



MANAGING DIGITAL TRANSFORMATION

Per Andersson, Staffan Movin,
Magnus Mähring, Robin Teigland,
and Karl Wennberg (eds.)

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Karyn McGettigan, Language Editor



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In his central role at the Wallenberg Foundations,
Peter Wallenberg Jr has furthered a broad range of important research
and research-led education initiatives at the Stockholm School of Economics
(SSE) and its Institute for Research (SIR). This indispensable work has also
helped create a fertile ground for research on digital innovation and
transformation: a phenomenon currently experienced, shaped, and
managed in and between organisations and throughout society.

This is the topic of this book, which we dedicate to him.

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Acknowledgements

Every year since 1992, the Stockholm School of Economics Institute for Research (SIR) has published an Annual Research Anthology, and this year SIR is publishing the book in cooperation with MTC (Stiftelsen Marknadstekniskt Centrum). The purpose of the SIR Annual Research publication is to enable managers and practitioners better understand and address strategically important challenges by showcasing SSE research on a selected topic of importance for both business and society.

This year's book, *Managing Digital Transformation*, features authors from academic areas across SSE together with representatives outside the institution. The book's eighteen chapters show the strength and breadth of SSE's research within the area of digitalization and reflect the importance that SSE places upon closely linking research to practice and on investigating the leadership challenges and their implications in order to support value creation in society.

Participating in the many ongoing research projects at SSE and the multitude of aspects of digital transformation addressed in the various chapters has been very rewarding for the editors. We would like to thank all the authors for their hard work and cooperation throughout the project. In finalising this book, we have relied upon the expert work of Karyn McGettigan for language editing, Petra Lundin for layout and graphic design, and Marie Wahlström for digital access to the book. We are, indeed, most grateful for their excellent and diligent work.

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Stockholm, January 2018

Per Andersson, Staffan Movin, Magnus Mähring, Robin Teigland, Karl Wennberg

Introduction

One of the hottest research topics lately is digitalization. Many research projects are focusing upon different perspectives. Gone are the days when digitalization or business implications of ICT were just about increasing efficiency. Instead, the ripple effect of digital development can now be felt wider and deeper than ever before. The way in which business is conducted and how it creates value, as well as how corporations can become more efficient and sustainable, are all implications of digitalization. Adapting to new demands and taking advantage of the plethora of possibilities, however, is not always easy.

Managing digitalization and the transformation of business always involves new challenges. The novelty and complexity of the digital age has led to an increased academic interest in the area of digital transformation and a call from companies that seek support in this process.

We take a look at digitalization from the perspective of business research. This creates a better understanding of the challenges that today's businesses are facing. We believe this anthology will serve as a tool to help businesses better understand the force that is digitalization and support these corporations in their digital transformation.

The idea behind this anthology grew as Marknadstekniskt Centrum was taking part in several interesting research projects. Companies were asking MTC to facilitate contact with scholars and supply them with academic insight. Vinnova came on board, by supporting the project *Progressiv digital utveckling förutsättningar för framgång* (*Progressive Digital Development: Pre-Requirements for Success*) of which this book is a part: its aim to stimulate business to become more progressive in digital change. At last, this book and the website www.digitalchange.com have become a reality.

This joint venture between Marknadstekniskt Centrum and The Stockholm School of Economics Institute for Research follows the SIR tradition of publishing an annual yearbook to showcase its vital research contributions. The book begins with an overview of digitalization, then moves to understanding the new digital customer, and ends by exploring re-organisational effects, business models, and ecosystems. We hope this year's anthology will be useful for managers by facilitating their digitalization processes.

PART 1: DIGITALIZATION – DIFFERENT PERSPECTIVES

The role of digital technology in business and society is rapidly shifting from being a driver of marginal efficiency to an enabler of fundamental innovation and disruption in many industrial sectors, such as media, information and communication industries, and many more. The economic, societal, and business implications of digitalization are contested and raise serious questions about the wider impact of digital transformation. Digitalization affects all private and public operations, as well as the internal and external workings of any operation. Digitalization is the major driving force behind sweeping large-scale transformations in a multitude of industries. Part 1 includes various perspectives on digitalization and digital transformation.

PART 2: THE NEW DIGITAL CUSTOMER

Digitalization has resulted in more user-centric business and user-centric systems. The changing behaviour of the digital consumer/customer is discussed here as it connects to new forms of customer involvement and engagement, as well as analysis models of what creates customer value in this digital context.

PART 3: THE RE-ORGANISATION IN ORDER TO CONNECT WITH THE DIGITAL CUSTOMER

How can companies connect with digitalized consumers and non-digitalized customers? This is a central issue in managing digital transformation, as it draws attention to the emerging intra-organisational, marketing, and customer interaction challenges associated with digitalization: for both the consumer and the supplier. Another aspect of this is the internal handling of new forms of organizational ambidexterity; that is to say, companies and organizations engaged in digitalization processes often require an internal re-organisation in order to handle the demands that digitalization brings, and to explore new digital opportunities while promoting their existing business and operations.

PART 4: BUSINESS MODELS AND ECOSYSTEMS

How do companies change, adapt, and innovate their business models? Given that digitalization leads to a convergence of previously unconnected or loosely connected markets, the digitalizing company and organisation is analysed in its systemic and dynamic context. This part draws attention to business models

and business model innovation. Incumbent firms need to adapt and change business models while competing with digital start-ups based upon new scalable business models, accessible ventures, and rapid processes of intermediating. These chapters discuss completely new co-operative business models: processes that need to be developed as companies shift from products to digitally based services.

The Ecosystem places digitalizing organisations and companies into their broader and systemic context. This includes discussions on digital disruption, industrial convergence processes, and shifting patterns of competition and cooperation. Digital technologies cause markets to converge in many new and sometimes unexpected ways. The result is the emergence of new roles and market positions of technical platforms.

Staffan Movin, Stiftelsen Marknadstekniskt Centrum

Digital Transformation Supporting Public Service Innovation: Business Model Challenges and Sustainable Development Opportunities

PER ANDERSSON AND LARS-GUNNAR MATTSSON

Introduction

Digital transformation is a megatrend as is the widespread concern for sustainable development. In this chapter, we discuss how digital transformation of public services may promote sustainable development. We take the perspective of private business firms that are involved in service innovation processes, focusing upon their business modelling challenges. To a certain and varying extent, public services have become “privatised”, yet they are always subject to publicly decided and enforced norms and regulations. We assume that public services are provided with the, admittedly complex, “common good” in mind, which is in line with sustainable development criteria. Therefore, public service innovation, enabled by digital transformation is an important phenomenon subject to development and implementation of both private business models and of public norms and practices. We investigate the nature of these challenges and opportunities, with the help of four cases on digital transformation of public services: City Lighting, Public Transportation, Healthcare, and Education.

The disposition is as follows: first, our analytical framework is presented; secondly, the four cases follow; third, we discuss opportunities for sustainable development based upon the cases; lastly, we identify five business-modelling issues that we suggest should receive increased attention in both practice and research.

Analytical Framework

Our analytical framework is based primarily upon our recent research on ICT enabled service innovations, business models, and dynamics of market networks. (Andersson & Mattsson 2015) This contains three major components, which are all related to digital transformation: business modelling, public service innovation, and market reshaping.

BUSINESS MODELLING

In Andersson and Mattsson (2015), we stressed the importance of development and implementation of new business models (Osterwalder et al. 2005) during digital transformation. In an extensive analysis of the literature on business models, Zott et al. (2011) found that a business model is a holistic system-level perspective that includes both content and processes; it is firm-centric, yet is boundary spanning with a focus upon value creation rather than value capture. Related to this is how the firm will obtain revenues for its value-creating activities and how value is calculated. Ehret et al. (2013) and Mason and Spring (2011) propose a network approach to understand the role of business models. This is in line with the original use of the concept in analyses of how new ventures manage to integrate resources by means of network relationships. Business models of networked firms must, in some way, overlap or be complementary. A general assumption is that a business model expresses the business logic of the firm, what value the company offers to customers and, relating the concept to a business network perspective, the infrastructure and the architecture of the network of partners. Applying a network view, La Rocca and Snehota (2017) stress the limits to autonomy of individual business firms to perform their own business model. They need to observe and adapt to differences across counterparts.

PUBLIC SERVICE INNOVATION

An innovation is a new way to create value. When it comes to public services, an innovation should be hopefully evaluated with reference to aspects of “common wellbeing” and with a focus upon the beneficiaries. Innovations always require some new combinations of resources, yet should also adapt to existing resources: especially in a use context. Resources co-create public service innovations, which are controlled by public and by private actors.

A service innovation must find use in socio-economic technical contexts. This might require added innovative resource combinations or adaptation between existing and new resources.

Digital transformation tends to stimulate and enable service innovation. The “service dominant logic” stream of research associated with Stephan Vargo and Robert Lusch (for example, Vargo and Lusch, 2004 and 2014) has stimulated research on business models and service innovation (Maglio and Spohrer, 2013), business models and service orientation (Kindström, 2010) and digital transformation and service innovation (Araujo and Spring, 2006). Digital transformation is seen to have effects upon the packaging of the service-based value offering, as well as on infrastructures and external partnerships. Vargo et al. (2015) use the concept of “service ecosystem” to also include actors other than market actors.

Little attention in research on service innovation seems to be directed to public service innovation.

MARKET RESHAPING

Market processes are embedded in socio-economic contexts characterised by interdependencies, interaction, and connectedness. Cooperation and competition co-exist in markets. Innovation is crucial to achieve efficiency and effectiveness: that is to say, for the creation of value. This means that *value is co-created* in the market. The *overlapping* of networks and *intermediation* in networks will likely change during innovation processes since new resource combinations develop, as exemplified by converging industries, bundling of services, technical platforms.

SUSTAINABLE DEVELOPMENT

Concern for unsustainable development is widespread: in terms of negative ecologic, social, and economic effects of human activities. This is especially true when it concerns global warming. The UN Agenda 2030 specifies 17 sustainable development goals and some general directions for how to reach them. Public service innovations aimed at promoting sustainable development should be especially important for public actors with an influence upon public services. The World Economic Forum argues that opportunities to develop and implement service innovations based upon digital transformation should be given a high priority (WEF, 2016).

To sum up, digital transformation is associated with challenges to develop viable business models. This chapter will focus upon public service innovation. Service innovations involve market reshaping, especially with shifts in intermediation and overlapping. These three processes are interconnected and associated with business model challenges for the involved private business firms, thus, influencing the achievement of sustainable development.

Four Cases

The cases all describe early stages of applications of digital transformation; they include: city lighting, healthcare, public transportation, and education. The digital transformation challenges are collected from a longitudinal comparative research project that contains in-depth studies of companies in 15 different contexts engaged in digital transformation processes, as described in Chapter 2 of this book. Andersson & Rosenqvist state that digitalization is associated in many of the studied sectors with overlapping between sectors/networks, which sometimes includes tension between different industrial logics. The processes in most cases open up for considerable changes and re-positioning of companies where business development and business model challenges become part of the digital transformation.

The discussion here builds upon a broad set of ongoing case studies, and on secondary sources on digitalization. We employ qualitative methods overall: specifically, a multiple comparative case-study approach, complemented with a rich set of secondary sources (reports and so on).

Of the four case narratives, Philips, is based purely upon secondary sources. Getinge and Nobina were initially part of two master program projects at the Stockholm School of Economics¹ that were performed in 2016. Complementary information was collected in follow-up interviews within the digital transformation research project (Digital Transformation in the Networked Society). Sensavis, was initiated in the research program with a set of interviews in 2016, and completed in a master thesis in 2017.²

1 Rosén, A & Lechner, J. (2016), *Advanced Market Monitoring. Sensemaking and Strategic Analysis for Medical Device Complementors to Big Data Platforms*, Business case research thesis, Stockholm School of Economics, June 2016, Fedrizzi, M. & Liedholm, A. (2016), *Nobina and Combined Mobility Services in Sweden. A scenario-based analysis*, Business case research thesis, Stockholm School of Economics, June 2016,

2 Badhani, S. & Mut, J. (2017), *Business Model Innovation in Edtech. An Exploratory Study of Business Model Innovation in a Complex Market Environment*, Master thesis, Stockholm School of Economics.

CASE 1 PHILIPS: LIGHTING AS A SERVICE³

Philips launched their strengthened vision for sustainability in 2012: “At Philips, we strive to make the world healthier and more sustainable through innovation. Our goal is to improve the lives of 3 billion people a year by 2025... We have identified three key innovation areas: 1) Improving people’s lives; 2) Improving energy efficiency of Philips products; and 3) Closing the materials loop...” The company has embraced a circular economy mindset over the past five years. The transition toward a circular sustainable economy in the Lighting sector is intertwined with both digitalization and a radical business model shift toward service sales: introducing “lighting as a service” and products as service providers. The business model promotes customer access to products and systems instead of customer ownership. Value for customers become performance based. The new concept emerged with a Dutch architectural company.

“In 2009 Rau Architects, an architectural agency specialising in sustainable building design, approached Philips for help to upgrade lighting at its Amsterdam office. They only wanted to buy light, and not the expensive lighting infrastructure (lamps, luminaires, cables, and controls) that it would eventually need to replace and dispose. They wanted the exact amount of light for workspaces and rooms that employees needed, but nothing more. Rau Architects, Philips and an installation partner, CasSombroek, began a co-creation process to design a tailor made, intelligent lighting system maximising natural sunlight, adapting LED light fittings to the building and installing a motion/daylight sensor and controller system. It proved to be an extremely interesting experiment in – and proof-point of – how little artificial light an office actually needs. Since 2010, Rau Architects only pays for the actual amount consumed light (lux), not the equipment or the raw materials used in the products.”⁴

By moving from a one-time sale to a ‘pay per lux’ model, Philips maintains ownership of the materials while Rau pays for maintenance and servicing with the option to adapt or upgrade the set-up. The installation of the LED lamp

3 This case builds upon secondary sources from Philips, see e.g.: <https://www.philips.com/c-dam/corporate/about-philips/sustainability/sustainable-planet/circular-economy/light-as-a-service/case-study-circular-economy-lighting-NUS.pdf>, <http://www.lighting.philips.com/main/services> and from other sources, e.g.: “Circular economy snapshot: Philips light as a service” (<https://www.issuelab.org/resource/circular-economy-snapshot-philips-light-as-a-service.html>) and <https://smartcitiesworld.net/news/news/philips-light-as-a-service-offering-1137>,

4 Zero Waste Council: “Circular Economy Snapshot: Philips Light as a Service”, p.1, see footnote 3.

system saved 35% energy. Digital transformation continued in the next phase when Philips implemented smart energy meters, which provided further insight into the energy consumption per space. The report states that this monitoring and optimisation process saved another 20%. Thus, more than half the energy was saved. At the end of the contract period, Philips lighting products can be taken back into its production process and the raw materials re-used.

Philips argued that the new system provided additional benefits for the development of smart cities, beyond efficiency and reduced carbon emission. With lighting levels that can be adjusted and no compromise in light quality, it can be used to create safer roads and streets, more productive offices, more liveable cities and attractive public spaces, and more patient-friendly hospitals. "... The company developed a commercially successful business model with significant environmental and financial benefits for customers."(ibid)

Managed lighting services extend the lifetime and performance of the lighting products. This allows the customer to take full advantage of the newest lighting solutions, increase energy efficiency, and reduce operational costs. Philips pays the upfront costs of installation and is compensated through a performance contract: the energy savings the retrofit produces. Exploring possibilities from a second-hand market enables Philips to capture new value from used parts and luminaires; co-creation with like-minded companies creates a platform for innovation.

Philips also acknowledges barriers in switching to the new orientation. Lighting is not widely recognised as being the key to energy efficiency. People do not see the electricity costs associated with lighting. They are unaware of new energy-efficient lighting technologies.

Philips' CEO stated: "I don't want to make this sound easy. In our health-care business, for example, a lot of customers initially thought: 'A second-hand product? We don't want it.' Of course, we are refurbishing it and guaranteeing it as new, but convincing a hospital customer: for example, is challenging and requires a major educational program. We still have much more to do given the size of the market, but as we work with hospitals and establish ourselves as technology partners—and not just sellers of a 'box'—we can more easily convince customers of the mutual benefits of circular-economy principles. Similarly, for municipal-lighting customers, the thinking around the tendering process needs to change. These customers are used to looking at the initial purchase price, not the total cost of ownership and the ecological impact.

Changing the ownership of the lights is also tricky, as it often gets into legislative issues with municipal governments. There are supply challenges in operating in this new way, as well. We need to get our products back. Street-lights are fairly simple because the lights don't walk away, but consumer lamps are another story. Here we work with partners to organise for collection, but even then it's very hard. Currently, in Europe we recover about 40 per cent of our lamps, of which 85 per cent are recycled for reuse."

Still, the company has started the process of fundamentally redesigning its business models and value chains. The basic idea is that, instead of selling products, Philips envisions a future where it retains ownership: selling use as a service so it can optimise the use of resources. Philips is defining new business models, and refining concepts of legal ownership and use, adaptive logistics, and financing strategies. Working with investment models, and finding new potential, has become part of the switch. New business models are developed and tested: utility funding schemes, public private partnership, or creating a new energy service company. This includes private financing alternatives such as instalment payment, bank loan, and financial lease, and also fiscal measures. Public funding issues are brought up including subsidies, economic stimulus measures, and carbon finance.

The LED and digital transformation is both a technology and business model transition: going from analogue and regular lamps, stand-alone and "dumb" products with replacement sales, to digital systems and LEDs that are connected in "smart" systems and services based upon "projects". The transition from analogue to digital is based upon a switch from lighting replacement products to financing and leasing lighting as a service: "This will reap not only the direct economic benefits of lighting, but also the benefits beyond lighting fully in line with the transition from a linear to a circular society."(pp. 26)

Digital transformation is a central part of the big shift, as the CEO states: "We are putting networking capabilities in these lights, as well, essentially making them part of an IT network. This lets the community adjust the lights depending on the circumstances. For example, if there is low traffic density at night, then the lights can be turned further down. But if there is a soccer match one night, the lights can go up. And, of course, we can apply all sorts of algorithms as well to give customers even more control. These kinds of innovations help us move away from selling products and toward selling higher-value solutions.

We believe that customers will increasingly consider natural resources in their buying decisions and will give preference to companies that show responsible behaviour: something we are already seeing. Designing products and services for a circular economy can also bring savings to a company. The first impression people always have is that it adds costs, but that's not true. We find that it drives breakthrough thinking and can generate superior margins.”

CASE 2 NOBINA: MOBILITY AS A SERVICE IN PUBLIC TRANSPORTATION⁵

Nobina is an established provider of public transportation in the Nordic countries. Nobina wishes to change its role from “bus operator” to “mobility provider”. Digital transformation is said to enable mobility solutions to increasingly pressing urbanisation-related problems, such as traffic congestion and air pollution.

The target of political authorities in Sweden is to double the share of public transportation by 2030 in the following ways: 1) Carbon dioxide emissions will be reduced and energy efficiency improved throughout the entire transport system; 2) Road safety will be improved; 3) Traffic congestion will be reduced; and 4) More equal opportunities for citizens will be offered by the public traffic system.

Discussions between private and public organisations on mobility as a service revealed that car-operating costs would be saved, and that time delay and congestion could be reduced. Taking cars off the road also means reducing the number of traffic accidents. Removing cars from the road would also generate savings for cities by allowing them to avoid road construction costs.

Transport operators are now able to provide mobility as a service, thanks to the technological advancements made possible by the Internet of Things. A widely acknowledged belief in public transportation is that the time has now come to integrate different types of transportation means, both public and private, which could offer people a flexible and convenient door-to-door alternative to private car ownership.

One of Nobina’s representatives described the challenges: “In order to double the public transport market share, there needs to be a shift in our sector: from a production culture to a service culture. Through new approaches

5 This is a condensed version of a case presented in Fedrizzi, M. & Liedholm, A. (2016), *Nobina and Combined Mobility Services in Sweden. A scenario-based analysis, business case research thesis*, Stockholm School of Economics: June 2016, and complementary interviews: 2017.

and smarter co-operation, we will increase the efficiency of our operations, extend the range of transport services offered, and raise the quality.” The main finding in an industry analysis and report was that increasing ride sharing, bike commuting, and car sharing will result in substantial economic savings for commuters as well as cities⁶. Moreover, the diffusion of smart-phones and apps is what was expected to enable digitalization and Intelligent Transportation. The spread of digital payment solutions facilitates the purchase of online services and the transactions between individuals. Online platforms require new digital technologies; however, a lot of the potential comes also from the analysis of big data.

Nobina and the transportation industry are now looking more and more towards new solutions for smart mobility. The industry is already moving towards a greater integration of the services. Some projects are already running (e.g. SLL-bike sharing). “Samtrafiken”, the association of all the actors of public transportation in Sweden, plans to include as members also companies operating with non-public mobility (i.e. car sharing, Uber). However, the public sector is not eager to bear the whole risk of the implementation of such new concepts. The public sector will have to rely on the total or partial investments by private actors. A private actor might even manage the overall integration of the public/private transportation network including the implementation and maintenance of a technological platform.

The actual demand for the mobility as a service is still unknown. Since narrow coverage would undermine the overall usefulness of the new concept, the geographical reach is a fundamental service feature. Innovation propelled by the public-sector will likely mean that public transportation providers will be adopting these new solutions, thus, making companies such as Nobina, key business partners with Uber, taxi firms, car-sharing enterprises, and other ancillary yet necessary alternatives in order to provide flexibility for sectors where bus and train traffic is very limited or non-existent. Striking a balance between providing flexible solutions and not compromising basic public transportation needs is one of the challenges Nobina and other involved actors identify. An obstacle going further in this digital transformation concerns which forms of bilateral agreements will be formed between public transportation and private companies or between private companies to achieve service

6 Deloitte Insights: “Smart mobility: Reducing congestion and fostering faster, greener, and cheaper transportation options”. Part of the “Smart mobility” research report

integration. Interviews reveal no competitive conflicts between parties in different transportation sectors; they mainly view each other as complementary. Parties may engage in bilateral integration while participating in a public-private or private-private partnership. Forms for Public-Private Partnerships need to be developed. Local public transport agencies in Sweden already experiment with tendering mobility as service provision, as they complement rather than compete with car ownership, thus, matching the political goals of Sweden's sustainable transportation initiatives.

Nobina identifies several challenges and crucial competencies for the development and implementation of mobility as a service. The company must refine its relationship management skills in order to maintain cohesion in the emerging mobility-as-a-service networks, including alignment of the different interests. Nobina needs to coordinate actors that are currently separately running their own businesses. In addition, Nobina must be involved in building and managing a technical platform with which it has an interaction or, for example, outsourcing to IT specialists by leveraging the existing partnership with Ericsson for the development of driverless buses. Having a mobility service solution in place will require marketing efforts even though the introduction of incentive-based contracts has led the company to start focusing upon the end customers: the travellers. Communicating the advantages of the solution to travellers that are used to the traditional transportation concept is also a challenge.

CASE 3 GETINGE: CREATING NEW VALUE OFFERINGS AND EXPLORING A NEW MARKET BASED UPON BIG DATA⁷

The Getinge group incorporated its largest division, Maquet in 2000. The case concerns Getinge's critical care, which involves intensive care products such as ventilators, anaesthesia systems, and advanced monitoring.

While many businesses and industries have already embraced digitization and big data, the healthcare and medical technology sectors are still in the early phases of development. Clinical care providers offer increasingly complex and advanced procedures, thanks to the advancement of medical knowledge; however, the majority of healthcare actors are still mainly analogue.

7 This is a condensed version of a case presented in Rosén, A & Lechner, J. (2016), *Advanced Market Monitoring. Sensemaking and Strategic Analysis for Medical Device Complementors to Big Data Platforms*, Business case research thesis, Stockholm School of Economics, June 2016, and complementary interviews 2017.

Recordkeeping is conducted manually and medical journals are kept in paper files. Medical devices operate in “silos” and are neither connected to central platforms, nor communicated with other devices. Due to ageing populations and medical progress, governments, hospitals, and medical companies are increasingly engaged in digital transformation driven by the growing need for and costs of healthcare.

Through the use of large data sets and advanced analytics, companies and researchers are developing models that allow doctors to intervene early on in order for patients to avoid suffering and for governments to save money. In the hospital environment, facilitating and supporting digital solutions such as clinical decision support systems are seen as tools to avoid mistakes and promote best practices. Overall, government officials and opinion leaders within the sector see digitization and the use of big data analytics as the future of healthcare.

Although digitization and the subsequent development of big data solutions will improve healthcare, there are considerable uncertainties regarding what is needed for a company to survive and/or thrive in potentially radically different market conditions. The picture becomes increasingly unclear as the healthcare industry varies considerably across geographies, involving more stakeholders than a typical consumer market.

Maquet Critical Care, a subsidiary to the medical technology company Getinge, had earned a reputation for the sophisticated medical technology and cutting-edge engineering of their ventilators, advanced monitoring, and anaesthesia machines. Now, the company is increasingly feeling the pressure of the shift toward digital transformation as other medical device manufacturers are increasingly interested in the data generated by Getinge’s (formerly Maquet’s) machines. As part of its digitalization, Getinge faces the uncertainty of when big data platforms and solutions in healthcare will become popular. There is also considerable apprehension regarding the impact this will have upon the competitive landscape. Will there be one or several industry platforms? What organisation will be the platform sponsor? And, to what degree will the platform be open or closed for external developers and complementors? Since Getinge operates in the niche of high-end intensive care medical devices, the company has limited capabilities to develop the technological capabilities and skills to provide a platform with the necessary range. Even if pooled together with the other product and customer groups within

the Getinge Group, the company itself does not strive to become a “big data company”, as one of their representatives expressed it in one of the interviews.

There are several strategic questions concerning the future digital platform(s) for Getinge: one concerns the scope, type, and the technical nature of the platform. Another concerns the number of platforms that will emerge for the potential inclusion of the data generated by Getinge’s machines and competing and complementary machines in wardrooms. A third issue concerns the degree of the platform’s openness to external actors. There are also questions regarding the strengths of the complementors and what platform complementors can bring to the platform ecosystem.

Another question impinging on investments in big data-based hospital services is how to deal with the institutional context. For example, the Swedish hospital system and leadership is decentralised, which forces suppliers to develop reimbursement schemes with each individual hospital. A second challenge concerns who will pay for the treatments; the government, an insurance company, or a combination of both often pay for healthcare services. Their interests, which are obviously not the same as the patient’s, create tension between cost-efficiency and optimum care. Thirdly, reimbursement fee systems vary according to local jurisdiction. Vendors must contend with diverse bargaining power among public and private buyers, as well as those buyers whose administrators and clinicians often disagree on the value of a product. Old devices are incompatible for integration with new devices and are mostly replaced piecemeal, as they stop functioning. This makes hospital-wide device integration difficult and unlikely. This significantly slows down big data applications.

Furthermore, competitors’ machines flank Getinge machines. Thus, various software and platform connections exist linking all these machines in order to seamlessly collect and record vital patient data. Therefore, Getinge must become a complementor to one or more other big data platform. This makes it an issue for Getinge of how many platforms they compete with, who sponsors the platform, and who will have access to develop it.

Overall, Getinge faces a scenario where it does not have a broad perspective of the big data market, which it is about to enter. Platform uncertainties create risk where they may lose competitive advantage in the high-end medical device manufacturing market to a platform provider. Machine generated patient data is stored in proprietary systems that are largely unintegrated.

The more data that are available (weight, age, back problems, smoker, and so on), the better treatment options the systems are likely to produce. Systems provide clinicians with a better base upon which to make decisions and, thus, devote more time to the patients.

A move into new big data-based service business implies a business model shift from offering products to offering services. The shift from selling products to services is expected to be hard as conservative customers still often want to buy a product, not a service provided by a product they will never own. However, continuing to sell products diminishes medical device manufacturers' capacity to acquire and profit from the combination of medical and technical knowledge needed to develop big data solutions. Secondly, enabling data and privacy legislation allows actors to easily combine, analyse and use data securely, while restraining data and privacy legislation does the opposite. Hence, there is a need for legislation to catch up. The strategic challenge for Getinge and medtech suppliers in similar stages of digitalization is the fact that, by attracting new users (medical scholars, insurance companies), complementors add value to a big data platform while often protecting intellectual property rights in their applications (more competitive, protected technology). If platform sponsors are wed strategically or by profitability to an application, complementors may sign exclusivity contracts with them. In a competitive environment with each other, complementors can protect their products with intellectual property rights: by moving quickly and by working closely with other manufacturers in the industry to ensure they provide exactly what is needed. The question of number of platforms is largely driven by multi-homing costs for users. Switching between publicly accessible platforms might lead to lower costs; however, industry stakeholders want more proprietary: modular standards that can be costlier to users. Thus, having widespread standards is also a challenge. Standards tend to converge actors and can reduce multi-homing costs.

CASE 4 SENSAVIS: AN EDUCATIONAL TECHNICAL START-UP COMPANY IN SEARCH OF A VIABLE BUSINESS MODEL⁸

Sensavis, established in 2008, is a small Swedish company that offers high quality, 3-D visualisation software for the education sector. Sensavis' stated

8 This case is a condensed version of a longer case presented in Badhani, S. & Mut, J. (2017): Business Model Innovation in Edtech; *An Exploratory Study of Business Model Innovation in a Complex Market Environment*, Master thesis, Stockholm School of Economics; and from interviews with the focal company, Sensavis 2016-2017.

vision is to improve learning outcomes by making complex and abstract phenomena easier to understand: particularly in the area of science, technology, engineering, and mathematics. The mission is to give educators all over the world tools that enable them to include all students in learning processes. With headquarters in Sweden, the company operates in 36 countries serving over 550 schools, and reaches more than 220,000 students. Sensavis went through five distinct business model stages from 2008 to 2017, in an attempt to create an offering and a market position in a new emerging market for digitalized education. Changing the existing market was a major challenge, as the company's CTO expressed: "We are trying to change 100 years of tradition in schools, and that is the biggest challenge."

While many sectors have undergone digital transformation over the past few years, the education industry is still at an early stage (*WEF: New Vision for Education*, 2016). Firms that develop educational technologies, referred to as "edtech companies", challenge this status quo by creating digital products and services that present educators with an opportunity to change teaching and learning methods (Hsu et al., 2013). By doing so, edtech companies shape the emerging edtech industry, which has attracted significant flows of private investment over the past five years (*WEF: New Vision for Education*, 2016). In this emerging edtech industry, companies struggle to develop viable business models (Watters 2016). Needs are not yet defined and many stakeholders (students, teachers, school leaders, national and local authorities, producers of educational material, academic institutions specialising in pedagogy, and parents) have unclear or overlapping roles during the transformation process. Edtech companies need to develop business models to adapt to a complex value network, which includes private and public stakeholders and where value is strongly connected to sustainable development goals: through economic (efficient use of public money) and social (study results, equal opportunities including access to new education technology, and education better adapted to the diversified needs of pupils/students). The multiplicity of stakeholder demands, needs, and values in public-private networks, contributes to a high level of complexity within an already heavily bureaucratic organisational environment (Williams & Lewis, 2008). The public education sector, which is characterised by high levels of bureaucracy, risk-aversion, and slow technology adoption (OECD Conference: *Innovating the Public Sector: from Ideas to Impact*, 2014) stands in contrast to innovation-driven edtech companies.

Navigating in a network of multiple stakeholders is a central part of the process to develop a viable business model.

In the first step of change, Sensavis moved from being a tool provider to a product company. The journey began with Sensavis as a pure B2B company serving sales and marketing teams for their sales presentations, mainly in mining and machinery corporations. The value proposition focused upon “high tech” visualisations. Entering the education sector, Sensavis attempted to standardise its product by bundling hardware and software into “The 3-D Classroom” and selling their visualisations as an interactive visual learning tool, which enabled instructors to explain complex and abstract components of a subject in a simple understandable manner. In the second step, Sensavis changed from a product company to become a software provider. Sensing the wide range of different needs and characteristics among their customer segments, Sensavis got rid of the hardware and moved from a product company toward becoming a software provider. Sensavis changed the focus of its value proposition, emphasising the software’s beneficial impact upon student motivation, educational growth, and learning outcomes. Co-creation with users had the biggest impact upon the subsequent changes in the value proposition of the firm.

In the third change step, the company went from software provider to become a pure service company. Collaboration with their expanding value network increased the company’s knowledge of the institutional context and entry barriers. Sensavis sensed stark differences in institutional settings, between users and buyers, as well as among the user community; the company addressed them through a revised value proposition. “Teach – Create – Activate” (TCA) was born. The new value proposition focused upon improving learning outcomes. Due to the complex market situation and the lack of a digitization roadmap, Sensavis sensed that the real value for most of their customer segments lay in the provision of guidance, support, and inspiration. Seizing this insight, Sensavis shifted focus toward becoming a fully-fledged service company, not only selling software, but rather acting as a trusted digitalization partner to schools, municipalities, and ministries of education.

When adapting to different markets, Sensavis was forced to reconfigure the business model components to local institutional and settings.

Experience with private companies did not prepare Sensavis for the barriers in the education sector. Within the first few months, the company sensed that understanding the institutional context and positioning the company in

relation to it would be the first step toward delivering value to its customers. Having one foot in the classroom helped Sensavis understand differences in needs within and across its customer segments.

Depending upon the local institutional context, differences appeared across markets, which complicated the sales process. Sensing these differences, Sensavis changed the sales pitch, adjusting the value proposition according to which actor the company spoke, and aligned appropriate channels and relationships to match it.

Sensavis successively identified potential value flow opportunities, expanded the network, and changed the nature of existing value flows. Product development rooted in user centricity became central in value creation. Co-operation, co-opetition, and co-creation with actors in the value network changed where value was created not only by Sensavis, but also increasingly in collaboration with customers, users, and other value network participants. Initially, close contact with customers was necessary due to the complexity of the visualisations and constituted a demanding task in project management processes.

Analysis

DIGITAL TRANSFORMATION DIMENSIONS

Important dimensions in digital transformation include the digitization of information, assembling and analyses of large amounts of data (big data), internet representation of physical objects (Internet of Things), and technical platforms acting as intermediaries of information. These are all important characteristics in the following cases.

Philips develops intelligent lighting systems: an IT network with equipment composed of sensors, controls, smart lamps, and energy meters. Philips aspires to create a platform for innovation with technology partners, complementors, and customers/users: for example, municipal authorities. Digital transformation opens opportunities to redesign public transportation service to a mobility service for Nobina. This digital transformation depends upon Internet of Things: a diffusion of smartphones and apps, digital payment solutions, and the potential of big data for planning and operating public transportation, as well as the development of a technical platform. The Getinge case focuses upon the challenges and opportunities for a medical equipment company when technical and medical innovations open up for the use

of big data to increase the effectiveness of medical treatment. For this to be possible, one or more technical platforms need to be designed and operated, upon which data are assembled, analysed, and made available. A major issue for Getinge is if the data assembled by their equipment should be added to one or more platforms, be it open or private, and how this data should be used. The start-up company Sensavis participates in early phases of digital transformation for education activities, essentially promoting visualisation as an interactive learning tool. The company experiences the lack of a “road map” for digital transformation of education as being problematic, evidenced by the frequent changes in its business model. Sensavis’ development does not relate to major digital transformation concepts, such as Internet of Things, big data, and technical platforms during the studied period.

DIGITAL TRANSFORMATION AND PUBLIC SERVICE INNOVATION PROMOTING SUSTAINABLE DEVELOPMENT

A WEF report (World Economic Forum, 2016) states: “We believe that digital solutions can bolster the three pillars of development on which the Sustainable Development Goals (UN) are built: improving people’s quality of life, fostering equitable growth, and protecting the environment” (p.9). The report also specifies that “...digital innovation is reshaping industries by disrupting existing business and operating models. But it is also having a profound impact on society, presenting a series of opportunities and challenges for businesses and policy-makers.” (p.4). Thus, the interconnected business models of both private and public stakeholders need to harbour various forms of commercial, *business value* (for example, manifested in new, extended, revised revenues and/or efficiency improvements), as well as *societal values* (where the digital transformation might lead to improving people’s quality of life, foster equitable growth, and protect the environment).

Aligning policies, enhancing collaboration, and engaging the whole ecosystem of government, business, and civil society are some of the pre-requisites for making these digital transformations and broad service innovations actually happen.

In line with an observed trend in marketing literature and in business practice, the case firms shift to a more service oriented, customer centric strategy (Vargo and Lusch 2004), related to public service innovation enabled by digital transformation. For public services, interaction with public agents and adapt-

ing to public norms becomes important, which must be included in business model considerations.

A central dimension in any business model is the *value offering to the focal customers*. The value offering provided by Philips is formulated in a performance contract that promises significant environmental and financial benefits for the public customers. Digital transformation makes it possible to tailor lightning to changing needs for light and to optimise resources. Retained ownership of the products and equipment enables Philips to apply circular economy principles and to be a technology partner to the customer in application of new more effective lighting methods in the future. A seemingly unresolved issue is how the value, which is co-created, should be calculated and how a performance contracts shall be written. Also, when a contract period ends, is it possible to open a new tendering process when Philips enjoys such a dominant position?

A mobility solution for public transportation, as in the Nobina case, aims for a more flexible, needs-based, and effective public transportation system that integrates public and private operators. The value offering includes societal benefits in terms of time-savings, lower costs related to traffic accidents, and reduced CO₂ emissions. For Getinge, the added value of the data generated by use of its medical equipment depends upon how the data can be assembled in big data platforms and be used for more effective healthcare activities. The value offered by Sensavis in its latest business model is to help actors in the education sector to design and implement digital transformation projects in educational processes.

Sustainable development criteria involve a wider perspective on *what types* of values are involved compared with a more narrow traditional business model analysis. To *balance and coordinate* the business and the societal *values* associated with digital transformation and associated service innovations emerge as one common business model challenge. This becomes a matter of *defining the customers*, and the various values for different beneficiaries: consumers, citizens, business organisations, public organisations, the environment and society at large. In addition, defining the financial/economic value(s) will be part of the business model challenges. For private actors such as Philips and Nobina, this might mean radical *revenue model shifts*. Increased overlapping between public and private networks will blur the boundaries between the customer, the key partner, and the roles of supplier and distribu-

tor. In this respect, variation between different communities and different geographic locations adds to the challenges of developing business models that serve to coordinate activities across several involved business firms and localities, and to handle tensions between private and societal values. Furthermore, digital infrastructure issues also need to be handled: for example, determining upon what technical platforms to base the service innovation and the degree of the platform's openness.

Public actors need to rethink policies in order to participate in the co-creation of service innovations: for example, this relates to procurement procedures, service operations, pricing and cost accounting models, infrastructure, and principles for public/private collaboration.

The complexity of the customers and the customer interaction for the small company Sensavis became more and more apparent for two reasons: first, the small organisation had to adapt to different types of local school authority networks when the company expanded internationally; secondly, the growing service orientation meant there was closer interaction with the user networks of deans, IT support functions and schools, teachers, and pupils/students.

There are major problems in successfully developing and implementing business models for the service innovations in the cases. Nobina admits that there are problems moving from a production to a service culture, for both public and private actors, and coordinating actors that currently run their operations separately. There is also reluctance among local authorities to make the necessary investments in the digital infrastructure.

The four cases illustrate efforts aimed at *business modelling* rather than at developing a fixed business model. Nobina recognises the importance of developing incentive-based contracts focusing upon value for end customers and the need to strike a balance between flexibility and basic public transportation needs. For Nobina, as a presently traditional public transport company, it is obvious that, they need to integrate resources that are held by others especially private transportation providers in order to provide public mobility services.

The WEF 2016 report states: "Government leaders, regulators and civil servants have a significant opportunity to support the adoption and dissemination of new technologies, using the key levers that are available to them: setting the appropriate policies, regulations and national strategy for digital, while also transforming government agencies into hotbeds of innovation. Other important success factors include enhanced collaboration, both nationally and inter-

nationally, and the ability to engage the whole ecosystem of government, business and civil society.”(p.22) WEF’s statement focuses upon public actors while we present a private business perspective. We will now suggest five issues in digital transformation, public service innovations, and sustainable development that we argue should receive increased attention in practice and research.

Business Modelling Issues for Further Inquiries in Practice and Research

All four cases show critical influences on digital transformation by *public actors* and *public/private interaction*. The tendering process for municipal procurement of lighting for Philips needs to change. The present focus upon initial cost, ownership, and control of equipment needs to become a focus on total costs, maintenance service, ecology criteria, and technical development. Legislative issues involved in changing ownership of material, public-private partnership, and public funding should also be solved. The tendering process needs to be adapted for municipal customers: from initial purchase price to total cost and ecological effects, public-private partnership, public funding, and legislative issues involved in changing the ownership of material.

The digital transformation-based innovations by both Philips and Nobina should be helpful in implementing sustainability targets set by public actors. However, public-private partnership issues must be solved when developing and implementing the mobility solution to public transportation. For example: how should the tendering process adapt to the new criteria, what form of bilateral agreements will be needed, what type of contract is required, and who will develop and operate the technical platform? The institutional context has a major influence upon digital transformation at Getinge as well. Both private and public customers in the healthcare sector in Sweden, with its decentralised organisation and local jurisdiction, are reluctant to buy services instead of products; this is due to unclear reimbursement schemes, as well as data and privacy legislation.

Different institutional settings, bureaucratic public organisations, the influence of multiple public and private stakeholders, and public funding play important roles for the start-up, Sensavis.

In the context of sustainable development, the five areas for future attention and inquiry into business modelling adopt a broad perspective in practice and in research on business models in the public service

First, digital transformation of public service increases customer complexity and changes interaction with customers. Secondly, the process is also associated with changes in the value offering. Third, new partnerships need to be established. Fourth, digital transformation implies the creation of new infrastructures: for example, with the increased importance of technical platforms. Lastly, dimensions of business models need to be developed and implemented when it concerns the financial and economic, which includes revenue as well.

1. INCREASED COMPLEXITY OF CUSTOMERS AND CUSTOMER INTERACTION INFLUENCES BUSINESS MODELLING

All companies found an increase in the complexity and, in some ways, the institutionalised rigidity of the networks of actors (deciders, buyers, users, and so on) connected to the customer side. This concerns the structural complexity and/or the complexity of the customer practices. Public customers' procurement policies and practices were not adapted to the new value offerings provided. For *Getinge*, the complexity of the customer side was manifested in the discussion of how to approach regional authorities, hospital management, intensive care departments, and their leading doctors, and so on. *Sensavis* encountered similar challenges when it approached, to a varying extent, deans, teachers, schools' IT departments, local municipalities, central school administration units, and so on in different parts of the world. The newness of the service offerings challenged the seller's own knowledge of the customer's varying needs of different units, and the customer's view of the new value offerings.

We find that more attention in practice and research is needed on how awareness of and adaptation to the complexity of structure and practices within the public sector shapes customer business modelling.

2. INCREASED END-USER ORIENTATION PROPELS BUSINESS MODELLING AS FIRMS SUCCESSIVELY DEVELOP THEIR SERVICE-BASED VALUE OFFERINGS

The development of the value offering or ideas about a new value offering over time was associated with a successively increased orientation toward end users and in end-user contexts in all four cases. Philips describes the importance of understanding the various needs of the citizens in (big) cities. Nobina focuses upon the total and detailed transportation needs of individual travellers. *Getinge* directs its attention to big data through an increased interest in

doctors' decisions and support needs in interactions with patients, as well as the machines in intensive care contexts. Lastly, Sensavis successively shifts the attention to the pedagogical needs of teachers in their interactions between students with varying needs, which also includes student-to-student interactions and teacher/community interactions. Hence, the deeper companies go into the digital transformation processes in order to create and implement new service-oriented value offerings, the more they need to understand the details of the end-users' use contexts.

We find that more attention in practice and research is needed on how business modelling successively adapts value offerings to increased end-user orientation.

3. PARTNERSHIP CHANGES AND NEW PATTERNS OF COOPERATION AND COMPETITION DRIVES DIGITAL TRANSFORMATION AND BUSINESS MODELLING

The three incumbent firms' show the same general pattern: cooperation with others increases in order to integrate resources and implement new value offerings. The number of key partners needs to be expanded, often resulting in increased overlapping of networks and, consequently, new patterns of cooperation and competition. For the small start-up Sensavis, the later stages of the company's business modelling process indicated the start of similar network complexity and expansion, as the company began to connect to partner companies in the publishing industry.

We find that more attention in practice and research is needed on how business modelling is associated with expansion of the relevant network of actors involved in the provision of the digital service.

4. BUSINESS MODELLING RELATED TO SHIFTS IN THE ROLES AND POSITIONS OF DIGITAL PLATFORMS

The first three cases describe an emerging digital infrastructure, which comprises the development of two or more competing technical platforms. In the Sensavis case, larger platforms are beginning to emerge. In all cases, business modelling is importantly influenced by the planned or existing technical platforms upon which the planned value offering should be based. Which actors will become owners and/or managers of platforms? How will the technical platforms as intermediaries between actors involved in the provision

and use of services relate to individual actors' business modelling? A powerful actor such as Philips would more easily manage the competition between technical platforms than would a less powerful one, such as Getinge. However, for a small start-up such as Sensavis, the lack of dominating technical platforms creates opportunities for the continued development of the company's own technical platform, before competition increases between the platforms, thus, affecting competition and customer relations.

We find that more attention in practice and research is needed in order to understand how shifts in digital infrastructure and technical platforms interact with business modelling.

5. IMPORTANT SHIFTS IN BUSINESS MODELS DRIVEN BY EXPERIMENTATION (INNOVATION) AND THE TESTING OF NEW ECONOMIC MODELS

A central challenge for most companies is to find a viable revenue model as part of the business model. Business modelling is often associated with considerable experimentation and successive adaptation of the model for financial viability. Financial viability includes the challenge to find, test, and manage new revenue, as well as charging, pricing, and cost management models. Digitalization with more service-based offerings challenges existing revenue models. Sensavis changed revenue model several times, thus, shifting from product service sales to more "pure" service and access-based contracts. In the other cases, customers' public procurement policies did not seem to be adapted to this new form of interaction, relationship, and contracting with service providers. While the value offerings required other contractual relations and longer-term interactions between the suppliers and the public customers/users, the traditional procurement policies and procedures of the latter, indeed, imposed obstacles.

We find that more attention in practice and research is needed in order to understand how experimentation related to service innovation requires that business modelling include new aspects of economic viability of public services.

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