improve their competitive edge. Innovation is a new idea that can be applied to improve a product, service, or process (Kanter, 1988). Innovative companies generally encourage staff to experiment, and reward success and possibly mistakes. The market-oriented approach of innovative companies enables the use of innovative research techniques to find the customer knowledge that will provide the basis for disruptive innovation. According to Drucker (1998), innovation can be seen as an opportunity to provide for an unsatisfied consumer need, and most innovation is incremental and consists of an improvement in existing services or products.

A good example of this theory of newcomer and disruptive innovation is the electronic signature. No faster pen or scanner has been developed. This service is currently being introduced by the researcher himself, replacing the traditional paper contract signing process that has remotely required all parties to print, sign, and scan the contract and email it to the next contracting party. As an innovation, the electronic signing of contracts certainly reduces manual work, speeds up and streamlines the contract process, and reduces printing and paper waste, reducing the carbon footprint and supporting sustainable development. This disruptive innovation is easier to justify to users and customers, because it gives a competitive advantage in supporting sustainable development, is archived electronically, and is easier to find in the future if required.

The **human-driven approach to innovation** proposes that innovation comes from people, their skills, and competences. By systematically studying certain skills, anyone can improve associative thinking, which is the key concept for human-driven innovation. Dyer at al. (2008) define four discovery skills: observation, networking with different people, lots of experimentation, and questioning the status quo. Innovative people work harder at practicing and utilizing these skills than others. New ideas are formed and generated from self-transcending knowledge as a result of associations (Scharmer, 2001). Identifying emerging opportunities in a business environment is extremely important.

Rogers (2003) suggests that the **diffusion theory of innovation** can be considered the basic model for scientific research in the field. The diffusion theory of innovation designed to explain how, why, and how quickly new ideas or technology spread. The diffusion theory of innovation answers the questions about how innovation is progressing in the community, how innovation is spreading among users, and why innovative ideas are not always successful. Researchers have also been interested in how best to make new innovations and technologies available (Rogers, 2003). The introduction of many innovations and technologies is in line with Rogers' model of innovation diffusion. In Rogers' (2003) model, various communication channels like mass media are one of the fastest ways to reach potential adopters. Depending on the nature of the innovation, the

implementation phase can take a long time. Innovation often changes and continues to evolve in the innovation process.

3.6 Contingency theory

In contingency theory, an organization can be defined by its contingencies. Key contingencies include technology, the environment and market, the organization's size, and strategy. An effective organizational business model is possible through contingencies with the organization. Contingency theory states there is no single correct way to organize a business. The optimal way depends on context and contingency factors (Huczynski and Buchanan, 2001). In contingency theory, organizational structure and adaptability also play an essential role in change (Demers, 2007). Contingency theory can be a very effective starting point for the transformation process, in which contingencies in strategy can be related, for example, to management, corporate structure, or technology (Morgan, 2006). Contingency theory pays particular attention to how an organization responds to environmental demands and change. The essence of contingency theory is that if companies are to remain viable and competitive, they should strive to adapt to their environment. In addition, companies should strive to influence their environment. However, contingency theory is criticized for not explaining well what an organization should do when a manager is unable to adapt to situations in the workplace.

Contingency studies show that there no one best way to implement effective control exists (Chenhall, 2003; Perälä, 2006). The suitability of the organizational structure depends on various contingency factors. The controller theory developers Lawrence and Lorsch (1967) suggest that corporate management must create an organizational structure that meets the requirements of the operating environment. Lawrence and Lorsch (1967) present two basic assumptions of contingency theory.

1. Different organizations and technical implementations are needed in different markets.
2. Organizations operating in an uncertain environment need more differentiation than organizations operating in a stable environment.

The findings of contingency factors are presented as dependencies between technology, environmental, and organizational structures. Concerning dependency, it has been found that the more intense the competition, the more effective management control systems are needed (Chenhall, 2003; Malmi and Brown, 2008). The success and profitability of an organization are due to the combined effect of the external environmental factors the company faces and its internal choices. According to Gerdin and Greve (2004), the organizational structure does not depend on organizational factors: the environment; the strategies chosen; or the size of the company. There is therefore no single structure that fits all companies. Organizations are thus shaped not only by adaptation but by selection (Donaldson, 2001).

3.7 Virtual organization

Virtual organization functions as a new kind of structure, in which IT and business processes are integrated with other information systems (Hyvönen et al., 2008). An ERP system can act as a data collector, but the ERP must be connected to other information systems (Hyvönen et al., 2008; Granlund, 2007). Hyvönen et al. (2008) highlight the complex structure of the virtual organization. “The virtual corporation began as a vision of futurists, became a possibility for business theorists, and is now an economic necessary for corporate executives. All of this occurred in little more than a decade” (Davidow and Malone, 1992). A virtual organization can be configured and developed in conjunction with information technology to determine how it works, and the nature of organizational challenges in the virtual context. To be successful, a virtual organization requires a data-driven organizational attitude and reforms in its decision-making processes.

The strategic literature suggests that an organization must develop its strengths (Porter, 1980; Kaplan and Norton, 1996). Various studies show that the organizational structure must be aligned with the corporate strategy (Chenhall, 2003; Perälä, 2006). It is conceivable that strategy and structure are interdependent, in that they limit or reinforce each other (Chenhall, 2003; Ferreira and Otley, 2009). The structure of the virtual organization seems to be bidirectional (Ferreira and Otley, 2009). Some previous studies suggest that structure precedes strategy (Donaldson, 1987). The positive aspects of digitalization are the promotion of collaboration across service and sales channels, customer relationship management (CRM), process automation, ordering and marketing automation, document management (e.g. asset management and maintenance), and information management.

4 Summary of Publications

4.1 Publication I: Data utilization at Finnish water and wastewater utilities: Current practice vs. state of the art

4.1.1 The research objective

The aim of the first publication was to study the role and usage of different datasets and information systems at water and wastewater utilities in an environment in which most utilities were small to medium-sized. The emerging literature highlights the potential such data hold for improving the operation, management, and control of water systems. More efficient use of these datasets would therefore benefit utility operators, owners, and managers, as well as policymakers and regulators. However, in many cases there appears to be a gap between the state-of-the-art solutions and the reality at many water utilities. This paper analyzed the current status and provided suggestions for improvement. The study was conducted in Finland, where municipal water and wastewater services are provided by numerous autonomous utilities, which are either municipality owned or small cooperatives.

At present, the extent to which existing datasets and modern information systems are used by Finnish utilities still varies greatly. This is reflected in a recent regulation requiring that utilities have their network datasets in digital format by the end of 2016 in Finland (the amended Water Services Act 681/2014). The emergence of inexpensive sensor devices and intelligent communication networks will bring both new opportunities to utilities and new challenges with respect to (among other things) data management. The concept of the Internet of Things (IoT) envisions that objects will collect and exchange data over the Internet, radically increasing the amount of data in many fields, including the water and wastewater sector.

4.1.2 Results and contribution

The survey results reported here cover three themes based on respondent perceptions about: (1) information system capabilities; (2) data utilization for benchmarking; and (3) customer service and public image.

Information system capabilities. One of the main findings of the paper was that IT contract knowledge and contract competence had development requirements. At the majority of utilities surveyed, according to the respondents, open data and open interfaces had not been considered in the existing information technology (IT) contracts and systems, such as those related to customer information or customer care, and billing systems (Figure 5).

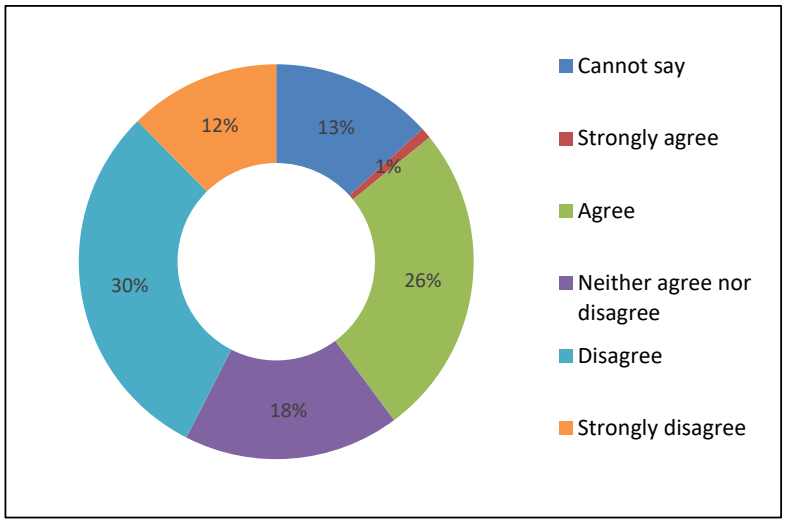

Figure 6. Open data and open interfaces have been considered in IT contracts.

The respondents believed the expanding existing information systems with open data interfaces or interfaces with other systems were very expensive. The utilities typically had to order all changes to their systems from a software vendor. The survey results support the idea that there is room for improvement in open data interfaces.

Survey respondents saw several areas where better data availability and information systems would add value to their business and ease their daily work, including real-time monitoring of the water distribution system and the utilization of smart meter data collection. The potential for user-friendly customer care and billing systems was also mentioned. Respondents also favored the transfer of billing systems to a cloud-based service that could be accessed irrespective of the user's location. The respondents wanted an online service to report failures and inform the utility's emergency repair department. Finally, respondents wished to provide better information and text messaging (SMS) services to customers and utility employees.

Based on the study survey results and the available literature, we can outline the competences needed in the water sector because of the growing data intensity and emerging analytical opportunities. Building a data-intensive capability is not a trivial task. The utilities must integrate existing and new technologies and information systems, and deal with vast amounts of data in (near) real time. This requires investment in information technology and software, as well as employee IT skills. We identify the need for competence in three key areas.

Managerial competence. Data-intensive approaches and decision-making processes offer many new opportunities for water utilities. However, solid leadership is essential if

the utility is to succeed in efficiently developing and utilizing big data (Davenport, 2014). Utility managers may need to experiment. Making the most of big data requires a data-driven organizational culture (e.g. Shen and Varvel, 2013; Dutta and Bose, 2015). In addition, utilizing data may require changes in decision-making processes. Managing these changes requires training in the collection, storing, analysis, and reporting of data, as well as in how to use data to make better decisions. As the water sector is still in the early stages of the big data era, it is difficult to calculate the return on investment in information technologies. A less risky approach may be to start small and learn from experience (Mui and Carrol, 2013). Data-intensive and agile management approaches require new leadership skills and practices in addition to data management skills. Most Finnish water and wastewater utilities are traditional organizations that are just starting to recognize the potential opportunities associated with open and big data.

Technological competence. To improve data management, new technological solutions must be adopted. As the installation base of sensors and smart meters increases, water utilities must deal with vast volumes of (near) real-time data. Current data management platforms and information systems may require significant changes due to the growing volume, velocity, and variety of geospatial and other data. An analytics platform is required to derive value from the data for utilities and their customers. The results can be presented in a visual and accessible format. All these needs require additional expertise in analytics, software systems, software engineering, and cloud computing. These skills must be developed either inside the utility or acquired from a reliable service provider (Gartner, 2015).

Security competence. Water utilities have thus far emphasized the care of the physical security of their assets. With smart metering and cloud-based software solutions, utilities must protect themselves and their customers against unauthorized access. Smart metering also gives rise to privacy concerns. McDaniel and McLaughlin (2009) discuss security issues in the context of smart electric grids, and their findings also apply to the water sector. They point out that vulnerabilities in software are especially attractive to hackers, who may seek to benefit financially or cause damage by attacking infrastructure control systems. Similarly, privacy safeguards are also needed to avoid the misuse of utility software or allowing data to fall into the wrong hands.

Moreover, the expanded use of intelligent communication networks and social media will increase the availability of data in the water sector and challenge current IT systems. We considered whether water and wastewater utilities were prepared to benefit from this change, given that most were small and had limited resources. The cost of hardware and software presents a barrier to modernizing information systems. Two organizational and operational options may help overcome this barrier. One is for utilities to merge to achieve purchasing power. Another is for solution providers to offer services with fees proportional to the number of utility customers.

4.1.3 Relation to the whole

Publication I contributes to all the theoretical and practical perspectives and results obtained by a survey of the study. The article's theoretical section and review show that there are several IT solutions for improving the business model to support the development of operations and data utilization for asset data maintenance, spatial data management, preventive maintenance, and real-time leakage monitoring. The deployment of these information systems clearly requires a coherent data strategy and new IT investment, and when new systems are deployed, efforts should be made to make full use of IT systems.

According to the results, there should be more systematic work to develop customer service and the corporate image. Currently, several organizations measure customer satisfaction and experience very irregularly and infrequently, and some have not studied the customer perspective at all. Utilizing new technologies such as smart meters and a two-way online communication service could be provided to customers, including leak detection and usage tracking (also enabling new billable services). With the increase in process metrics and data, more informed decisions can be made in organizations.

The review of the theoretical part increases the understanding of the need for various new management, technology, and security competences to make good use of the data available for improving the business model. Based on the findings, the article suggested particular small and medium-sized organizations should take a more active approach to information management and the development of competence in IT contracts. According to the research survey, one of the key issues was that development projects and especially business digitalization projects required solid and enthusiastic leadership within the organization.

4.2 Publication II: Innovation capabilities as a mediator between big data and business model

4.2.1 The research objective

Big data opportunities and the business transformation imperative resulting from digitalization lead to a situation in which incumbent firms must rethink and innovate their business models. Firms need to develop and train new capabilities to remain competitive in their business ecosystem. Digital technologies, such as social media, cameras, and web sources, produce vast amounts of data with a continuous feed. The number of devices (mobile, sensors, etc.) that are connected to the Internet is growing rapidly. Humans generate more and more digital breadcrumbs and data particles that individuals leave behind. People are really becoming "walking data generators" (McAfee and Brynjolfsson, 2012). The business landscape is becoming turbulent, and changes can happen rapidly.

The disruption of many current business models has already begun, and the threat of disruption may loom even more (Weill and Woerner, 2015).

The data generation and accumulation phenomenon can be called datafication. Datafication can be seen as an "information technology-driven sense-making process" (Lycett, 2013). As datafication proceeds, more and more data are produced, processed, and transferred. These data are often called big data. The importance of utilizing data in modern businesses is undeniable. Converting the available data into a quantified format leads to actionable information and therefore better decisions. Several studies show that data-intensive firms are more effective and profitable than their less data-driven rivals (Brynjolfsson et al., 2011; Dehning et al., 2003; McAfee and Brynjolfsson, 2012).

Business ecosystems (Iansiti and Levien, 2004; Moore, 1993) and data-related business models are emerging, providing services like data- (data-as-a-service), analytics- (analysis-as-a-service), or Internet of Things- (IoT) related offerings (Chen et al., 2011; Leminen et al., 2012). Many new startup firms follow the global trailblazers like Google or Amazon, and formulate their entire business models on top of or around the data. Data are a valuable and critical asset for such firms. If data are properly leveraged, they can also provide a competitive advantage against the competition. Startup firms rely heavily on data in their decision making, as well as product and service innovation. For most incumbent firms a data-driven approach remains a new and unexplored area. Technology vendors have introduced frameworks that aim to help organizations in their big data efforts. A typical approach is to offer "how to" examples or success stories in which business benefits have been achieved by utilizing a specific technology stack. In addition to practitioners, scholars are increasingly investigating different aspects of big data, such as value creation mechanisms (Hartmann et al., 2016; Wixom et al., 2013) and organizational performance (Akter et al., 2016; Ren et al., 2017; Fosso Wamba et al., 2017).

The purpose of this study was to present a practitioner-oriented framework that explained the role of human and data-driven innovation capabilities as a mediator between big data and the business model of a firm. Our framework helps in understanding how big data and innovation shape business models in the digital transformation. The term mediator is used to reconcile problems and promote development between innovation capabilities, big data, and the business model. The framework offers ways to organize perspectives on the transformation. This helps practitioners to focus on developing the capabilities and methods that best support the transformation toward data-driven business models.

The research process followed the Design Science Research Method (DSRM) (Peffers et al., 2007). The method provides an intact framework for conducting and evaluating design science research. Figure 6 shows in more detail how the DSRM frame was applied in the study.

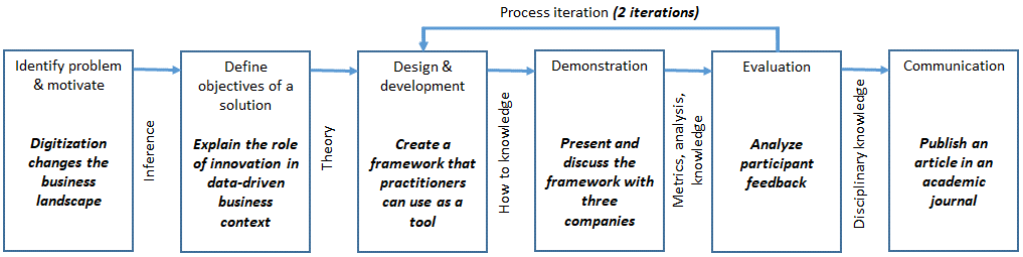

Figure 7. Research method applied from Peffers et al. (2007).

Other research methods, such as action research (Baskerville, 1999; Lewin, 1947) or action design research (Sein et al., 2011) also provide applicable methods for dealing with organizational change. The design science DSRM framework meets the needs of our research. The framework was developed in the study and therefore preferred design science to action research. As our goal was to develop a generic framework in a novel area, we preferred rapid iterations with moderate user input instead of their long-term commitment. In addition, practitioners favor approaches that present initial concepts or assumptions to provoke new ideas, instead of a clean sheet of paper as a starting point. Experimenting is a common technique for iterative development. The development, demonstration, and evaluation stages of DSRM form a cycle that aptly fits experimenting without overloading the participating firms.

4.2.2 Results and contribution

The opportunities of big data as a consequence of datafication and the business transformation imperative resulting from the digital transformation lead to a situation in which incumbent firms must rethink and innovate their business models and create new capabilities to stay competitive in their business ecosystem. The objective of the developed framework is twofold:

- To advance big data research by addressing the role of innovation capabilities in the data-driven business context.
- To assist practitioners in their big data initiatives by offering a framework that helps them to develop required capabilities.

The framework is created from the existing literature and can be found in Figure 7. It combines the business canvas model of Furr and Dyer (2014) with the 3V definition of big data (Laney, 2001), supplemented with a classification element for each dimension from the innovation perspective. These components add perspective to strategic management and information systems research. The framework provides a good starting point for understanding the potential impact of big data in the business environment and to enable discussion of these different perspectives.

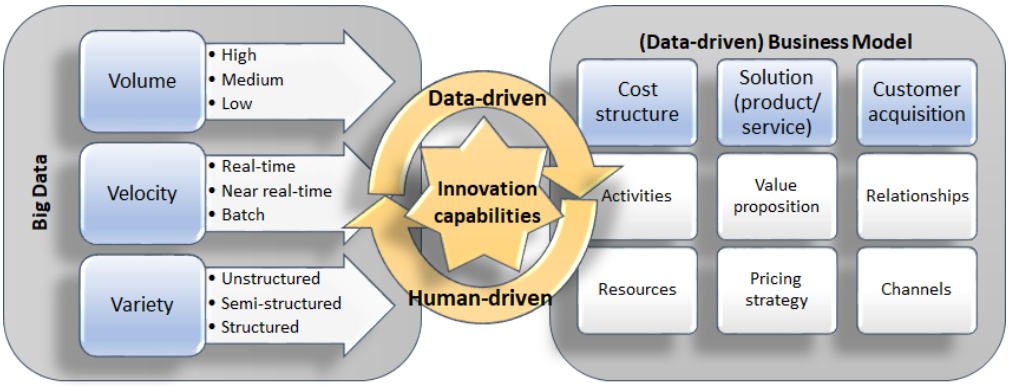

Figure 8. Innovation as a mediator

Companies can choose different practical approaches for the framework according to their current situation and future objectives. Increasing the role of data in the current business model, e.g. by automating delivery processes to decrease transaction costs, requires a different approach than developing a new data-driven model. Based on the evaluation phase of our framework, we synthesized an exemplary usage scenario as follows.

1. Assess the current situation and big data impact. This can be done by examining the business model components (Figure 7) one by one and creating scenarios for potential big data effects. The effects can be either risks (threat) or opportunities. Some are such that they cannot be influenced; some are within the reach of the company.

2. Define future business objectives. Clear goals and ownership are best practice for any business development initiative. Especially with new things, solid leadership is important to achieve set goals. This phase may be iterative, innovating back and forth between the business model and big data. What internal or external data could affect our business? What data do we need to best run our business? Novel ideas or long-term strategic goals often require experimentation for verification.

3. Evaluate big data value potential. Many innovations are human-driven, but increasingly, data are a source of innovation. Humans ideate things that require the gathering and combining of new and existing data in novel ways. Accordingly, experimenting with data may reveal insights that spark ideas. Human- and data-driven innovations are not mutually exclusive. Instead, they can and should support each other, effectively creating an innovation loop. Our framework provides support for these activities by explaining the theoretical background and enablers of an effective innovation process.

4. Identify the required datasets and capabilities. Identifying data that is beneficial to the business is a two-way operation. As one can intuit by examining our framework (Figure

7), human-driven innovation comes down to the question: "What data do we need to fulfill this business need?" On the other hand, data-driven innovation asks: "Do we have data or can we access data that are beneficial to our business?" Once the datasets are identified, the modified 3V model shown in Figure 7 can be used to classify and categorize the data at a more detailed level. In turn, this reveals possible gaps in ICT capabilities.

4.2.3 Relation to the whole

Publication II contributes to the whole in the context of strategic management. We presented a multidisciplinary framework that contributed to research by pinpointing the role of human and data-driven innovation capabilities as mediators between (big) data and the business model. The framework combined elements from innovation research and resource-based theory. This assists in understanding the role of human and data-driven innovation, and innovation capabilities in an organizational context. Thus, the framework acts as a mental model and a good basis for discussion that offers a way to organize perspectives of digital transformation, especially from the practitioner's perspective. Understanding the theoretical background of the innovation process in the big data context helps practitioners to focus on developing the capabilities and methods that best support the transformation to the data-driven business model.

4.3 Publication III: E-business and digital processes – blockchain in insurance

4.3.1 The research objective

Digitalization sets a framework and enables changes to be successful. We can therefore question existing operating methods and recreate them as quicker, more flexible, and more functional. Concerning business processes, payments, accounting, invoicing, orders, and different distribution channels for products and services face major changes and significant development. On the basis of the data sources referred to in this article's theoretical background, blockchain technology and the accounting-related approach of the distributed ledger (Xu et al., 2016) offer an innovative approach to the decentralized and communal management of business process data in the networks of different organizations. There is an analogy between blockchains and supply chain management (Korpela and Hallikas, 2017). The blockchain can hold any legal document in its worldwide ledger. It enables smart contracts, decentralized autonomous organization, decentralized government services, and transactions, for example (Tapscott and Tapscott, 2016). In immaterial data processes (such as the insurance business), instead of a material stream, a data stream resulting from customer needs is transferred and converted during handling into decisions that fulfill these needs – for example, into blockchain technology smart contracts. According to Zsabo's definition from the 1990s, "a smart contract is a computerized transaction protocol that executes the terms of a contract. The general objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality and even enforcement). Related economic goals

include lowering fraud loss, arbitration and enforcement costs, and other transaction costs." Blockchain technology has made smart contracts possible for single and multi-tranche transactions or document exchanges (Tapscott and Tapscott, 2016).

The insurance business is comparable to the financial business. In the insurance process, customers pay insurance premiums beforehand, the amount of which depends on the insured objects and their value. Insurance companies can distribute the risks of their customers and therefore use the insured objects to trade in securities, such as financial sector deposits and loans. If a customer risk is realized in the insurance business, the insurance company refinances the reactivation of the object or the consequences of the accident. The insurance business consists of networks of different parties (customers, agents, insurance companies, reinsurers, repair shops, etc.). This produces additional costs because of overlaps between data management and case handling, for example. These reduce companies' profitability. Customers always cover additional costs through their insurance premiums. In customer service, overlapping data-saving and handling processes also cause delays. The source material presented the risk of potential insurance fraud hidden within the insurance business as a key observation. For example, how can insurance companies, some of which operate in geopolitically different countries, ensure that compensation for the breakdown of a single car is not claimed from other insurance companies as well? The source material indicates that the technology utilized by the insurance business (Insurtech) seems to follow the deployment of innovative technologies in the financial sector (FinTech) with a slight delay (Erman, 2017).

Blockchain technology is regarded as a breakthrough that can make processes safer and more democratic, transparent, and efficient (European Parliament, 2016; EU, 2017). It enables various applications in several different fields (e.g. financial services, logistics, supply chain, delivery of social products, energy, IPR management, etc.). The EU (2017) sees blockchain technology as taking its initial steps, involving a set of challenges, such as questions related to legal regulations, interoperability, and scaling, that need to be resolved.

Using blockchains, data can be transferred quickly and at low cost, as no third parties are required (e.g. banks to transmit transactions between a buyer and seller). This reduces the overall data-handling costs. Similarly, innovative accounting firms discover an entirely new playing field. According to this article's authors, blockchain technology is based on a theory which, through innovation, simplicity and a high level of information security, represents an excellent vision of data architecture in a data-processing environment – an idea which creates discontinuities in the operating architectures in the public sector and in the business model. Good operating architecture produces added value for customers and organizations. An empirical aim is to engage Russian insurance companies and build a reliable e-business network. During the piloting stage, the aim is to build a motor insurance database consisting of roughly 100,000 vehicles, test it, and experiment with it using blockchain technology. In the world of blockchains, these automatic transaction chains are referred to as smart contracts.

4.3.2 Results and contribution

Blockchain technology has a strong group of supporters, especially in bitcoin networks. As part of digital business, smart contracts, and distributed ledgers also offer valuable support in the development of a motor insurance database (Deloitte, 2016). The motor insurance business consists of networks of different parties (customers, agents, insurance companies, reinsurers, repair shops, etc.). This produces additional costs – for example, through manual labor, and overlaps between data management and case handling. From the accounting perspective, processes undertaken in different organizations have parts that produce no added value, creating additional costs. These costs reduce profitability and are ultimately paid for by customers. In customer service, overlapping manual data-handling and transmitting processes also cause delays and potential errors. The source material also highlights the potential risk of insurance fraud in the insurance business. In this development, the aim is also to decrease the number of insurance frauds.

After a successful pilot project, the business model can be duplicated for other similar insurance solutions. The literary sources and the design thinking process helped us to identify opportunities for blockchain technology to build new and reliable vehicle insurance operations (Nakamoto, 2008; Neittaanmäki and Ogbechie, 2016). The validity of this research can be assessed on the basis of the critical deduction approved by the scientific community and background assumptions (Järvensivu and Törnroos, 2010). Blockchain technology is not yet widespread in the world. The idea comes from the bitcoin virtual currency. What added value can blockchain technology produce in e-business? The findings of previous research offer no explicit model for research into the blockchain. Using empirical research and implementing the design thinking method, we have been able to identify the characteristics of the studied blockchain technology. Minimizing insurance fraud is an identified goal in the application of blockchain technology. Analyzing the literary material, we have acquired new information for the research community. In addition, when applying blockchain technology and its algorithms extensively to other parts of society, the research process requires further multidisciplinary research, especially from the perspectives of legislation and taxation. Blockchains resemble decentralized accounting ledgers. Transactions and records cannot be changed or deleted as soon as they are written. Multiple copies make integrity easy to prove. This allows the participants to verify transactions inexpensively.

4.3.3 Relation to the whole

Publication III contributes to the whole by examining how new technologies like blockchain and smart contracts can improve the business model, and enable new business models and processes. Blockchain technology can generate new growth through the development of insurance products and the IoT, for example. The strength of blockchain technology is evident in smart contracts. Smart contracts are part of blockchain technology, because they guarantee the strict confidence of all parties.

With the successful adoption of new technologies that requires decisions on new IT investments, the various processes of the business model can be implemented in a more streamlined, cheaper way and increase profit, reducing manual work, and – the cherry on the cake – significantly reducing the risk of fraud.

4.4 Publication IV: Virtual organizations as a strategic choice – multiple case study

4.4.1 The research objective

This publication and its case study examine how a virtual organization can be configured with information technology, and explores how it operates and the organizational challenges that exist in the virtual context. The findings suggest that a virtual organization requires a data-driven organizational attitude and changes in decision-making processes. This study contributes to the current discussion of virtual organization by providing evidence that the switch to e-services entails a significant change in business models for professional service providers, as well as the acceptance and adoption of new services.

In the accounting service industry, a growing number of important items found in financial statements have come under real-time management, as information technology has made such practices both economically feasible and competitively necessary (Dyer and Ross, 2008; Everaert et al., 2010; Sarens et al., 2015; Sjögren et al., 2014). In addition, new studies (Bhimani and Willcocks, 2014; Hätönen and Eriksson, 2009; Salo, 2006) indicate that a digitally enabled business may create a range of challenges, as well as new opportunities, for accounting information providers. However, there remains a paucity of evidence on accounting services produced by virtual organizations. Digitalization is radically changing how work is done. Information technology allows employees to be more flexible about their working locations, and the line between work and free time is becoming more blurred. Virtual organizations create and offer the opportunity for strategic choices for employees and for subcontracting to client companies.

4.4.2 Results and contribution

The following description of case VO functions provides the answers to our research questions concerning how a VO might be configured alongside information technologies, and how it would operate. The configuration of the organizations is dynamic, because the length of employment depends on the employees themselves and their projects. Figure 8 presents the business model for the case's virtual organizations. The case organizations provide different kinds of direct real-time service or commodity to their own employees/customers. The employees inform the VO about invoicing, and the VO provides a service by invoicing customers, paying salaries to employees, providing them with other accounting services, and taking care of legal obligations, such as taxes and employee costs:

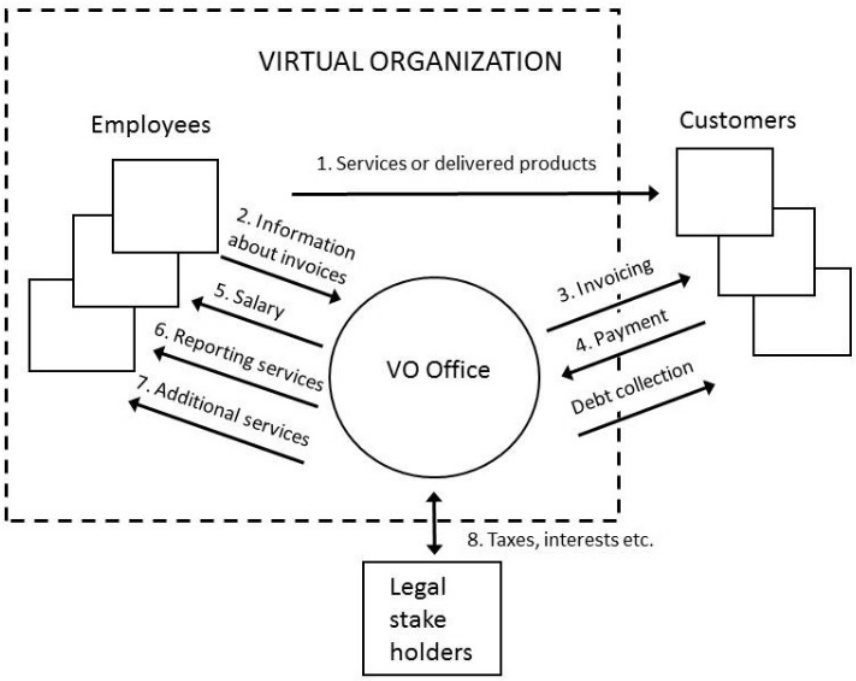

Figure 9. The operating model for the case organizations.

Thus, such virtual organizations could bring a sense of organizational cohesion and employer-provided employee security. In addition, the findings indicate that the virtual organization's attitude toward its employees seems to differ from conventional organizations. Typically, in analyzing the discourse of owners about their employees, the term used was "client." This can be understood as meaning that the dynamic context of these virtual organizations requires a new kind of attitude toward its workers from the employer.

The dynamic context of virtual organizations seems to require a new attitude toward their workers from employers. The findings suggest that even if the organization is dynamic, e.g. its members change quite frequently, employees may experience some form of organizational cohesion formed by the services related to the employment relationship. Such virtual organizations may be seen as a social construct linking buyers and suppliers demanding a new culture of decision making. Data-intensive approaches may therefore offer new opportunities for service providers. However, strong leadership and responsible management are conditions for successful and efficient data utilization (Davenport, 2014). For leaders, this may demand a more comprehensive view of the context to ensure successful change.

Furthermore, management needs encouragement to experiment. In general, making digital data-based organizational control systems requires a data-driven organizational attitude. Other studies have reported challenges in the area of decision making, such as a lack of a data-driven organizational culture (Shen et al., 2013; Dutta and Bose, 2015). Utilizing data may therefore lead to changes in organizational decision-making processes. New managerial skills are needed, both to understand and support these changes. Managing them requires training in collecting, storing, analyzing, and reporting data, as well as in how to use data to make decisions. The findings of this study also indicate that startup companies could present a new challenge to the accounting service industry, because the release of information creates opportunities for new market entrants. Startup company customers expect a reliable, safe, and easy digital service network. Therefore, future service providers may operate increasingly as producers of self-services.

4.4.3 Relation to the whole

Publication IV contributes to the whole by promoting the current discussion of virtual organization. It provides evidence that the change to e-services entails a significant change in business models for professional service providers, as well as the acceptance and adoption of new services for employees. Digital platforms and service providers enable virtual organizations and provide flexible strategic choices for employees, as well as the option of subcontracting.

Concerning the managerial implications for companies seeking to develop their virtual operations, this study suggests that the full utilization of IT systems without the manual phases of business processes will be necessary to make operations completely independent of time and place, and innovatively benefit from the new customers and markets created by digitalization. As the title of this publication refers to strategic choices, it is precisely the introduction of new IT solutions and cloud-based services that are flexible in their location that can make the business model more efficient, and must be compatible and supported by a data strategy.

5 Discussion and conclusions

This chapter summarizes the results of the individual studies. The chapter also presents the theoretical and practical implications of the research, and links the findings to previous research and theories. It discusses the usefulness of the research results. Following the implications of the study, proposals for further research are proposed. Indeed, there are many new areas of potential research, because the topic is a relatively new research area.

5.1 Theoretical and managerial implications

The main objective of this study was to explore in four published articles how to utilize digitalization opportunities to improve the business model. The aim of the research and articles was to find explanations for current digital practices. The study sought to gain an understanding of research into business model development and its practical social context. The results proposed in this study are based on existing scientific publications, literature, empirics, and personal observations. The study answers research questions with articles outcomes and contributions. The main research question of the study was: "How can the leveraging of digitalization improve the business model?" It was dealt with four and all publications. The first and second publications had own sub-questions, the third and fourth articles shared the same sub-question. The first sub-question, "What is the current practice vs. the state of the art for the digitalization of the business model in the selected industry?", was answered by the first publication.

Publication I highlighted that the water sector should be developed towards systematic work to develop customer service and the corporate image. Utilizing new technologies such as smart meters and a two-way online communication service could be provided to customers, including leak detection and water usage tracking for online monitoring water consumption, thus enabling new ongoing services with monthly recurring revenue (MRR). The outcomes of the article provide a backing for the development of a business model in the direction of servitization. The contribution of this article was to increase the understanding of the need for various new management, technology, and security competencies to make good use of the data available for improving the business model. Based on the findings, the article suggested that small and medium-sized organizations should clearly have a more proactive approach to information management and data analytics skills, as well as IT and also IT contract competencies that allow for better development and utilization of (big) data.

As Davenport (2014) suggests, Publications I and II together show that clear ownership is best practice if any business development initiative is to achieve its goals. The development of a business model may be iterative, an innovation between the business model and the data. How can a company’s internal or external data affect the business,

and which data are actually needed to run the business effectively? New ideas or long-term strategic goals often require experimentation to be verified. The company should evaluate the current situation and the data's impact. This can be done by studying the components of the business model one by one and creating scenarios for the potential data impact, which may be either risks or opportunities. As Christensen (2013) notes, incumbent companies are often unable to take advantage of new disruptive technologies. Incumbent companies tend to serve only their existing customers; new disruptive innovation tends to create entirely new markets or disrupt the old business model.

The second sub-question, "How can the ability of innovation capabilities be emphasized in the data value creation process?", was answered by Publication II. Publication II suggests an evaluation of (big) data value potential. Referring to the RBV framework that companies are the sum of their resources, and if these resources (such as data) are valuable, rare and inimitable, a competitive advantage can be obtained. A company's competitive advantage is the result of its valuable and unique resources (Gooderham et al., 2004). Capabilities are related to resources and the resource-based view (RBV) of a firm (Wernerfelt, 1984). In the resource-based view of a firm, resources and capabilities are the key concepts that explain a firm's competitive advantage. Human-driven innovation is common, but data are increasingly the source of innovation. People consider innovation that requires the collection and merging of existing and new data. Data experimentation can bring new ideas to life, and knowledge-based and human-driven innovation are of course not mutually exclusive and should support each other by effectively creating an innovation loop. Publication II provides precisely this support by explaining the theoretical backgrounds and enabling an efficient innovation process. Publication II proposes that companies need to identify the datasets, capabilities, and competences they need. Identifying the data to be utilized is a two-way operation. In examining a developed framework, human-led innovation should determine the information needed to meet this business need. Similarly, data-driven innovation should determine whether information is available, or whether information useful to the business can be used. All in all, once the datasets have been defined, the custom big data 3V model can be used to classify the data at a more detailed level.

The third sub-question, "How can new technologies streamline the business model?", was answered by Publications I, III and IV. Publication I shows that in the future utilizing data sets such as online water metering, continuous water quality monitoring, leakage and event detection, pipe condition monitoring, real-time modeling of networks, optimization of water and wastewater treatment, and network asset management many processes are streamlined, digitized and error-prone manual work is reduced. According to Thompson and Kadiyala (2014), the new technology facilitates water safety planning by providing continuous monitoring with distribution system sensors and Internet of Things (IoT). This also allows for early warning of pipeline breaks or water quality monitoring trends. Matsuoka and Muraki (2007) describe a new technology that enables preventive maintenance, which increases the safety of equipment and also water quality. According to Publication III, blockchain (emerging) technology can generate new growth through the development of insurance products by combining them with the Internet of Things.

One of the strengths of blockchain technology has been seen in smart contracts. Smart contracts are part of blockchain technology, because they guarantee the strict confidence of all parties. As part of digital business, smart contracts and distributed ledgers offer valuable support for the development of a motor insurance database (Deloitte, 2016). The motor insurance business consists of networks of different parties like customers, agents, insurance companies, reinsurers, and repair shops. This produces additional costs through manual processes and overlaps between data management and case handling, for example. From the accounting perspective, processes undertaken in different organizations have parts that produce no added value, creating additional costs. These costs reduce profitability and are ultimately paid for by customers. In customer service, overlapping manual data handling and transmitting processes also cause delays and potential errors. The source material also highlights the potential risk of insurance fraud in the insurance business. According to Chen at al. (2011), the big data value proposition is that companies can benefit from using it. In addition, new data-driven business models, such as data as a service (DaaS), are emerging. The success and profitability of an organization is due to the combined effect of external environmental factors and internal choices faced by the firm (Hoffman et al., 1994). Referring to contingency theory, different organizations and technical (and new technological) implementations are needed in different markets (Lawrence and Lorsch, 1967). Contingency theory also suggest that in the transformation process, attention must be paid to how the organization responds to the environment demands and changes in order to remain viable and competitive. According to Morgan (2006), with new technologies, organizations must strive to adapt to their environment. In addition, companies should actively influence their environment.

The third sub-question is also answered in Publication IV. It demonstrates that case organizations provide different kinds of direct real-time service or commodity to their own employee/customers. These employees inform the virtual organization (VO) about invoicing, and the VO provides a service by invoicing customers, paying salaries to employees, providing them with other accounting services, and taking care of legal obligations, such as taxes and employee costs. In the publication, digitalization and digital platforms are directly related to exploitation of services, and these technologies allow companies to offer their services to service users regardless of location and time. Approaching the transition to digital data-driven organizational management systems, it also requires data-driven organizational attitude. Other studies have reported challenges in the area of decision making, such as the lack of a data-driven organizational culture (Shen et al., 2013; Dutta and Bose, 2015). Utilizing data may therefore lead to changes in organizational decision-making processes. New managerial skills and competences will be required both to understand and support these changes. Managing them requires training in the collection, storing, analysis, and reporting of data, and in how to use data to make decisions. It also requires an increase in process metrics and data, allowing for more informed decisions. Digitalization and new technologies can thus increase the company's reliability and transparency, as well as reduce risks.

5.2 Limitations and future research directions

The surveys in this study focus on digital exploitation in a limited number of selected industries and companies. First, the research's generalization is partly limited, because the companies are of very different sizes and provide different services. Second, the study only concerns companies in Finland. The study's scope is limited to these cases, and not all the findings can be directly applied to other organizations elsewhere. This research focuses on qualitative research using qualitative methods. Further studies could focus on the practical implementation of digitalization and changes in industry.

Social media, the IoT, and mobile and cloud technologies appear to be changing how work is done. In particular, research could be conducted into how a small and growing (startup) company might best utilize digitalization in internationalization. Second, an interesting subject for further research would be the monetization of the data generated by digitalization through new innovations, the benefits of streamlining existing processes, and the sale of enterprise- or customer-generated data.

5.3 Conclusions

The digitalization of the world and business is generating data at an accelerating rate, while creating an ever-growing new resource that generates storage and processing costs as it grows. When used properly, however, data are a productive resource. How can data be turned into money? This can be done in many ways, either through innovation or a more intelligent use of existing information resources. Almost all the information in the world is only a few years old, even though it has been collected since the 1950s. Combining data generated by an organization with external data creates new opportunities. For example, new players can find themselves at the junctions of distribution chains, where they can provide their customers with a view of service processes and the flow of goods in a way that was previously impossible. Practices have been identified in this study to increase the understanding of and commitment to digitalization and data exploitation toward a more efficient business model.

Leveraging a framework such as VRIN or VRIO can help streamline and reform the business model. The purpose of the frameworks is to improve competitiveness by enhancing resources. These resources include all possible factors of production, both tangible and intangible. Information and skills, motivation and learning new things play a central role in human resources. Key issues in organizational resources include information systems, contracts, organizational structure, and patents. The effective integration of previously acquired or new information systems with other systems, including external systems, can significantly improve operational efficiency and profitability. Of course, information systems should be used efficiently and appropriately for the company. Such information system investment, integration, and information systems training should be implemented in accordance with the company's data strategy.

For the purpose of information and data management, customer satisfaction should be measured regularly to ensure the customer also feels that their vision and feedback are valued. One of the most important factors influencing the customer's value is the customer's expectation of the company. The customer experience cannot therefore be managed without knowing and measuring customer expectations. The customer experience is primarily about managing customer value from the customer's perspective. In providing a superior customer experience, the company also increases customer loyalty.

Nowadays it can be easy to fall in love with novelty innovations, digitalization and (big or open) data and believe that technology sells itself within organizations. Falling in love and enthusiasm is normally a good thing, of course, but change does not happen so easily and it requires consistent work and consideration of different perspectives. According to the research, and as Davenport (2014) states, strong leadership is essential if there is to be a successful benefit from the effective development and utilization of (big) data. This study suggests the full utilization of IT systems without manual phases of operation will be necessary to make operations completely independent of time and place, and innovatively benefit from the new customers and markets created by digitalization. The results suggest that there is much room for improvement regarding both open data and big data utilization. Data-intensive and agile management approaches require new leadership skills and practices, in addition to data management skills and competences. Solid leadership is essential if we are to succeed in efficiently developing data-intensive approaches and data-driven innovation in business. In particular, Publication II suggests that organizations should be proactive in actively seeking new possibilities, and supporting the necessary and related capability creation. Whether the organization is light or overworked, digitalization development projects should always have a responsible and enthusiastic passionate project leader.

According to the understanding and knowledge of the dissertation's publications, the following key perspectives should be considered in leveraging digitalization opportunities with the aim of improving the business model:

- Digitalization and digitalization projects should always start and be led with solid and enthusiastic leadership (Publications I & II)
- Customer satisfaction and customer experience should be regularly measured, and the organization should be encouraged to experiment with data-driven innovation (Publications I & II)
- The company should have a clear data strategy that fully supports the development of the business model (Publication II)
- Frameworks such as VRIN, VRIO, etc. should be leveraged to streamline or reform the business model with the goal of achieving a sustainable competitive advantage (Publication II)

- Investments in information systems must also keep in mind the integration of information systems and data interfaces between both internal and external systems, with the aim of reducing manual work, and accelerating and streamlining processes and error-free operation (Publications I, III, & IV)
- Organizations should offer training in new skills and competences, such as improving the use of data potential and analytical skills, and in competence in IT contracts to achieve competitive advantage through novel knowledge (Publications I, II, & IV)

Increasing global competition and advances in digital technology have led many companies and organizations to try to find novel solutions to meet the needs of their customers. In the same context, both digitalization and servitization create opportunities for companies. A significant part of the new customer services is now implemented digitally, and correspondingly, the design of service systems for new products is also guided by digitalization. Based on these perspectives and actions mentioned above, it is easier to consider how to get the business model of a company's products, projects, or services modified toward servitization. This reform of the business model would convert the company's revenue from project-based revenue into more predictable time-based ongoing service charges and monthly recurring revenue (MRR) that is not significantly affected by, for example, seasonal fluctuations or fluctuations in order volumes within months. By leveraging digitalization, servitization aims to reduce costs and increasing efficiency while also strengthening customer relationships. Eggert et al. (2014), Kastalli and Van Looy (2013), Neely (2008) states that managers should pay attention to the relationship between new service development and performance by promoting innovative business models to achieve a positive outcome in order to overcome the "servitization paradox" where costs increase and performance may decline.

When creating a data strategy that supports the development, measurement and monitoring of a more flexible business model, data privacy, security and in Europe also General Data Protection Regulations (EU GDPR) must be considered. In addition, data transparency, ethical and moral principles and social challenge from a human-centric perspective will take an even greater stance in the future. The data strategy should take into account the diversity and fair treatment of different stakeholders and avoid discrimination and unfair bias. Digitalization does not really sell itself. Transformation to digital with the right people and leadership will facilitate a successful change. Digital transformation and disruption require changes in organizational dynamics. Digital agility is important and organizations need to be sensitive to learning and testing and scaling the business model. Leveraging digitalization and digitally mature organizations requires

clear alignment with data and business strategy, enthusiastic leadership and commitment to leadership, and ensuring that employees have the necessary skills, training and agility.

During the current coronavirus (COVID-19) pandemic and crisis, companies and organizations have learned how to use and adapted very quickly to digital software, telecommuting, and videoconferencing applications like Microsoft Teams and Zoom. Business Finland, the Finnish government organization, is currently financing and supporting corporate projects to revamp its business model in the wake of the pandemic. Abnormal situations are great opportunities for business model reform: The world will not return to normal after this crisis, but new insights will drive business forward. It can be said that crises can be a quick and effective way of learning things when you have to. Likewise, companies representing the incumbent business model should learn new ways to act before they are forced to do so.

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Publication I

Sirkiä, J., Laakso, T., Ahopelto, S., Ylijoki, O., Porras, J., Vahala, R.
Data utilization at Finnish water and wastewater utilities: Current practices vs. state of the art

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Data utilization at finnish water and wastewater utilities: Current practices vs. state of the art

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ABSTRACT

This paper analyses the current role of data assets and information systems at water and wastewater utilities in a context where most utilities are small to medium sized. Special focus is put on big data and open data, and existing information systems for their management. Based on a survey and the available literature, we conclude that water utilities could benefit from developing their data assets, and that increasing amounts of data will require utilities build in-house competencies related to management, technology, and security.

1. Introduction

The aim of this article is to study the role and usage of different datasets and information systems at water and wastewater utilities in an environment where most utilities are small to medium sized. An emerging literature highlights the potential that these data hold for improving the operation, management, and control of water systems. More efficient use of these data sets would therefore benefit utility operators, owners, and managers as well as policy makers and regulators. However, in many cases there appears to be a gap between the state-of-the-art solutions and the reality at many water utilities. This paper analyses the current status and provides suggestions for improvement.

This study was carried out in Finland, where municipal water and wastewater services are provided by numerous autonomous utilities, which are either municipality owned or small co-operatives. Finland has a population of around 5.5 million people, of which 92% are connected to centralized drinking water supply and 82% to centralized wastewater treatment. Requirements for drinking water and wastewater treatment are rather stringent and thus the quality of the operations and outputs can be considered high. The total number of water or wastewater utilities in the country is more than 1,400, of which around 400 are owned by municipalities and about 900 by cooperatives. The majority of the utilities have fewer than 20,000 customers, while 20 of the largest utilities provide service to some 80% of all customers (Water Association Finland, 2016). The situation is similar to many other European countries, such as Sweden, Austria, and Portugal. Nearly 50,000 water utilities operate in the US, the majority of which serve smaller communities (EPA, 2008).

Currently, network asset data together with water quality measurements at treatment plants (which are required by environmental authorities) and customer information form the core datasets that all utilities have in some format. The format can be digital, but as Grigg (2012) describes, the smallest utilities may only have paper records on their assets. Utility-specific information and control systems in use at water and wastewater utilities cover:

- Customer information systems (CIS)/customer care and billing systems (CC&B), customer relationship management (CRM), for customer care and billing purposes. This is a mandatory system needed for charging on water consumption, wastewater, connection fees and in some cases also stormwater fees.

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- Computerized maintenance management system (CMMS) for maintaining an asset and equipment register and planning and scheduling maintenance activities, often missing from small utilities.
- Geographical information systems (GIS) and network information systems (NIS) for network information management. These are currently used by larger utilities but not by all small utilities (Jordan, 2010; Grigg, 2012).
- Supervisory control and data acquisition systems (SCADA) for receiving data on the networks and the treatment plants.
- Other systems tailored for the sector such as benchmarking and reporting systems.

At present, the extent to which existing datasets and modern information systems are used by Finnish utilities still varies very much. This is reflected by a recent regulation requiring that utilities must have their network datasets in digital format by the end of 2016 in Finland (Act 681/2014 on the Amended Water Services Act 2014).

In the future, the amount of data available can be expected to grow thanks to digitalization. Brynjolfsson and McAfee (2014) suggest that "everything that can be digitized will be digitized and everything that can be automated will be automated". The ongoing digitalization has been predicted to become as significant a change as industrialization was (Frey and Osborne, 2013). The emergence of inexpensive sensor devices and intelligent communication networks will bring new opportunities to utilities but also new challenges with respect to (among other things) data management. The concept of the Internet of Things (IoT) envisions that objects will collect and exchange data over the Internet, radically increasing the amount of data in many fields, including the water and wastewater sector.

In this article, examples are given based on the literature review on advanced cases of data utilization. The potential and challenges water and wastewater utility managers see in emerging new datasets are studied with a survey. Following the Survey Methods and Survey Results sections, we provide a Needs Assessment focusing on the competencies that will help utilities that wish to benefit from the presumably growing amount of available data. The Discussion section brings the findings together.

2. State of the art in data utilization at water and wastewater utilities

2.1. Advanced examples presented in the literature

Currently, data is produced mainly from measurements of different physical or chemical attributes of water at different points in the water supply and sewerage supply chain. The new potential data utilization technologies include online water metering, continuous water quality monitoring, leakage and event detection, pipe condition monitoring, real-time modeling of networks, optimization of water and wastewater treatment, and network asset management.

Online water consumption metering is an example of an existing technology not yet widely in use in the water sector. Smart electricity meters are being deployed widely already, while at the same time smart meters for water are not yet installed on such a grand scale (Stewart et al., 2010). Even though there are differences between the water and energy sectors, potential benefits exists for the water sector as well. Beal and Flynn (2015) found evidence that the awareness of the benefits of smart metering is increasing at the utilities in Australia and New Zealand. Smart online meters are able to deliver real-time data and thus help in understanding for water consumption patterns (how much, when, and where water is delivered to the consumer). Water demand estimation through smart meters can be used to optimize demand patterns even when just a part of the consumers are monitored in real-time (Aksela and Aksela, 2011; Gurung et al., 2014). Gurung et al. (2014) found that enhanced modeling and optimization of the water supply network provides financial benefits in terms of avoided system costs. Another benefit of smart meters is the large amount of data points they enable. These data can be used in the same way that network flow and pressure measurements are currently used, such as for leakage detection.

Smart water consumption meters can also provide new kind of services to customers. Britton et al. (2013) showed that smart meters are able to identify post-meter leakage. This information may be of interest to insurance companies in terms of the potential to significantly reduce water damages to property and ensuing insurance compensations. Nguyen et al. (2013) propose a model where water consumption can be measured and analyzed at the household level. The proposed architecture uses data from smart meters and pattern recognition to profile residential water consumption. The algorithms used can detect and categorize events like the use of washing machines, toilets, or showers automatically. Customers can access their water consumption history on a web site and compare their consumption to benchmark information from similar consumers. The detailed history data, trends, and up-to-date information help utilities to plan and manage the networks as well. The analysis of such data could also provide a chance to new services such as closure of connection in case of a leak inside properties. Fischer (2011) studied the overall potential of smart metering. The benefits include more efficient water use and the subsequent reduction in energy and chemicals needed in water and wastewater treatment. Despite the higher initial investment costs, smart meters are expected to prove more cost-effective in the future (Fischer, 2011).

Another relevant domain for utilities is water safety planning. Thompson and Kadiyala (2014) present a continuous monitoring system for water quality. The system is an integrated solution combining sensors and analyzers in the distribution system, data from other sources, such as customer feedback and security monitoring, data analysis, and visualization software. The results of their study show operational enhancements, such as early alerts of pipeline breaks or water quality monitoring trends, which were earlier unavailable. Examples are given of how the system has helped in locating the causes of water quality problems. An additional benefit reported in their study is improved regulatory compliance.

Preventive maintenance is another important utility activity. According to Matsuoka and Muraki (2007) preventive maintenance is the systematic care and protection of equipment and machines and the reliability of the process depends on systematically scheduling. In the most advanced cases, predictive maintenance uses sensor feedback information from equipment to make data-driven decisions, improve quality and production performance, and prevent more expansive repair costs (Fraser, 2014). The maintenance system can also be integrated through a geographical information system (GIS) platform that brings different types of data together based locational components for more efficient management of water, wastewater, and stormwater systems (Shamsi, 2005).

Continuous monitoring is also of high value in the hydraulic operation of water distribution. Many studies have been conducted on event recognition in water supply networks (e.g. Vries et al., 2016; Romano et al., 2014). For example, Romano et al. (2014) portrayed an operational event recognition system which can be used to detect and analyze pipe bursts and leakages with accuracy and reliability. The benefits reported in the study include reduced

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reaction time to sudden events, the diagnosis of the causes of said events and the prioritization of responses. In a broader context, real-time monitoring can be applied to continuous awareness of the network state. Real-time or dynamic modeling of water distribution networks has been investigated in several studies (e.g. Sunela and Puust, 2015; Boulos et al., 2014; Hutton et al., 2012). Real-time control is a relevant issue in sewer networks as well. Campisano et al. (2013) studied the potential and limitations of existing equipment for real-time control of sewer systems and found that the technologies needed for real-time control are largely there, even though room for improvement was found such areas as water quality measurement.

2.2. Big data and open data

Intelligent communication networks with smart meters and sensors produce vast amounts of data in (near) real-time. Mayer-Schönberger and Cukier (2013) introduced the useful term "datafication" to frame the idea of enabling and utilizing detailed information from various sources. Converting available data into a quantified format that can be stored easily can lead to actionable information and thus better decisions through new services, such as predictive analysis.

Datafication results in big datasets or "big data." Various conceptions of big data have been proposed in the literature (Ylijoki and Porras, 2016). Understanding big-data characteristics is essential to building related software solutions. Laney (2001) advanced the 3 V conception of big data: volume, velocity, and variety. Volume refers to increasing amounts of data. Velocity indicates the need to capture and analyze data at high speed in (near) real-time. Variety is related to different types of data, such as transactions, social media posts, and video. Some technology vendors have developed their own conceptions of big data.

A related emerging development is the rise of open datasets. According to the Open data Institute (2016), "open data is data that anyone can access, use or share. When big companies or governments release non-personal data, it enables small businesses, citizens and medical researchers to develop resources which make crucial improvements to their communities." Organizations, particularly governmental and other public actors, are producing and publishing increasing amounts of open data for the public. In the European Union, for example, spatial data is available through the INSPIRE directive (European Parliament and of the Council, 2007). Price information on municipal construction contracts are now made publically available in Finland. Social media channels are also increasing the available data. Utilities use these mostly for customer service and feedback, but they provide potential for data collection as well.

Big data and open data are partially overlapping concepts. Some open-data sources are in effect producing big data. Similarly, some actors publish big data under an open-data license. Examples include the U.S. Energy Information Administration, which currently offers more than 1000 open access data sets and NASA Earth Exchange (NEX), which provides earth science datasets and climate projections. These data are available in various formats.

For the water sector, as in other fields, big data and open data offer many possibilities in terms of asset management and system control as well as new services that can be provided to utilities and their customers. Much of the big data in the water sector is related to piped networks, but water treatment facilities can also produce large amounts of data and these data can be processed in new ways. High-grade monitoring and control of water treatment processes can thus be aspired (Haimi et al., 2013).

For various industries, data-driven organizations appear to have a competitive advantage. (McAfee and Brynjolfsson, 2012). Water and wastewater utilities can similarly benefit from a data-driven approach in measuring and improving decision-making. Even though the water sector is still at the early stages of accumulation, and the data are largely transactional, a number of documented case studies on advanced data utilization are available. In other words, the potential for these and other applications are just beginning to be explored.

3. Survey method

In order to map the status of the utilization of existing information systems and datasets at water and wastewater utilities, a survey with special focus on the possibility of integrating open or big data into them was conducted. The survey was designed in cooperation with key actors in the Finnish water sector. The development the survey involved the Finnish Water Utilities Association (FIWA), the Association of Finnish Local and Regional Authorities, the Ministry of Agriculture and Forestry, the Finnish Environment Institute, the consulting company Sito Ltd., and some Finnish water utilities. An online-survey link was sent to 314 water professionals working at Finnish utilities and a total of 150 utilities in February 2015; altogether, a total of 113 completed questionnaires were received.

The aim was to gain insight on current data management practices and preferences in the Finnish water sector. Different groups of professionals may take part in decisions related to data management and information systems at utilities. Because of this, one to three water professionals were selected from each utility (based on utility size) to answer to the survey. The sample covered utilities located all over Finland to ensure good representation of all the types of facilities encountered across the country. The overall response rate to the survey was 36%. Of the respondents, 33% represented top management, while 48% were other utility employees and 19%, were technical experts and maintenance engineers. The average age of the respondents was 52 years.

The survey had 24 questions, six open, of which only some were relevant for the topic of this analysis. The open questions were not mandatory, and the respondent was able to bypass individual questions. Due to this, the number of responses on individual questions varied. The questions of the survey covered different aspects related to data management and policies. These included data usability and system interoperability, license and maintenance agreement policies, current needs for training and know-how on information systems, and anticipated needs for data-related services.

3.1. Survey results

The survey results reported here cover three themes based on respondent perceptions about (1) information system capabilities, (2) data utilization for benchmarking, and (3) customer service and public image.

3.2. Information system capabilities

At the majority of utilities surveyed, according to the respondents, open data and open interfaces have not been taken into account in the existing information technology (IT) contracts and systems, such as those related to customer information or customer care and billing systems (Fig. 1).

The respondents were of the opinion that expanding existing information systems with open data interfaces or interfaces to other systems is highly expensive. The utilities typically have to order any changes to the systems from a software provider. The survey results support the idea that there is room for improvement

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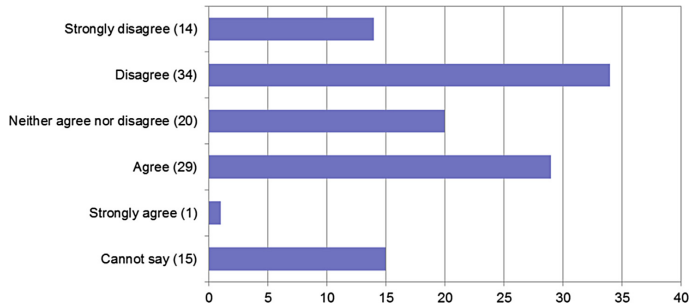

Fig. 1. Open data and open interfaces have been taken into account in IT contracts.

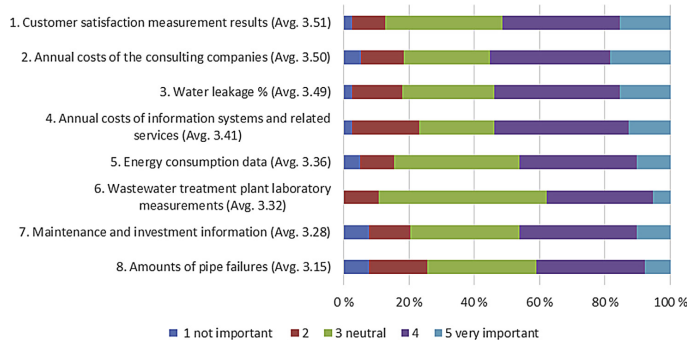

Fig. 2. Benchmarking the following information of water utilities can provide additional values for the water business.

in terms of open-data interfaces.

Survey respondents saw several areas where better data availability and better information systems would add value to their business and ease their daily work, including real-time monitoring of the water distribution system and utilization of data collected by smart meters. The potential for user-friendly customer care and billing systems was also mentioned. Respondents also favored getting billing systems into a cloud-based service, which could be accessed irrespective of user location. The respondents wished for an online service to report failures and inform the utility's emergency repair department. Finally, respondents wished to provide better information services and text messaging (SMS) services to customers and utility employees.

3.3. Data utilization for benchmarking

Respondents were also asked about the extent to which they use data from a national benchmarking system (named VENLA). The benchmarking system VENLA is provided by the Finnish Water Utilities Association (FIWA) to member utilities. As summarized in Fig. 2, the most important and useful metrics in the benchmarking system for comparing water utilities of similar size were considered to be: (1) the results of customer satisfaction surveys, (2) annual spending on consulting services, (3) operational performance data (namely, leakage levels in the water distribution system and inflow and infiltration levels in the wastewater network), and methods used to reduce leakage and inflow and infiltration.

The current web-based benchmarking system is used by 37% of the water utilities represented in the survey. The system was considered to help in developing targets and collecting information for comparative reports for the staff and the executive board. Among the respondents, 25% felt they had clearly benefited from operational benchmarking while 13% did not appear to take advantage of the benchmarking data.

The survey also explored rights of access to the benchmarking data (Fig. 3). The respondents were of the opinion that the benchmarking results should be shared among various interest groups. Three of the most important groups were considered to be the home organization, governmental authorities, and research organizations and universities.

The responses also revealed that 26% of the respondents reported that their utilities carried out a customer satisfaction survey annually and 19% mentioned that surveys were conducted every two to five years; 45% reported that surveys were not conducted on a regular basis and 10% were not aware of any customer satisfaction surveys.

3.4. Customer service and public image

The respondents were of the opinion that interactive online services can encourage citizens to observe and report water leaks or other problems to the water utility. They also estimated that open

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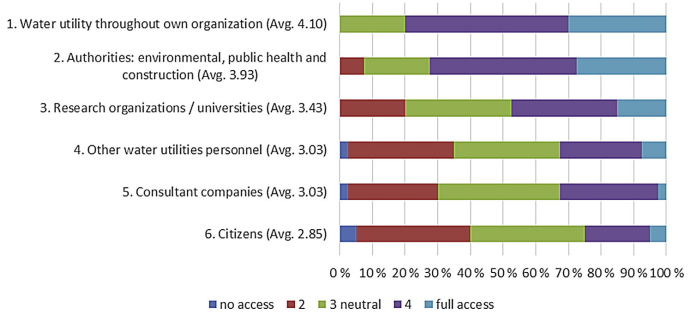

Fig. 3. Extents of the rights of different groups to obtain benchmarking data.

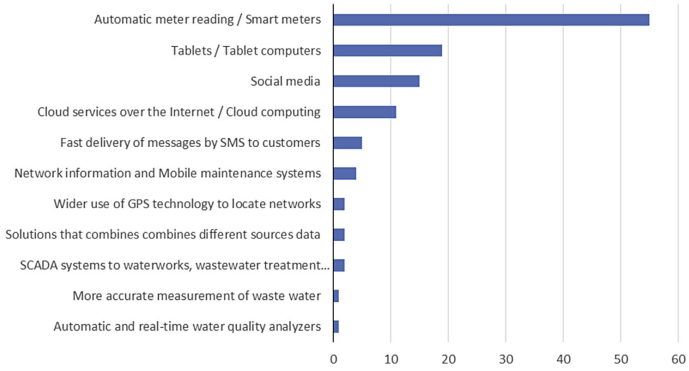

Fig. 4. New technological solutions which can be put into operation in the future.

data and transparency would have a positive impact in terms of convincing decision makers to increase investments for network renovations. The respondents thought that, in the coming years, the three most important technological developments will be smart meters and automatic meter reading, wider use of tablet computing by personnel, and more active use of social media (Fig. 4). Respondents expected the use of smart meters to increase progressively as their cost declines. Tablets were considered beneficial in improving for example fieldwork efficiency as they allow network and maintenance data to be entered and viewed in the field. Development of customer communication was considered an important future task. Social media channels (such as Facebook and Twitter) were expected to complement text messaging (SMS) and e-mail communication services. The role of cloud services and cloud computing were expected to play a bigger role in customer care and billing systems. Cloud services were seen to also help facilitate the administration of meetings and preparation of common documents.

In the open questions, survey respondents highlighted some ideas for improvement and future prospects in data management. They saw a need to develop consulting services for competitive tendering and long-term engineering services for automation projects. The respondents wished to outsource the GPS field surveying related to network digitalization and updating of environmental permits. Some respondents also mentioned a need for outsourcing billing and customer services. Automatic computing of non-revenue water (NRW) per network area was also mentioned. According to the results (Fig. 5), representatives of the Finnish water sector believe that more training and mentoring regarding new IT systems and consulting contracts is needed.

4. Needs assessment

Based on our survey results as well as the available literature, we can outline the competencies needed in the water sector due to the growing data intensity and emerging analytical opportunities. Building data-intensive capability is not a trivial task. The utilities must integrate existing and new technologies and information systems and deal with vast amounts of data in (near) real-time. This requires investments in information technology and software, as well as employee IT skills. We identify the need for competency in three key areas.

4.1. Managerial competency

Data-intensive approaches and decision-making processes offer many new opportunities for water utilities. However, solid leadership is essential if the utility is to succeed in efficiently developing and utilizing big data (Davenport, 2014). Utility managers may need to experiment. Making the most of big data requires a

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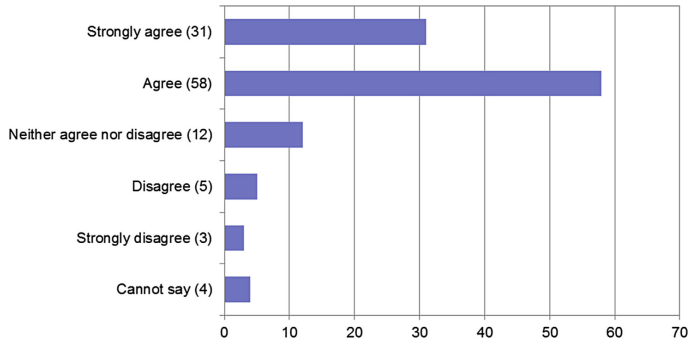

Fig. 5. Needs to be obtain more training and mentoring with new IT systems and consulting contracts.

data-driven organizational culture (e.g. Shen and Varvel, 2013; Dutta and Bose, 2015). In addition, utilizing data may require changes in the decision-making processes. Managing these changes requires training in how to collect, store, analyze, and report on data as well as how to use data to make better decisions. As the water sector is still in the early stages of the big data era, it is difficult to calculate the return on investment in information technologies; a less risky approach may be to start small and learn from experience (Mui and Carrol, 2013). Data intensive and agile management approaches require new leadership skills and practices in addition to data management skills. Most Finnish water and wastewater utilities are traditional organizations that are just starting to recognize the potential opportunities associated with open and big data.

4.2. Technological competency

In order to improve data management, new technological solutions must be adopted. As the installation base of sensors and smart meters increases, water utilities must deal with vast volumes of (near) real-time data. Current data-management platforms and information systems may require significant changes due to the growing volume, velocity, and variety of geospatial and other data. An analytics platform is required to derive value from the data for utilities and their customers. The results can be presented in a visual and accessible format. All these needs require additional expertise in analytics, software systems, software engineering, and cloud computing. These skills must be developed either inside the utility or acquired from a reliable service provider (Gartner, 2015).

4.3. Security competency

Water utilities have so far emphasized care of the physical security of their assets. With smart metering and cloud-based software solutions, utilities must protect themselves and their customers against unauthorized access. Smart metering also gives rise to privacy concerns. McDaniel and McLaughlin (2009) discuss security issues in the context of smart electric grids and their findings apply to the water sector as well. As they point out, vulnerabilities in software are especially attractive to hackers who may try to benefit financially or cause damage by attacking infrastructure control systems. Similarly, privacy safeguards are also needed to avoid the misuse of utility software or allowing data to fall into wrong hands.

5. Discussion

The expanded use of intelligent communication networks and social media will increase the availability of data in the water sector and challenge current IT systems. We considered whether water and wastewater utilities are prepared to benefit from this change, given that most are small and have limited resources. The cost of hardware and software presents a barrier to modernizing information systems. Two organizational and operational options may help overcome this barrier. One is for utilities to merge in order to achieve purchasing power. Another is for solution providers to offer services with fees proportional to the number of utility customers.

Our survey of utility respondents shed light on these issues, identifying smart water meters as the most interesting new technological development. Wider use of tablets for field work and more active use of social media were also considered potentially beneficial. Modern cloud computing services were considered promising in the areas of customer care and billing systems. Online services were expected to encourage water customers to report leaks and other failures to the utility. Benchmarking similar sized utilities was considered beneficial especially sharing knowledge about customer satisfaction, annual spending on consulting, and methods for combating leakage in water distribution systems and inflow and infiltration in sewer systems.

The survey results suggest that there is much room for improvement regarding both open data and big data utilization in the water sector, supporting the view that the industry is only beginning to understand the potential that new datasets offer. Many water and wastewater utilities are interested in smart water meters and social media. However, it is apparent that the technology platforms of most Finnish water utilities were not designed for and are not prepared to deal with large amounts of real-time data.

Based on our findings, we encourage small and medium sized utilities to take a more active approach to information management, including IT contracts that enable the development and utilization of big data. Smart meters and two-way online communication services could be offered to customers, including leak detection and usage monitoring (possibly enabling new billable services). In any case, new managerial, technological, and security competencies are needed if utilities are to make good use of the information now available to them.

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Innovation capabilities as a mediator between big data and business model

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ABSTRACT

The digital transformation is forcing organizations to change towards more data-driven business models. In this paper, we propose a conceptual framework that explains the role of innovation capabilities as a mediator between big data and business model. Using the design science research method approach, we built the framework based on the existing literature. We then applied the framework to the real-world context with three firms and refined it based on the feedback. This study contributes to big data research by pointing out the role of human and data-driven innovation capabilities in the big data value creation process. The developed framework is practitioner oriented, offering a systematic approach towards the development of big data capabilities.

KEYWORDS

big data; business model; business transformation; business value; datafication; digital transformation; framework; innovation

1. Introduction

Linking the opportunities of big data and the business transformation imperative resulting from digitization leads to a situation where incumbent firms must re-think and innovate in their business models and create new capabilities in order to stay competitive in their business ecosystem. Digital technologies, such as social media, cameras or open web sources, produce vast amounts of data. The number of "things" (mobile devices, sensors, etc.) that are connected to the Internet is rising rapidly. Humans generate more and more digital breadcrumbs; we are actually becoming "walking data generators" (McAfee & Brynjolfsson, 2012). The business landscape is becoming turbulent, and changes can happen rapidly. The disruption of many current business models has already begun (Weill & Woerner, 2015).

The data generation phenomenon is called datafication. Datafication can be seen as an "information technology-driven sense-making process" (Lycett, 2013). As datafication proceeds, more and more data are produced,

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processed and transferred. These data are often called big data. Although big data is understood in various ways, the importance of utilizing data in modern businesses is undeniable. Several studies show that data-intensive firms are more effective and profitable than their less data-driven rivals (see e.g. Brynjolfsson, Hitt, & Kim, 2011; Dehning, Richardson, & Zmud, 2003; McAfee & Brynjolfsson, 2012).

Business ecosystems (Iansiti & Levien, 2004; Moore, 1993) and data-related business models are emerging, providing services like data (data-as-a-service), analytics (analysis-as-a-service) or Internet of Things-related offerings (Chen et al., 2011; Leminen et al., 2012). Many new startup firms follow the trailblazers like Google or Amazon and formulate their entire business models on top of or around the data. Data are a valuable asset for these kind of firms. Start-ups heavily rely on data in their decision-making processes and product and service innovations.

For most incumbents, however, a data-driven approach is still a new and unexplored area. Technology vendors have introduced frameworks that aim to help organizations in their big data efforts. A typical approach is to offer "how to" examples or success stories where business benefits have been achieved by utilizing a specific technology stack. In addition to practitioners, scholars are increasingly investigating different aspects of big data, such as the value creation mechanisms (Hartmann et al., 2016; Wixom, Yen, B., & Relich, 2013) and organizational performance (Akter, Wamba, Gunasekaran, Dubey, & Childe, 2016; Ren et al. 2017; Wamba, Gunasekaran, Akter, Ren, Dubey, & Childe, et al. 2017).

The purpose of this study is to present a practitioner oriented framework that explains the role of human and data-driven innovation capabilities as a mediator between big data and the business model of a firm. Our framework helps in understanding how big data and innovations are shaping business models in the digital transformation. The term mediator is used to reconcile problems and promote development between innovation capabilities, big data and business model. The framework offers ways to organize perspectives on the transformation. This helps practitioners to focus on developing the capabilities and methods that best support the transformation towards data-driven business models.

2. Research method

As big data is an emerging area for both scholars and practitioners, the results of the research should benefit both theoretical and practical viewpoints. Therefore, a natural research discipline for the study is information systems (IS) research. IS research draws from behavioral and design sciences, exploring the combination of technology, organization and people. It

should both make theoretical contributions and provide assistance to practitioners in solving current problems (Benbasat & Zmud, 1999; Iivari, 2003).

Design science is one of the two established paradigms in IS research. Hevner et al. (2004) give a clear goal for design science research in their definition: "Design science creates and evaluates IT artifacts intended to solve identified organizational problems." Their description of artifacts covers tangible products, constructs, models and methods. Thus, our framework fits into their definition. We followed the design science research method (DSRM) framework (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007), which provides a nominal process for conducting and evaluating design science research in information systems. Figure 1 shows the DSRM framework as we applied it in our study. Starting by identifying the problem, we followed the framework in our study. This paper represents the last stage, communication. The steps or stages, of the DSRM framework can be identified also by looking at the organization of this paper.

After building the framework, we used three real-world case scenarios for evaluation and to develop the artifact further. First, we tested the framework with two big data intensive firms. Secondly, we analyzed one mature stage big data implementation in order to find out how the framework might have benefited the implementation. We then refined the framework based on the feedback from both iterations. The companies utilize big data and look for opportunities to develop data driven business models. The firms are in different stages of utilizing big data and represent different industries. They focus on potential benefits in cost savings, product development and revenue generation. Thus, the three firms offer different viewpoints to the evaluation of the framework.

Other research methods, like action research (Baskerville, 1999; Lewin, 1947) or action design research (Sein et al., 2011) provide applicable methods for dealing with organizational change as well. However, we found that the design science DSRM framework would meet the needs of our research. We were developing an artifact (the framework) and therefore preferred design science to action research. As our goal was to develop a generic framework in a novel area, we preferred rapid iterations with moderate

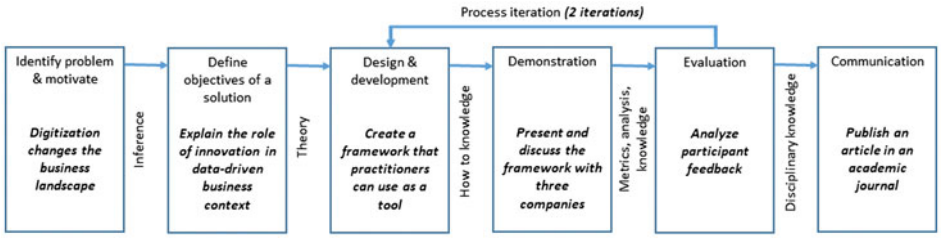

Figure 1. Research method, applied from Peffers et al. (2007).

user input instead of their long-term commitment. In addition, practitioners favor approaches that present initial concepts or assumptions in order to provoke new ideas, instead of a clean sheet of paper as a starting point. Experimenting is a common technique for iterative development. The development, demonstration and evaluation stages of DSRM form a cycle that fits well to rapid experimenting without overloading the participating firms.

3. Building the framework

Linking the opportunities of big data (as a consequence of datafication) and the business transformation imperative (resulting from the digital transformation) leads to a situation where incumbent firms must re-think (innovate) their business models and create new capabilities in order to stay competitive in their business ecosystem. The objective of the developed framework is twofold:

- Advance big data research by addressing the role of innovation capabilities in data-driven business context.
- Assist practitioners in their big data initiatives by offering a framework that helps them in developing required capabilities.

3.1. Theoretical background

The framework treats innovation capabilities as a mediating factor between the business model and big data. Therefore, the nature of the framework is multi-disciplinary. The elements are related to strategic management and information systems research.

The value chain and five forces model, e.g. (Porter, 1991; Porter & Millar, 1985), are commonly used strategic management frameworks. The former is an internal view of the business, whereas the latter provides an outside-in industry view. Porter's models explains the source of competitive advantage by two factors: low cost or differentiation. Another established strategic management framework is the resource-based view (Wernerfelt, 1984). It combines the internal and external views of previous models. The resource-based view aligns well with data-oriented business environments, where digital ecosystems, e.g. (Weill & Woerner, 2015), are increasingly used to add value.

IS research draws from behavioral and design sciences, exploring the combination of technology (including data), organization and people. This research should both make theoretical contributions and provide assistance to practitioners in solving current problems (Benbasat & Zmud, 1999;

Iivari, 2003). One of the strengths of information systems research stems from the combination of behavioral and design sciences; technology, data and behavior are inseparable in an information system.

Digitalization implies business changes that are technology driven. Thus, strategic management and IS research provide a broader view to the topic. Moreover, change requires innovation. Start-ups and incumbents search for new, technology and data driven innovations. We discuss how data- and human-driven innovations act as a mediator between (big) data and business model later in this paper. In this section, we briefly present and define the building blocks from the above described disciplines that our framework relies on, namely the concepts of business model, capabilities, innovation and big data.

3.1.1. Business model

The concept of business model has been vividly discussed in the strategic management discipline. It relates to how an organization arranges its functions in order to create value. The term business model is often used interchangeably with strategy (Burkhart et al., 2011). Many definitions exist for both terms (e.g. Amit & Zott, 2001; Casadesus-Masanell & Ricart, 2010; Teece, 2010; Timmers, 1998). However, there seems to be consensus that these concepts differ from each other: strategy is more focused on competition and product-market matters, whereas the business model describes how the strategy is implemented (Zott, Amit, & Massa, 2011).

Osterwalder and Pigneur (2010) define the business model as follows: "A business model describes the rationale of how an organization creates, delivers, and captures value." They also present a business canvas framework that serves as a tool when analyzing how an enterprise creates value. Furr and Dyer (2014) present a simplified business canvas framework. It includes three main elements: solution (which is further divided for value proposition and pricing strategy), cost structure (activities and resources) and customer acquisition (relationships and channels).

3.1.2. Capabilities

Capabilities are related to resources and the resource-based view (RBV) of a firm (Wernerfelt, 1984). In the resource-based view of a firm, resources and capabilities are the key concepts that explain a firm's competitive advantage. Teece (2007) introduced the concept of dynamic capabilities, defining them as "the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments," which complements the RBV by explaining how firms renew their competencies in order to adapt to the changing business environment.

Big data is a disruptive new technology. Incumbent firms typically rely on the idea that their current capabilities are relevant with regard to new technologies, but often this is just based on assumptions (Sainio, 2005). Accordingly, incumbents often fail to take advantage of disruptive technologies, even when they are well aware of them (Christensen, 2013). These are the main caveats for incumbents and therefore a deeper understanding of the datafication phenomenon and correct recognition of the required capabilities are crucial steps when a firm assesses the effects of big data.

3.1.3. Innovation

In order to innovate effectively and develop an innovative organization culture, the firm needs to understand the nature of innovation. Innovation and change are tightly related: to innovate effectively aims at changing something. Many different perspectives towards the concept of innovation have been taken in several disciplines. Thus, there are different definitions of the term (e.g. those suggested by Ettlie & Reza, 1992; Schumpeter, 1942; West & Anderson, 1996). After a review of existing definitions, Baregheh, Rowley, & Sambrook, (2009) provided a synthesized definition that views innovation as a dynamic capability: "Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace."

3.1.4. Big data

Laney (2001) described three essential dimensions of big data: "volume, velocity and variety" (the 3 V definition). Volume refers to ever-increasing amounts of data. Velocity indicates the need to capture and analyze high-speed data in (near) real-time or else the value may be lost. Variety relates to different types of data, be it structured or non-structured, such as social media posts or a video. In recent years, scholars and especially practitioners have developed numerous big data definitions. Ylijoki and Porras (2016b) present a detailed discussion about big data definitions and the history of the term, concluding that the abovementioned dimensions are not only used in most of the definitions, but also form a logically coherent set. For the purposes of this research, the 3 V definition is adequate.

3.2. Innovation capabilities as mediator framework

The value proposition of big data is that companies can gain benefits by making use of it. Indeed, new, data-driven business models are emerging, like the data-as-a-service or analytics-as-a-service approaches discussed by

Chen et al., 2011). To give another example, van't Spijker (2014) lists five value generation models for data-driven business: 1) selling data directly, 2) innovating products through data, 3) swapping commodity offerings into value-added services, 4) creating interaction in the value chain and 5) creating a network of value based on data exchange. One example of data monetization is presented by Najjar and Kettinger (2013), who have investigated the process, benefits and drawbacks of the data monetization process in a large drug retailing firm. Internet of Things-related business models are evolving (Bucherer & Uckelmann, 2011; Chan, 2015; Leminen et al., 2012; Westerlund, Leminen, & Rajahonka, 2014). These examples clearly indicate that big data affects business models.

We adopt the business canvas model by Furr and Dyer (2014) into our framework, shown in Figure 2, as it covers essential elements from the innovation point of view. The business canvas model provides a (sufficiently) detailed starting point to understand the potential impact of big data in business context. Organizations can develop different scenarios using the canvas as a tool. It helps in concentrating on different viewpoints, such as streamlining core activities or developing new pricing strategies with data and analytics. On the other hand, it helps in seeing the big picture, as it covers all core functions of an organization. Moreover, we use the 3 V definition of big data (Laney, 2001), supplemented with a categorization element for each of the dimensions, in order to ease the use in practice.

The data deluge and changing business models are challenging incumbents to develop new capabilities. Approaches using resource-based theory have been popular among big data researchers recently, (Braganza, Brooks, Nepelski, Ali, & Moro, 2017; Gupta & George, 2016; Mikalef et al., 2017). We make no exception to the approach. However, we wish to add to the conversation the role of innovation capabilities in shaping the business model, as shown in Figure 2. In the big data context, we distinguish between "data- and human-driven" innovations.

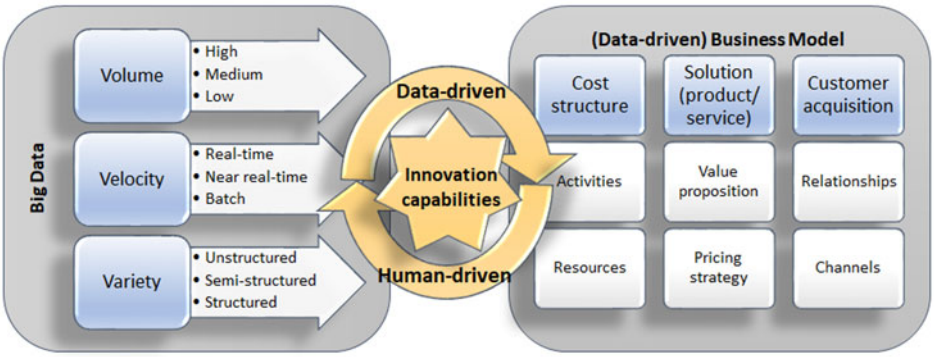

Figure 2. Innovation capabilities as a mediator framework.

The "human-driven approach" to innovation states that innovations stem from people (Harmaakorpi & Melkas, 2012). New ideas – the seeds of innovations – often emerge sub-consciously, when our brain associates things. Dyer, Gregersen, and Christensen (2008) claim that by training certain skills systematically, anyone can accelerate associative thinking. The four discovery skills are: observing (especially looking for surprises), networking with people from different backgrounds, experimenting a lot and questioning the status quo. Innovative people spend more time exercising these skills than others. New ideas emerge from self-transcending knowledge (Scharmer, 2001) as a result of associations. Self-transcending knowledge is future-oriented knowledge. It could be considered to be tacit knowledge prior to its embodiment. A good example of a person utilizing this approach was Steve Jobs.

Enabling human-driven innovation requires that individuals may use part of their time in seemingly unproductive discovery-skills development. This is important for developing self-transcending knowledge. Another requirement is that the organization's culture and management practices must support risk-taking and allow mistakes. Dyer, Gregersen, and Christensen (2011) present four principles that the most innovative organizations apply: 1) innovation is everybody's job, 2) both incremental and disruptive innovations must be considered, 3) innovations are developed in small teams and 4) managed risks must be taken. These are by no means trivial requirements: e.g. Sandberg and Aarikka-Stenroos (2014) identify a restrictive mindset, lack of discovery competences and unsupportive organizational structures as the three main internal barriers to radical innovations in incumbent firms.

Another way to view innovations relies on data and automation. A novel approach, "innovation automation," is data-driven. Data-driven innovation suggests that the innovation processes could and should, be automated (Shaughnessy, 2015). This approach puts technology and (big) data at the core of the innovation processes. More and more data becomes available, technological and analytical capabilities are increasing and data processing costs are decreasing. Utilizing automation and vast volumes of different data will produce a more holistic view, leading to more data-driven decisions and more agile innovation processes. For example, big data might be used for early recognition of trends, combined with automatized simulations of possible scenarios in order to fertilize people's thinking and, in turn, new human innovations. An example of innovation automation approach is Netflix, a company offering on-demand movies and television series.

Data-driven innovation, especially when combined with rapid experiments, can significantly speed up the innovation process, as the Netflix (Amatriain, 2013) example shows. Manyika et al. (2011) claim e.g. that

manufacturing firms can reduce their product development costs by 20–30% as well as achieve up to 50% faster time-to-market cycle by utilizing big data. One case study of utilizing data to drive innovations is documented by Jetzek, Avital, and Bjorn-Andersen(2014). However, for most incumbents, innovating with big data is in its infancy.

Innovation capabilities are at the core of the transformation of a firm. Therefore, understanding the nature of innovation is a prerequisite of a fertile innovation process. However, the kind of activities that efficient innovation processes require are in contrast with the current procedures of most incumbent firms. Incumbents organize themselves to be effective. They concentrate on minimizing all kinds of waste (like allocating time to seemingly unproductive activities such as developing discovery skills) and avoiding errors. This indicates that focusing on the organizational aspects of innovation capabilities is an important factor for a successful business transformation.

4. Evaluating the framework

The purpose of demonstration and evaluation phases was to assess the applicability of the framework in practical situations in business. Another objective was to gather feedback in order to develop the framework further.

4.1. Demonstration

The following sections describe the demonstration phase. In addition to presenting our approach and the companies, we provide a synthesis of the findings.

4.1.1. Demonstration process

First, we presented the framework to two big data intensive firms. One operates in several countries, offering cloud-based human resource (HR) solutions, and the other is a startup company offering SaaS-based integrations. Both firms act as "data hubs" and deal with large amounts of data. This gives them opportunities to develop even smarter data-related services or products, like predictive HR signals or benchmarking analyses. Using the proof-of-concept approach, we demonstrated the usage of the framework through semi-structured interviews. The people we interviewed were members of the executive boards of their firms. Our aim was to find out the usability of the framework in firms that are in the quite early stages of exploiting big data. In the second iteration, we performed a "postmortem" examination of a real-world big data case. Reflecting the case against the

framework, we explored how the framework might have helped the company to understand the impact of big data.

4.1.2. Demonstration contexts

The arrangements for the demonstrations of the framework were as follows: we prepared materials for the interviews beforehand. The material consisted of an overview presentation of the framework and a brief questionnaire to assess the current situation. As orientation material, we sent a set of preliminary questions to the interviewees a couple of days before the interviews. The duration of each interview was around two hours. We recorded the interviews and took notes. At the end, we asked for feedback, both verbal and written. Afterwards, we analyzed our notes and outlined them in memos. Any unclear points were checked in the recordings. The interviewees reviewed the memos.

The first iteration was to introduce the framework to the HR solutions provider and the integration services provider. Two interviewers participated in both interviews. Sympa, the HR solutions provider, is an established firm in the HR business. Their key offering is Sympa HR, a cloud-based tool for managing employment relationships, from recruitment to termination of employment. The firm is an established company that already has a large number of customers in several countries. However, they are seeking rapid growth. Their management has discussed big data, although they have not yet formulated a clear big data strategy.

The other firm, Flashnode, is a Finnish startup offering services for interconnecting and synchronizing data. The firm's business model relies on highly standardized integrations, which challenges the traditional tailored interface development approach. A key objective of automated integrations is to reduce the manual work done by client companies. They have an aggressive growth strategy. Their position as a data hub offers various opportunities to utilize big data. The company accumulates huge amounts of data in terms of transaction volumes.

The second iteration was the postmortem examination of an existing big data initiative. A bus company operating 430 buses in urban and suburban areas wanted to improve their cost efficiency. A potential target for this purpose was to reduce fuel costs, as these costs represent the company's second largest expense. Meeting the business goal would require a transformation process consisting of training and motivating of the drivers, and a technical solution to collect detailed fuel consumption data. We applied the same procedures as in the first iteration, with the exception that only one interviewer was present. During the analysis of the case, we interviewed the owner of the big data initiative (the chief technical officer,

CTO) and inspected the software vendor's project documentation. The bus firm treated the initiative as a business development program

4.1.3. Demonstration findings

Here are the key findings of research and interviews of three different firms. The HR solution provider firm sees several areas where big data can add value to their business, such as integrating external data, utilizing metadata that their platform generates, and creating a "Sympa tribe" ecosystem for their customers. Moreover, they increasingly utilize sensor data, such as access control logs and working time recordings.

In the second case the provider of system integration the data is internally mostly applied to product development prioritization. Based on the big data, internal analyzes have also been carried out to compare customer-specific data volumes and other business customers trends. In this case, customer data is enriched with other external sources. Based on the above, the purpose is to develop a reporting service that provides benchmarking data to customers. For example, how does our business compare to industry in general in terms of transactions of subscription volumes.

In the case of the bus company they set the business goal as follows: to educate and motivate the drivers to change their driving habits, which will in turn lead to reduction in fuel consumption. They appointed the CTO to lead the program. They consulted potential software and hardware vendors and selected the technologies. The implementation started with a pilot project, which integrated the technologies using data from ten buses. After an assessment of the pilot, a full-scale implementation project followed. During the following months, the project team implemented a production-ready system and solved several data quality-related issues. At the same time, the firm created a change management plan for the release and roll-out. After two years of use, the system has proved to be a success. It has met the original business goal. The system and its usage have costs, but the net result is a significant cost reduction due to permanently lower fuel consumption. Moreover, the firm has recorded remarkable improvement with regard to the traveling experience in customer satisfaction surveys. The passengers have noticed that the drivers drive smoothly. A third achieved benefit is, of course, the reduction of carbon-di-oxide emissions.

4.2. Evaluation

In this section we first analyze our findings from the demonstration. Next, we offer building blocks for practitioners by describing an exemplary process and discussion on how to apply the framework in practical situations.

4.2.1. Evaluation of the demonstration

The first iteration of the demonstration phase confirmed that the framework provides a mental model for evaluating the effects of big data in the business context. The interviewees found the framework useful for this purpose. The HR solution provider emphasized that the framework helps to create a systematic approach that will save time. Managing a growing business is hectic; they could not tie key resources to long consulting projects. The integration services provider stated that the framework offers guidance and provides understanding of big data adoption. They saw big data as a strategic issue. Applying the framework would help identify the required changes, as the business model aspect of the framework emphasizes the strategic importance of big data. Another key aspect of the framework is focusing on the importance of data, as "you can always build or buy algorithms, but you cannot generate data from the void."

In both firms, we noted that the framework helped keep the discussion focused. It helped in keeping concentrated on one topic at a time. Moreover, the discussion regarding new ideas was lively. Although this may be related to personal characteristics, the framework facilitated the ideation. Both firms considered the framework useful in their feedback. After the first iteration, we reflected the discussions in our framework. From the theory point of view, no new aspects were recognized. By looking at the practical side, the interviewees appreciated our orientation material, as it helped them to perceive the framework.

In the second iteration, we analyzed the bus firm's big data initiative. The initiative started when the firm noticed that the current technology enabled them to collect detailed data from the buses. This idea led ultimately to the big data initiative. The management of the company considered that the big data initiative would strengthen their competitive situation due to increased operational efficiency.

The firm set a clear objective for the program, although they did not define an explicit value for it. They also set a member of the executive board (the CTO) to lead the program. They focused on meeting the business goal, i.e. reducing fuel consumption. The firm also recognized real-time monitoring needs on the horizon. However, as the fuel consumption analysis did not require real-time processing, they decided to postpone the implementation to later phases. The project team, consisting of members of the firm and a software vendor, identified the required datasets and drew up a cost-effective architecture without paying attention to additional features. In the pilot phase, neither the firm nor the software vendor considered real-time needs. The project members may have discussed possible future scenarios in their coffee breaks, but the project did not consider those scenarios officially. This ultimately led to a situation where further development to meet the real-time needs is difficult.

Our framework would have helped the bus firm to understand the situation better at the beginning of the program. The owner of the big data initiative shared this view and saw that the framework would have been helpful. A better understanding of the data might have helped them to earlier identify certain data-related issues that reflected on the attitudes of middle management. Moreover, the framework would have helped to develop capabilities to tackle the data issues. Another capability-related matter was the shortage of analytical capabilities, which has been a hindrance to making use of the gathered data. In addition, using the framework in the early phases would probably have stressed the future needs. This, in turn, would probably have led to a different architecture or technology selection in the project phase.

The two companies that had less experience with big data paid only a little attention to developing capabilities, whereas the postmortem indicated that more attention should have been paid to capability development during the project. Another observation, although an expected one, was that the usage of the framework benefits from facilitation. Preparing supporting material for the interviews and group work adds a middle layer between the framework and the daily operations. This helps the participants connect the framework concretely with their own context. Using a few questions or brief examples that concretely link to the firm's current situation would concretize the subject and help link big data to the firm's business context even better than a generic approach.

The demonstration phase confirmed our initial assumption that simplicity is a virtue when providing building blocks to practitioners. This assumption in mind we carefully considered in the first place the balance between theoretical completeness and practical viewpoints in the presentation of the framework. E.g., the simplified business canvas model (Furr & Dyer, 2014) we chose, covers essential components from innovation point of view. However, it should be noted that extension to full business model canvas (Osterwalder & Pigneur, 2010) can easily be done (by scholars or practitioners) whenever required.

4.2.2. Suggestions for making use of the framework

Companies can choose different practical approaches to the framework according their situation and objectives. Increasing the role of data in current business model, e.g. by automating delivery processes to decrease transaction costs requires a different approach than developing a new, data-driven model. Based on the evaluation phase of our framework, we synthesized an exemplary usage scenario as follows.

1. Assess current situation and big data impact: This can be done by looking at the business model components (see Figure 2) one by one and

creating scenarios of potential big data effects. Effects can be either risks or opportunities; some of the effects are such that they cannot be influenced, some of them are within the reach of the company.

2. *Define business objectives.* Clear goals and ownership are best practices for any business development initiative. Especially in the case of new things solid leadership is important to achieve the set goals. This phase might be iterative, innovating back and forth between the business model and big data. What internal or external data could affect our business? What data do we need in order to best run our business? Novel ideas or long-term, strategic goals often require experimenting for verification.
3. *Evaluate/ideate big data value potential.* Many innovations are human-driven, but increasingly, data are a source of innovations. Humans ideate things that require gathering and combining new and existing data in novel ways. Accordingly, experimenting with data may reveal insights that spark ideas. Human-driven and data-driven innovations are not mutually exclusive. Instead, they can, and should, support each other, effectively creating an innovation loop. Our framework provides support for these activities by explaining the theoretical background and enablers for an effective innovation process.
4. *Identify required datasets and capabilities.* Identifying data that is beneficial to the business is a two-way operation. As one may intuitively think when looking at our framework (Figure 2), human-driven innovation comes down to a question: "What data do we need to fulfill this business need?" On the other hand, data-driven innovations ask: "Do we have data or can we access data that is beneficial to our business?" Once the datasets are identified, the modified 3V model shown in Figure 2 can be used to classify and categorize the data at a more detailed level. This, in turn, reveals possible gaps in ICT capabilities.

As another building block, and from the IT point of view, the 3 V model of big data (Laney, 2001) is a good starting point. Adding categorization elements to the dimensions (see Figure 2) and classifying any available or required data source (internal or external) accordingly helps to identify potential development needs of the current IT platform. For example, a business need may need to harvest and analyze social media data. The framework helps to translate the business need into an IT-related requirement: Do we have the hardware and software that is required to gather and process (relatively) low volumes of unstructured data in near real-time? It should, however, be noted that there are technical and data-related challenges (Benabdellah et al., 2016; Ylijoki & Porras, 2016a). Technical challenges are hardware- and software -related, such as managing vast

volumes of data with a Hadoop cluster, or using a not only SQL (NoSQL) database to store unstructured data. Analytical capabilities are human-centric, like building a predictive analytics model or interpreting a business need into an algorithm. A firm can develop technical and analytical capabilities in-house, or it can leverage service providers.

5. Conclusion

The paradigm shift towards more data-intensive business landscape is inevitable. Companies must consider the combination of big data, innovations and potential value against the required transformation when they plan their big data initiatives. For incumbents, the transformation may be more revolutionary than evolutionary, which implies a complicated process. Our practitioner oriented framework helps in understanding the role of innovations and (big) data in the digital transformation. Understanding these factors forms the basis for informed management decisions regarding business transformation and the capabilities the transformation requires.

In this paper, we have presented a multi-disciplinary framework that contributes to research by pinpointing the role of human and data-driven innovation capabilities as a mediator between big data and the business model. The framework combines elements from strategic management, innovations research and resource-based theory. It helps to understand the role of human and data-driven innovations, and innovation capabilities in an organizational context. Thus, the framework acts as a mental model that offers a way to organize perspectives on the digital transformation, especially from the practitioner's point of view. Understanding the theoretical background of the innovation process in the big data context will help practitioners to focus on developing the capabilities and methods that best support the transformation towards data driven business models.

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Publication III

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E-BUSINESS AND DIGITAL PROCESSES – BLOCKCHAIN IN INSURANCE*

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***Abstract**: Digitalization is a global megatrend which affects all business fields and enables significant changes in different business processes. This article studies the opportunities provided by blockchain technology to modernize vehicle insurance processes. Smart contracts are particularly emphasized when it comes to the development of the insurance business. On the basis of the data sources referred to in the theoretical background of this article, the blockchain technology and the distributed ledger approach related to accounting offer an innovative way for decentralized and communal management of business process data in networks of different organizations. The insurance business consists of networks of different parties (customers, agents, insurance companies, reinsurers, repair shops, etc.). This produces additional costs, for example, through manual labor and overlaps between data management and case handling. From the accounting point of view, organizations perform work that does not produce any value and incur unnecessary costs. These costs reduce the profitability of companies. Customers cover additional costs through insurance premiums. When it comes to customer service, overlapping data saving and handling processes also cause delays and potential errors. The source material presented the risk of potential insurance fraud hidden inside the insurance business as a key observation. The empirical pilot project related to this study in the Schengen border between Finland and Russia offers new information and practical solutions for handling the documents required when crossing the border.*

***Key words:** Blockchain, distributed ledger technology, process disruption, insurtech, agility*

1. INTRODUCTION

The ongoing process of digitalization has been said to be as significant a change as industrialization was in the past (Frey and Osborne, 2013). According to Brynjolfsson and McAfee, (2014), "everything that can be digitized will be digitized and everything that can be automated will be automated." Digitalization sets a framework and enables changes to be successful. As a result, we can question existing operating methods and recreate them to be quicker, more flexible and more functional. With regard to business processes: payments, accounting, invoicing, orders and different distribution channels for products and services are facing major changes and significant development. On the basis of the data sources referred to in the theoretical background to this article, blockchain technology and the approach of the distributed ledger (Xu et al., 2016) related to accounting offer an innovative way for the decentralized and communal management of business process data in networks of different organizations. There is an analogy between blockchains and supply chain management (Korpela and Hallikas, 2017). The blockchain can hold any legal document, in its worldwide

* ***Review paper***

ledger. It enables smart contracts, decentralized autonomous organizations, decentralized government services, and transactions among things (Tapscott and Tapscott, 2016). In immaterial data processes (such as the insurance business), instead of a material stream, a data stream resulting from customer needs is transferred and is converted, during handling, into decisions that fulfill these needs – for example, into smart contracts in reference to the blockchain technology. According to Zsabo's definition from the 1990s, "a smart contract is computerized transaction protocol that executes the terms of a contract. The general objectives of smart contract design are to satisfy common contractual conditions (such as payment terms, liens, confidentiality and even enforcement), Related economic goals include lowering fraud loss, arbitration and enforcement costs, and other transaction costs." Blockchain technology has made smart contracts possible for single and multi-tranche transactions or document exchanges (Tapscott and Tapscott, 2016).

The insurance business is comparable to the financial business. In the insurance process, customers pay insurance premiums beforehand, the amount of which depends on the insured objects and their values. Insurance companies can distribute the risks of their customers and, therefore, use the insured objects to trade in securities, such as deposits and loans which are used in the financial sector. If a customer risk is realized in the insurance business, the insurance company will refinance the reactivation of the object or the consequences of the accident. The insurance business consists of networks of different parties (customers, agents, insurance companies, reinsurers, repair shops, etc.). This produces additional costs, for example, because of overlaps between data management and case handling. These reduce the profitability of companies. Customers always cover additional costs through their insurance premiums. When it comes to customer service, overlapping data saving and handling processes also cause delays. The source material presented the risk of potential insurance fraud hidden inside the insurance business as a key observation. How can insurance companies, some of which operate in geopolitically different countries, ensure that, for example, compensation for the breakdown of a single car is not claimed from other insurance companies, as well. The source material points out that the technology utilized by the insurance business (Insurtech) seems to follow the deployment of innovative technologies in the financial sector (FinTech) with a slight delay (Erman, 2017).

Blockchain technology is regarded as a breakthrough able to make processes safer and more democratic, transparent and efficient (European Parliament, 2016; EU, 2017). It enables various applications in several different fields (e.g. financial services, logistics, supply chain, delivery of social products, energy, IPR management, etc.). The EU, (2017) sees that the blockchain technology is only taking its initial steps, and it involves a set of challenges that need to be resolved, such as questions related to legal regulations, interoperability and scaling.

Using blockchains, data can be transferred quickly and at low cost, as no third parties are required (e.g. banks to transmit transactions between a buyer and a seller). This reduces the overall data handling costs. Similarly, innovative accounting firms will have a whole new playing field. According to the authors of this article, blockchain technology is based on a theory which, through innovation, simplicity and a high level of information security, represents an excellent vision of data architecture in a data processing environment – an idea which creates discontinuities in the operating architectures in the public sector and in business operations. A good operating architecture produces added value to customers and also to organizations.

2. METHODS

This article aims to answer the following research question: What added value can the blockchain technology produce in e-business? The goal of this study is to understand the blockchain technology. According to Reynolds, (2006), this paradigm is a radically new phenomenon and its conceptualization proposes a new research method or strategy and offers new solutions. This study aims to identify the complex and unclear blockchain phenomenon (Bryman and Bell, 2015). The design thinking method will be used as a working method in the experimental project of the blockchain solution. Design thinking integrates human, business, and technological factors in problem forming, -solving, and -design: Furthermore, essential element in a design thinking is end-user focus with multidisciplinary collaboration and iterative improvement to produce innovative products, systems, and services (Plattner et al, 2011). By applying the design thinking method, the aim is to achieve interim results during the piloting stage and to produce a customer-driven solution in the following steps (Liedtka, 2015; Kalugina and Safronova, 2017).

Step 1. Presenting blockchain operations to companies and setting goals

The aim is to engage Russian insurance companies and to build a reliable e-business network. During the piloting stage, the aim is to build a motor insurance database consisting of roughly 100,000 vehicles, to test it, and experiment with it using blockchain technology.

Step 2. Developing empathy

In the planning stage of the design thinking method, the aim is to achieve an empathic understanding of the problem to be solved in order to reach a deeper personal understanding of the questions related to the theme. The following methodical tasks are fulfilled during this step: an emotional interest to solve the problem and divergences to find a solution for targeted activities.

Step 3. Journey maps for users and agile prototyping

The project agilely builds the first application to be tested by customers. During this step, customer feedback is collected to identify any defects for the next development step.

Step 4. Presenting the project to customers. Evaluating feedback and the project.

During this step, the project's evaluation criteria are defined and analyzed. Finally, the impact of the solution on the efficiency of business processes is assessed. The goal is to develop frontier traffic and to streamline vehicle insurance processes.

3. THEORETICAL BACKGROUND

3.1. Blockchains, decentralized ledgers and smart contracts

In 2008, report "Bitcoin: A Peer-to-Peer Electronic Cash System" was published under the name Nakamoto, (2008). This idea is known as the blockchain concept. Nakamoto's publication led to the first blockchain solution, i.e. bitcoins. However, Nakamoto's publication does not refer to blockchains, but to chains of blocks. The currently used term blockchain is still attempting to find its place, but the underlying description of an IT idea and the implementation of the bitcoin application are based on Nakamoto's report. In a purely peer-to-peer version, payments can be sent in an electronic network directly from one party to another,

without any financial institutions in between (Nakamoto, 2008). Nakamoto, (2008) defines electronic cash as a chain of digital signatures. Each owner transfers a bit to the next in digital format by signing the distribution of the previous transaction and the public key of the next owner, and by adding them to the end of the bit. The payment recipient can check the signatures in order to verify the chain of ownership.

The current blockchain concept has three different meanings (Nakamoto, 2008).

1. Blockchain as a data structure
2. Blockchain as a technology stack
3. Blockchain as a social phenomenon

According to Deloitte, (2016), the blockchain technology, however, has potential applications, such as smart digital contracts. According to Swan, (2015), smart contracts are automatically initiated computer programs. Common versions of smart contracts include tacit contracts made with a vending machine. The content of the contract can be expressed as desired by the contracting parties. Smart contracts can interact with other contracts or, for example, send cash from one party to another once a specific contract clause has been fulfilled. The public goal of the Ethereum project is to decentralize the Internet. Its users maintain a network in which it is possible to maintain web pages, register contracts, set up polls, manage decentralized autonomic organizations – to do nearly everything that currently requires identification using banking credentials, public notaries, certification services or network service providers (Neittaanmäki and Ogbechie, 2016).

According to McKinsey, (2017), the advantages of blockchain technology in close cooperation between the insurance and financial sectors includes smart contracts and the payment of insurance compensation linked to those contracts. According to Hoffman et al., (1994), the success of an organization (in terms of profitability) comes from the joint effect of the external environmental factors faced by the company and its internal choices. Gerdin and Greve, (2000) also link the organizational structure firmly to the contingency concept. The organizational structure does not depend on factors tied to organizations: the environment, selected strategies or the size of the company. Therefore, there is no single structure that is suitable for all companies.

Blockchains and decentralized ledgers are often considered identical concepts. According to Puntix, (2017), this is not the case, even though these technological concepts have become intertwined in recent years. The technological concept of decentralized ledgers is associated with the decentralization of databases over different platforms, areas and parties. A centralized company-specific database is the opposite of this concept. What makes decentralized technologies attractive is that there is no intermediary in this solution. Similarly, companies that use decentralized ledgers apply this solution to the validation and authentication of business transactions in data exchange networks. In this solution, the final data record is only saved in the database after there is sufficient certainty between the parties involved, i.e. a mutual understanding. Similarly to blockchain technology, in decentralized ledgers, every record transferred to the database is provided with a timestamp and a separate cryptographic signature. All parties to the network can view all records in the database. Similarly, the technology includes a history of all data saved in the database, and this history can be audited and verified.

In reference to the aforementioned, it is easy to see why many consider blockchains and decentralized ledgers to be identical concepts. According to Puntix, (2017), blockchains only comprise a single distributed ledger solution, and it is represented by bitcoin and Ethereum solutions. Similarly, the blockchain concept refers to a solution in which blocks are chained, with each chain containing transaction records. Moreover, cryptographic signatures with hash technology allow these blocks to be chained and distributed to anyone and at any time, without needing to download any specific application. What makes blockchains particularly attractive is that they deal with more than simple data structures. A blockchain is made up of a blockchain, while distributed ledgers do not require this.

3.2. Academic discussion of the blockchain concept

According to Huhtinen, (2014), only a few academic studies have been conducted on bitcoins. These mainly approach the blockchain technology from a technological perspective, not from the perspective of economics. According to Madsen, (2013), the volume of bitcoin trading is low compared to trading in financial instruments. Madsen says that bitcoins have good applications, but so far they have not demonstrated to researchers of economics how the world revolves around them. Therefore, Madsen sees that bitcoins, together with their cryptographic approaches, are a technological innovation, not an economic one. In his study on the financial economy, Huhtinen (2014) also raises concern over trust in bitcoins. Therefore, Huhtinen says, in reference to Madsen, that bitcoins do not pose any threat to current financial instruments. In summary of the aforementioned, Madsen, (2013) firmly believes that bitcoins are more related to technology than to economics.

According to Coggine, (2017), the increasing need for blockchain experts has raised the blockchain technology to the focal point of certain leading universities in the United States. Stanford University offers courses in, for example, cryptographic currencies, blockchains, smart contracts and related applications. Berkley University and MIT also offer similar themes. Neittaanmäki and Ogbechie, (2016) studied whether blockchain technology could become a potentially disruptive technology. The technology may have advantages other than financial: they could be political, humanitarian or social. In their study, Neittaanmäki and Ogbechie, (2016) refer to Swan, (2016), according to whom blockchains may introduce micropayments and transfers between smart contracts alongside basic payments. These do not yet exist in current web environments.

Erman, (2017) examines FinTech from the point of view of open innovation and the impact of this technology on services offered in the financial sector. When it comes to the innovative blockchain technology, Erman's interview material revealed interesting development paths in the banking sector. For example, banks seem to focus on improving their cost efficiency rather than on radically improving their service range.

3.3. Blockchain solutions and the insurance business

The development of insurance business processes goes hand in hand with this research article. Therefore, the theoretical background focuses finally on blockchains in the insurance sector. According to McKincey, (2016), there are projects experimenting with the blockchain solution in the insurance business. These have developed proof-of-concept (POC) cases based on decentralized ledgers. Their aim has been to replace specific parts of traditional insurance processes to shorten the process cycle and to reduce the risks associated with insurance

processes. Initial cases revealed opportunities for business growth and for improved efficiency in business processes.

According to Hargrove, (2008), every function at the different process stages that does not produce added value reduces gross profit by eight cents per dollar. According to McKincey's report (2016), insurance companies are ready to test blockchain technology, even though its true benefits are still in the future. These benefits will come from cooperation over the entire network. According to Mavadiya, (2016), the insurance business seems, on the basis of general observations, to utilize new technology in reshaping its business processes with a slight delay. However, there is real demand for improving the management of large customers and specifically risky objects. These involve high volumes of data exchanged between agents, insurance companies, reinsurers and customers. Blockchains, or the principles of distributed ledgers, can offer a solution in that blockchains are similar to general ledgers. Transactions become unchangeable once a transaction has been registered and it no longer can be removed. In addition to having several copies, the integrity of the general ledger can easily be verified. Blockchains are shared by all parties involved. In other words, they are held by all, and not by any single party. As blockchains are shared, they are located in many locations at the same time and, therefore, everyone has their own copy. This increases flexibility. Engines that add timestamps to blockchains in computer records indicate the time when each data element was created, allowing the parties to see that they have not been changed after their creation. In general, insurance operators are often frustrated because different parties routinely maintain overlapping processes. This increases not only costs, but also delays in processing chains.

4. RESULTS

Blockchain technology has a strong group of supporters, particularly, in bitcoin networks. In addition, as part of digital business smart contracts and distributed ledgers offer valuable support for the development of a motor insurance database (Deloitte, 2016). The motor insurance business consists of networks of different parties (customers, agents, insurance companies, reinsurers, repair shops, etc.). This produces additional costs, for example, through manual labor and overlaps between data management and case handling. From the accounting point of view, processes carried out in different organizations have parts that do not produce any added value, causing additional costs. These costs reduce the profitability and ultimately end up being paid for by customers. When it comes to customer service, overlapping manual data handling and transmitting processes also cause delays and possibly errors. The source material also highlighted the potential risk of insurance fraud in the insurance business. In this development, the aim is also to decrease the number of insurance fraud.

An empirical aim is to engage Russian insurance companies and to build a reliable e-business network. During the piloting stage, the aim is to build a motor insurance database consisting of roughly 100,000 vehicles, to test it, and experiment with it using blockchain technology. In the world of blockchains, these automatic transaction chains are referred to as smart contracts. After a successful pilot project, the business model can be duplicated for other similar insurance solutions. The literary sources and the design thinking process helped us to identify opportunities for blockchain technology to build new and reliable vehicle insurance operations (Nakamoto, 2008; Neittaanmäki and Ogbechie, 2016). The validity of this research can be assessed on the basis of critical deduction approved by the scientific community and background assumptions (Järvensivu and Törnroos, 2010).

5. CONCLUSION

In conclusion, it can be said that the blockchain technology is not yet widespread in the world. The whole idea comes from the virtual currency of bitcoin. What added value can the blockchain technology produce in e-business? The findings of previous research do not give an explicit model for research on blockchain. By means of empirical research and by implementing the design thinking method, we have been able to identify the characteristics of the studied blockchain technology. Minimizing insurance fraud is an identified goal in the application of the blockchain technology. Analyzing the literary material, we have acquired new information for the research community. After the successful pilot project, the business model can be duplicated for other similar insurance solutions. In addition, when applying blockchain technology and its algorithms extensively to other parts of society, the research process requires further multidisciplinary research, in particular, from the viewpoints of legislation and taxation.

Blockchain technology can generate new growth, for example through the development of insurance products (through Internet of Things). The strength of blockchain technology has been seen in smart contracts. Smart contracts are part of blockchain technology because they guarantee strict confidence of all parties. Blockchain technology is innovated as it develops. There is still only little market for blockchain applications. Blockchains resemble decentralized accounting ledgers. Transactions and records cannot be changed or deleted as soon as they are written. Because of multiple copies integrity is easy to prove. This allows the participants to verify transactions inexpensively. Blockchains are common to all actors. No one alone controls the blocks. Blockchain technology can be integrated into multiple areas.

There are limitations to this study. However, these limitations can provide a basis for future research. This study consists of ongoing Blockchain pilot project between Finland and Russia. We believe that this study extends knowledge about blockchain technology and distributed ledgers. First, we need more empirically tested data about the networks of different parties. Second, it would be interesting to conduct a survey of insurance business. During the pilot project it becomes clear if Russian business customers want to attach insurance information to a cloud service database in Russia. European Parliament and EU are also interested in the research results and benefits of blockchain technology. Multidisciplinary research on smart contracts can produce new innovations for future needs.

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Publication IV

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Virtual organizations as a strategic choice – multiple case study

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VIRTUAL ORGANIZATIONS AS A STRATEGIC CHOICE MULTIPLE CASE STUDY

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Abstract: Digitalization is an important global megatrend causing major changes in business processes, strategies and future skills requirements. Due to developments in digital media and information technologies, a growing number of important items on financial statements have come under real-time management as information technology has made such practices both economically feasible and competitively necessary. Digitally enabled business may create a range of challenges as well as new opportunities for accounting information providers. However, there still remains a paucity of evidence on accounting services produced by virtual organizations. This multiple case study examines how a virtual organization could be configured alongside information technologies, and looks at how it would operate, and what the organizational challenges are in a virtual context. The three companies selected for this case study operate in the e-services business and use cloud-based information systems. The findings suggest that a virtual organization requires a data-driven organizational attitude, and changes in the decision-making processes. Additionally, a virtual organizing appears to require a new kind of attitude towards its workers from the employer. The findings suggest that even if the organization is dynamic, e.g. its members may change quite frequently, employees could experience organizational cohesion formed by the services related to the employment relationship. The findings of this study indicate that startup enterprises could benefit from accounting services in a new way. They expect a reliable, safe and easy digital network of services. Therefore, in the future service providers might operate increasingly as providers of self-services. This study contributes toward the current discussion of virtual organization by evidencing that the change to e-services implies a significant change in strategic management and business models for professional service providers, as well as acceptance and adoption of the new services.

Keywords: Digitalization, virtual organization, accounting, strategic management

1. INTRODUCTION

Digitalization and the Internet of Things (IoT) are important global megatrends that affect all sectors and will cause major changes in all sectors for business processes, strategy and employee know-how, as well as future skills requirements. In addition, the current digital era allows new forms of organization based on digitization. According to Bailey and colleagues [1:1485], "Digitization involves the creation of computer-based representations of physical phenomena". Correspondingly, the term virtuality refers to the situation when digital representations substitute physical objects, processes, or people they represent [1]. The traditional view is that organizations create services, but modern IT technology allows that

services may also create dynamic virtual organizations forming a basis for exchange relationships between buyers and suppliers. According to the Service Federation Based Model for the creation of virtual organizations (VO), potential members of a virtual organization are comprehended as service providers [2]. These service providers constitute a service portal based on an indirect selection where services, not providers, are selected by customers [3].

In the accounting service industry, a growing number of important items found on financial statements have come under real-time management, as information technology has made such practices both economically feasible and competitively necessary [4] [5] [6] [7]. Extant studies [8] [4] [5] [9] [10] [6] [7] indicate that digitally enabled business may create a range of challenges as well as new opportunities for accounting information providers. However, there still remains a paucity of evidence on accounting services produced by virtual organizations. Digitalization is radically changing the way of working. Information technology allows employees to be more flexible about their working locations and the line between work and free time is becoming more blurred. Virtual organizations create and offer the opportunity for strategic choices for employees and for subcontracting to client companies.

This case study examines how a virtual organization could be configured together with information technology, and explores how it would operate, and what organizational challenges exist in a virtual context. The findings suggest that a virtual organization requires a data-driven organizational attitude and changes in the decision-making processes. This study contributes to the current discussion on virtual organization by evidencing that the change to e-services implies a significant change in business models for professional service providers, as well as acceptance and adoption of the new services.

2. THEORETICAL BACKGROUND

2.1. DIGITALIZATION AND BUSINESS STRATEGIES

The current ongoing process of global digitalization is predicted to become as significant a change as the process of industrialization had been [11]. Globally produced data doubles every 18 months, and the volumes expand by 35–50% per year [8]. Digitalization and the digital revolution has led to new ways of doing business, as well as threatening traditional ways of doing business, which remain in the old operating models. Expert work and analytics will be automated, and thus the importance of employees or consultants with relevant skills will continue to grow. Almost all information is undergoing a process of becoming digital, services are becoming electronic and data itself can be processed into new business. Despite the process of digitalization, the objectives of most companies remain traditional, such as achieving improvements in profitability, as well as developing and improving quality, market share, returns on capital and the achieving better results. Business processes that are especially improving include payments, invoicing, orders, distribution channels and other completely new services.

The development of digitalization will promote collaboration in the organizations of the digital service channels, customer relationship management (CRM), sales, ordering and marketing automation, process automation, document management, and knowledge management. Brynjolfsson and McAfee [12] suggest that “everything that can be digitized will be digitized and everything that can be automated will be automated”. Traditional

business strategies and digital business strategies will be combined in the near future [13]. What do these changes mean for accounting services? These issues are discussed in the following sub-section.

2.2. ACCOUNTING SERVICE DIGITALIZATION

In a very short span of time several new techniques have evolved as a result of increased global development in communications and information technologies [14]. E-services and real-time accounting (cloud computing) go even further, because these allow users to access accounting software via the Internet, providing access to financial data anywhere, from any device. Gullkvist [15] has argued that a new feature in emerging e-services is the introduction self-services. The real-time economy, consisting of automatic digital format transactions between companies, will revolutionize the way accounting transactions are received, processed and exploited [16]. Although the term "e-services" is commonly used in business and information science journals, a generally accepted definition of the concept does not seem to exist [15] [17]. For this study, based on Gullkvist [15] and Rust and Kannan [18], an e-service is defined as "the provision of service over electronic networks" where in this study the term "networks" implies the Internet.

Terms such as paperless accounting, e-accounting, internet accounting and digital accounting have emerged in the media [15]. Digitization has fundamentally and permanently changed the accounting profession, and the computerization of accounting has moved into a new stage, the digitalization of accounting [19] [15]. Deshmukh [20] defines digital accounting as the representation of accounting information in digital format, which can then be electronically manipulated and transmitted. Gullkvist [15] notes that emerging technologies are being developed for further automating procedures, developing more appropriate information technology-based processes, e.g. electronic bank statements, electronic reporting to tax authorities, electronic invoicing and web-based accounting software. Technological innovations cover a broad range of information technologies and systems.

Computerized accounting systems have been highly valued because they have made it easier to monitor and compare costs between different time periods [21]. Traditionally an accountant has been a key person in the client firm's business [22] [23] [24] [14] [7]. However, the use of new technologies may create management problems [8]. Accounting service providers should provide financial information according to the clients' specific requirements or needs [7]. The main motive given in extant studies for adopting such a practice was to form a virtual organization [9]. As soon as the information became freely available, the cost of network building collapsed [25]. Digitization and automation are set to reach dramatically higher levels over the short term [8]. However, the question remains how the virtual service providers will take their position in this changing digital environment.

3. RESEARCH METHODOLOGY

In this study, a qualitative multiple case study approach [26] was chosen to examine 1) how virtual organizations could be configured alongside information technologies to produce e-accounting services, 2) how they would operate, and 3) what the challenges of strategic management in a virtual context would be. The data was collected in a series of in-depth,

semi-structured interviews, which were transcribed and analyzed with an inductive analysis method. The data consists of four interviews (an interview from each company, except two interviews from Case Company A) each lasting from 50 min to 1 h 15 min. The interviews were carried out between March 2015 and March 2017. The data collection continued until a point of data saturation was reached.

The qualitative data used were transcripts of the recorded interviews. The benefits and challenges of virtual organizations were analyzed throughout using a systematic two-phase analysis procedure. The inductive analysis method included two coding phases from first-order concepts to second-order order themes. To increase the objectivity and reliability of the analyses, the first-order concepts were categorized by a research team consisting of three researchers. The first-order concepts were elicited using an open-coding technique. The second-order themes were based on joint axial coding by the above-mentioned team.

The companies A, B and C were selected for case evidence of a virtual organization (VO). The three companies selected for this study operate in the e-services business and use cloud-based information systems. Company A was originally a traditional accounting service provider which has expanded its services towards into a digital platform that forms a VO. Company B supports start-up enterprises and individuals in starting a business by taking care of the required bureaucracy. The service has already over 30,000 users in the Nordic countries. Company C is a billing service cooperative established in 2008 and is part of a larger human resource management company. The service has already over 20,000 users in Finland. The business ideas of these virtual companies are to allow employees to combine the benefits of entrepreneurship and employment. The workers are employed in the company, but they do their work by telecommuting, and invoice their own customers through these case companies. The companies are responsible for accounting and real-time reporting for their employees, and professionals involved are typically freelancers, consultants, designers, graphic designers, and photographers.

4. FINDINGS

4.1. STRATEGIC OPERATION MODELS

The following description of case VO functions provides the answers to our research questions of how a VO could be configured alongside information technologies, and how it operates. The configuration of the organizations is dynamic, since the length of the employment depends on the employees themselves and their projects. The operation model of the case virtual organizations is presented in Figure 1. The case organizations (A, B, C) provide different sorts of direct real-time services or commodities to their own employee/customers. These employees inform the VO for invoicing, and the VO provides service by invoicing customers, paying salaries to employees, providing them with other accounting services, and taking care of legal obligations, such as taxes and employee costs:

"The organization handles billing, pays salaries, takes care of legal obligations, insurance, and voluntary obligations. – We have made a payroll calculation program, where employees see their own incomes and are able to pay for their own work they have done for their customers. And we have some extensive financial management software, that is cloud computing software and has all accounts receivable, accountants payable. – The billing

program, and banking connections are mostly used. The billing program automatically registers the customer's payments in the system. It also allows you to send debt collection letters. If there are any problems with debt collection, you can send a direct signal to the collection agency." CEO CASE A

"In an optimal case, the whole can work independently, it does not require the work of a third party or a staff for its virtual workforce. The system is comprised of a real-time balance and is based on the automation and development of these digital processes. At the same time, when some information is searched for once, an automatic model can be created that continuously generates data. On this basis, it can be said that our systems are very real-time." CEO CASE B

"We have different so-called low barrier entrepreneurs, freelancers, self-employed people, and employees who don't have to do their own accounting. We pay them a salary and transmit all statutory payments to the right people. If they need help, they can contact us by e-mail, messaging, extranet messaging, chat and telephone. Users expect that the program is simple and easy to use." CASE C

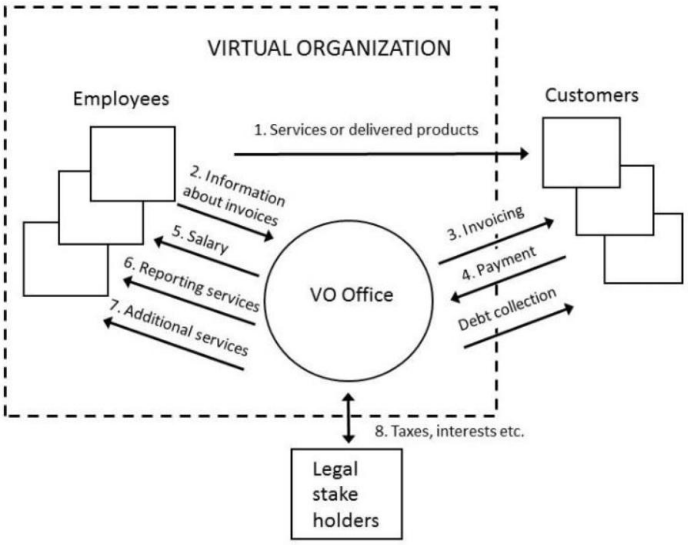

Figure 1. The operating model of the case organizations

Thus, these kinds of virtual organizations could bring a sense of organizational cohesion and employee security provided by an employer. In addition, the findings indicate that the virtual organization's attitude towards its employees seems to be different than in conventional organizations. When analyzing the discourse of the owners about their employees the used term was typically "client". This can be understood so that the dynamic

context of these virtual organizations requires a new kind of attitude towards its workers from the employer.

4.2. BENEFITS AND CHALLENGES OF VIRTUAL ORGANIZING

The second sets of questions aimed to investigate how informants comprehended the benefits and challenges of the virtual organization. The themes which emerged from the analysis related to benefits were: new service markets for start-up enterprises, electronic business processes and cloud services improving efficiency, performance, and flexibility, competitive advantage from effective data exploitation, economies of scale, and the opportunity to take advantage of mobile applications and on-line self-services.

The most principal and the most frequently mentioned benefit was that the novel digitalization enabled the business idea of service markets for start-up enterprises:

"The services are that the organization handles billing, pays salaries, takes care of legal obligations, insurance, and voluntary obligations. [...] The service allows entrepreneurial activities without the risks to the entrepreneur." CEO Case A

"Start a business without a company of your own" […]. "Work as freelancer and invoice for work without owning a company" […] "Try out your business idea before setting up an actual company." […] "We´ll take care of all the paperwork and pay your income as a salary to you after the client has paid the invoice you have created." […] "Register free and start invoicing your clients." CEO Case B

Compared to the alternative of working directly with their own customers, these enterprises receive many benefits from the employment relationship with the case organizations, e.g. real-time automatic financial management, e-services for optimizing reporting for all stakeholders, salary reports, real-time taxation and statistics. Furthermore, digitalization enabled virtual on-line services and the use of mobile applications increase the user friendliness:

"The connections are mainly via the Internet. Face-to-face meetings and conversations are not needed"[…] "And we are also developing a mobile application that I think is good for the modern world and will make this more user-friendly". Executive Case C

The challenges that emerged from the analysis included providing a more demanding electronic customer service, dependence on the functioning of electronic co-operation between state institutions, and the risk that manual work may decrease the efficiency of virtually organized processes:

"Providing customer service electronically is considerably more demanding compared to a situation where all the users would be physically present, and then we would be able to guide them in the use of the service." CEO Case B

"IT interfaces with state institutions should be developed in order to provide information to those parties and retrieve information from them." CEO Case B

"And as long as certain processes or work is manual or requires manpower, then a virtual organization will not work, because it relies on a staff workload tied to a time and place." CEO Case B

In summary, these results indicate that in order to gain full benefits from digitalization of services as a strategic choice, it should be based novel business ideas and markets based on digitalization. Furthermore, the digitalization of the processes should be thoroughly implemented without manual phases.

5. DISCUSSION

This study using a multiple case study methodology examines how virtual organizations could be configured alongside information technologies, how they operate, and what benefits and challenges lay in virtual organizational context. The dynamic context of virtual organizations seems to require a new kind of attitude towards its workers from employers. The findings suggest that even if the organization is dynamic, e.g. its members change quite frequently, employees could experience some form of organizational cohesion formed from the services related to the employment relationship.

These kinds of virtual organizations might be seen as a social construct linking together buyers and suppliers demanding a new culture of decision making. It could be concluded that data-intensive approaches may offer new opportunities for service providers. However, strong leadership and responsible management are conditions for successful and efficient data utilization [27]. For leaders, it might demand a more comprehensive view of the context ensure successful change. Furthermore, management needs encouragement to try new experiments. In general, making digital data based organizational control systems will require a data-driven organizational attitude. Other studies have reported challenges in the area of decision-making, such as a lack of a data-driven organizational culture [28] [29]. Therefore, utilizing data may lead to changes in the organizational decision-making processes. New managerial skills will be needed, not only for understanding, but also supporting these changes. Managing these changes requires training in collecting, storing, analyzing and reporting data and on how to use data to make decisions. The findings of this study also indicate that startup enterprises could challenge the accounting service industry in a new way, because the release of information creates opportunities for new market entrants. Startup enterprise customers expect a reliable, safe and easy digital network of services. Therefore, in the future service providers might operate increasingly as producers of self-services.

This study contributes to the current discussion on virtual organizing by evidencing that the change to e-services implies a significant change in business models for professional service providers, as well as acceptance and adoption of new services for employees. In terms of the managerial implications for companies aiming towards virtual operations, this study suggests the full utilization of IT systems without manual phases of operation will be necessary to make operations totally time and place independent, and innovatively take advantage of new customers and markets brought about by digitalization.

The scope of this study was limited to these cases, and these findings might be not applicable to other kinds of virtual organizations. In addition, other limitations need to be acknowledged. Firstly, the context of this study focuses on three selected VO business networks, and this should be considered when utilizing the results in another context. Secondly, the local and situational context should be reflected. Despite of the exploratory nature of this study, the findings suggests that virtual organizations demand new kinds of organizational skills and attitudes. A possible area for future research would be the identification of these changes, and more importantly, how members of virtual organizations make sense and adapt their behavior to meet these changes.

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