MATERNAL HEALTHCARE IN LOW-RESOURCE SETTINGS

Investigations of IT as a Resource

THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

MATERNAL HEALTHCARE IN LOW-RESOURCE SETTINGS

Investigations of IT as a Resource

HAWA NYENDE

Department of Applied Information Technology
University of Gothenburg

UNIVERSITY OF GOTHENBURG
Gothenburg 2020

Gothenburg Studies in Informatics, Report 58
ISBN: 978-91-7833-944-0 (PRINT)
ISBN: 978-91-7833-945-7 (PDF)
Printed in Borås, Sweden 2020
Printed by Stema Specialtryck AB

The thesis is available in full text online
http://hdl.handle.net/2077/64184

I dedicate this thesis to my beloved family who have always been my joy and my love.

ABSTRACT

Maternal mortality is a major problem especially in developing countries. Maternal deaths are partly attributed to the limited access to healthcare and a shortage of medically trained health professionals who can provide maternal healthcare service. Approaches have been adopted to improve access and quality of healthcare. However, the approaches have been challenged by quality of care and limited infrastructure. The quality of healthcare can be improved through transforming healthcare, by managing and organizing care on a value-based system. Thereby, involving multiple actors who integrate resources to co-create value in order to benefit themselves and others. Information technology (IT) has been identified as a key driver of value co-creation in this transformation though, the way in which IT can drive value co-creation in healthcare has not been fully explored. The thesis aims to enhance our knowledge on how IT as a resource contributes to value-based maternal healthcare in low-resource settings. This thesis draws on service dominant logic framework and case study approach. The empirical foundation of the thesis comprises of four studies that are focused on the use and design of IT for maternal healthcare. Three studies were carried out in Uganda and one study was carried out in Sweden. Interviews, observations, focus group discussions and document reviews were used in data collection. Thematic analysis was used to analyze the data that was collected. The studies resulted into the appended five published papers.

The findings in this thesis shed light on the empirical understanding of the practices in maternal healthcare that include institutions and structures, and, the existing IT infrastructure that support actors to co-create value. In addition, empirical insights on opportunities in which IT can be designed and used to achieve value-based maternal healthcare are provided. Lastly, findings provide insights into value as perceived by actors at various levels when they use IT to engage in co-creation activities in maternal healthcare. In addition to the empirical insights, the thesis contributes theoretically to information systems research by enhancing knowledge on the role of IT in service innovation. Particularly, this thesis contributes by identifying three aspects in which IT triggers value co-creation. Aspects include recreating relationships among actors, transforming actor

capacities and re-organizing tasks in maternal healthcare. Thus, the thesis identifies the importance of IT in resource integration that leads to value. In addition, the interplay of all the three aspects extends understanding on the dynamics and transformative perspective of the service ecosystem that is required to achieve value-based maternal healthcare. Practically, the thesis contributes to value-based maternal healthcare by identifying managerial implications in the structural and functional roles of IT that overcome opposing demands in the co-creation activities at various levels of healthcare. Another implication is the digital infrastructures that communicate value propositions and provide resource-rich service platforms for resource integration. Lastly, the thesis contributes to policy by suggesting implications on applying task-shifting strategy in low-resource settings and, technology use and designs that support professionals and non-professionals in the task-shifting strategy.

Keywords: Maternal Healthcare, Value-based healthcare, Low-resource settings, Service-dominant Logic, Value Co-creation, Information Technology, Task-shifting strategy

ISBN: 978-91-7833-944-0 (PRINT)
ISBN: 978-91-7833-945-7 (PDF)

URL: http://hdl.handle.net/2077/64184

LIST OF PAPERS

The thesis is based on work contained in the following published papers:

I. Paper I: Nyende, H., Ask, U., & Nabende, P. (2017). Adopting a service-dominant logic to prediction of pregnancy complications: An exploratory study of maternal healthcare in Uganda. In Proceedings of the 25th European Conference on Information Systems (ECIS) (pp. 1145–1160), 5–10 June 2017, Guimeras, Portugal.

II. Paper II: Nyende, H. (2018). The role of technology in value co-creation of maternal health care: A service-dominant logic perspective. In Proceedings of the 26th European Conference on Information Systems (ECIS) (pages 16), 23–28 June 2018, Portsmouth, UK.

III. Paper III: Nyende, H. (2019). Value co-creation in design of mHealth applications for maternal healthcare service delivery. In Proceedings of the International Federation for Information Processing Working Group 9.4 (IFIP 9.4) (pp. 89–103), 1–3 May 2019, Dar es Salaam, TZ.

IV. Paper IV: Nyende, H. (2019). Value of mHealth apps for maternal healthcare. In Proceedings of the Information Systems Research Seminar in Scandinavia (IRIS) (pages 17), 11–14 August 2019, Nokia, Finland.

V. Paper V: Nyende, H. (2020). Maternal healthcare service transformation: Exploring opportunities for IT use in task shifting. In Proceedings of the Hawaii International Conference for Systems Sciences (HICSS) (pp. 3639–3648), 7–10 January 2020, Maui, HI, USA.

ACKNOWLEDGEMENTS

I owe the success of my 4-year PhD journey to a number of individuals and institutions who I would like to thank. I would like to thank my supervisors, funders, colleagues, collaborators, family and friends, without whose support this work would not have been completed.

First and foremost, glory and praise be to Allah, Lord of the Worlds, the most merciful. The one whose wisdom is perfect and whose knowledge is neither acquired through learning nor preceded by ignorance nor followed by forgetfulness. This work could not have been possible without you. Thank you, Allah, for getting me this far.

I would like to express my sincere gratitude to my supervisors whom I am deeply indebted to, for their quality supervision that has transformed my life in ways I could never have envisioned. My supervisors have played rather specific roles in getting me to graduate. First and foremost, I sincerely thank Urban Ask, for accepting me as a doctoral student. Thank you for your analytical expertise, suggestions, motivation, patience, and ability to instill calmness at times of uncertainty. Your constructive feedback and proactive planning got me to conferences I have never imagined. My sincere thanks also go to Jonas Landgren, my main supervisor, for taking over the baton from Urban and "finishing the job" in a great and supportive way. Thank you for your thoughtful inputs, guidance, and much needed encouragement, despite my tendency to ignore possible plans or expectations. I also sincerely thank Berner Lindström, for your constructive feedback and for providing me with high-level views and strategic guidance, going beyond the meaning of individual papers. I thank Peter Nabende, for offering constructive suggestions and feedback, and for always being encouraging and very positive towards my decisions. Lastly, I extend my gratitude to my examiner Jan Ljungberg, thank you very much for guiding this work in a flexible and accommodative way.

Special thanks go to SIDA for funding this work. I thank the administrators at the International Science Programme (ISP) at Uppsala University, Sweden: Therese Rantakokko and Chris Bengtsson, for your support and guidance on practical matters including stipend, resident permits and insurance during my stay in Sweden. I thank the director and admin-

istrators of the Makerere-Sida programme: Professor Buyinza Mukadasi, Nestor Bahenya Mugabe, Gyaviira Lubowa, Charles Lwanga, Paul Kiggundu, Annet Nakanyike, for your support in handling the practical matters including planning, reporting, budgeting and travel arrangements.

I would like to thank the BRIGHT project team at Makerere University in Uganda, Gothenburg University and Chalmers University of Technology in Sweden. I specifically thank: Engineer Bainomugisha, Evelyn Kahigi, Benjamin Kanagwa, Raymond Mugwanya, Michel Chaudron, Regina Hebig, and Eric Knauss, for your support in organizing all the seminars, workshops, summer schools and for providing me the opportunity to fulfill my dreams. I thank: Johan Magnusson, Dina Koutsikouri, Kalevi Pessi, for your encouraging words and for providing me opportunities to participate in seminars and conferences at the division of Informatics.

I am greatly indebted to Pär Meiling for the exceptional support you provided during my lengthy stays in Sweden.

A big thank you to the management team at the Swedish Management and IT research school (MIT). Specifically, I would like to thank Christine Keller, Peter Ekman, Fredrick Nilsson, Fredrick Tell, and Golondrian Jarke for the support and for accepting me to be part of this network. My thanks go to all the impressive fellows at MIT, for their constructive comments and generous feedback on my working manuscripts throughout the PhD process.

My colleagues at the IT faculty, including academic and administrative staff, thank you for providing a great research environment! I would like to thank Magnus Bergquist, who provided valuable insights into my work on the final seminar. I would also like to thank Urban Nuldén, Dick Stenmark, Fredrik Svahn, Lisen Selander, Lars Lindsköld, Agneta Ranerup, Johan Lundin, Marie Eneman, Tomas Lindroth, Zhang Yixin, Alice Srugies, Alexander Almér, Nataliya Berbyuk Lindström, Aida Hadzic Zukic, Juho Lindman, Faramarz Agahi, Guro Refsum Sanden, for thoughtful inputs, inspirations, and for providing opportunities for me to participate in PhD courses, seminars and conferences. Thank you, Lisa Johansson, Gustav Östling, Jenelyn Aggerstam, Emil Fägerwall Ödman for the administrative support you provided. I would like to thank Catharina Jerkbrant and Mattias von Feilitzen for your support and expertise in typesetting this manuscript.

In addition, my research would not have been possible without the support from all my collaborators in academia and industry. Therefore, I would to thank and the midwife managers at Västra Götalands Region: Linnéa Swanson, Helena Seth and Susanne Samuelsson, for the productive collaboration, invaluable contributions and intensive discussions. I also thank Nikolaos Andrikopoulos and Anne Svensson at University West for your contributions and insightful discussions. I thank other industrial collaborators who have requested anonymity, for their time and participation in my work.

I would like to thank fellow PhD students at the IT faculty for sharing your input during my PhD journey. Thank you: Frida Magnusdotter Ivarsson, Mikael Gustavsson, Rashidah Kasauli Namisanvu, Michael Kizito, Grace Kobusinge, Dragule Swaib, for your unceasing readiness to lend a listening ear during the difficult times and for your wonderful company on the unforgettable trips we made together. I thank: Mikael Lindquist, Nadia Bravo Ruiz, Jwan Khisro, Charlotte Arghavan Shahlaei, Masood Rangraz, Lu Cao, Anna Rossander, Karin Ekman, Anita Grigic Magnusson, Adones Rukundo and David Bamutura, for your warm friendship and for being extremely supportive in my PhD studies.

I would like to thank my colleagues and administration at the School of Computing and Informatics technology (SCIT), Makerere University. I thank: Gilbert Mayiga, Agnes Rwashana Semwanga, Josephine Nabukenya, Mercy Amiyo, Grace Kamulegeya, Joseph Balikuddembe, John Ngubiri, Mary Nsabagwa, Nasser Kimbugwe, Halimu Chongomweru, Jacob Katende, Peter Kaamu and Hasifa Namatovu for your constructive feedback, support and guidance during my PhD studies and for providing a great work environment. I thank members of the Development Informatics Research Group at SCIT: Rehema Baguma, Fiona Ssozi, Agnes Nakakawa, Fiona Tulinayo, Amina Zawedde, Florence Kivunike, Irene Arinaitwe, Margaret Nagwovuma, and Alice Mugisha, for your constructive comments and feedback on my working manuscripts.

I am extremely thankful to have maintained a rather healthy study-life balance throughout the years. I would like to extend my special appreciation to my family and friends for their continuous prayers, support, and patience. First and foremost, I owe much of my success to my beloved parents, who always encouraged me and let me make my own choices in life.

My father, Haji Khalid Nyende (the late), I still recall your encouraging and inspirational words when I informed you about the start of this PhD journey. I am very sorry that you did not get to see me finish this. I know that you would be very proud of me. My mother Hajat Mwatum Nyende, you must be feeling excited to welcome a doctor in our beloved family. Your endless prayers and encouraging words always got me going, more especially, during those difficult times when I felt like giving up. Thank you very much. I love you mum; you are the best! I would like to thank my mothers: Florence Kyebambe, Halima Nyende, Rehma Nakigozi Nyende and Amina Nyende, for your prayers, support and encouragement during my studies.

I am one of the gifted few with many siblings whom I would like to thank for being extremely supportive and friendly during my PhD studies. Thank you for taking over my family responsibilities during the extended stays in Sweden. In a special way, I thank Haji Abu Nyende for taking over the responsibility of handling my projects while I was in Sweden. Thank you to: Ambassador Zaake Kibedi, Isa Nyende, Hadija Nyende, Ayub Nyende, Nusura Nyende, Haji Hussein Nyende, Siraj Nyende, Zubeda Nyende, Rehma Nyende, Asuman Nyende, Rashid Nyende, Asha Nyende, Asina Nyende, Adam Nyende, Safina Nandase and Ismail Kirya, for always checking on me and encouraging me to push forward.

I am very grateful to my friends: Sarah Annet Nakamya, Justin Nagginda, Sophia Masembe, Zaitun Nantale. Amina Nasaazi, I am greatly indebted to your generosity towards my daughters, especially, during my absence. Richard Musota, I remember that time when the bus broken down on the way from Kanungu to Mbarara, you provided all the support I needed to complete my fieldwork. Thank you very much Richard. Donald Rukanga, Stephen Tashobya and Ivan Kazibwe, thank you very much for supporting my fieldwork. Brian Mukyake, thank you for handling my professional activities during my absence. My long-time friends: Faizal Batiibwe and Jean Lubega, thank you for always checking on me and for the inspirational words.

To my loving husband Musa Musazi, thank you for being at my side in all good and bad times, and for enduring my regular motivation and productivity swings. I am also very grateful to my beloved daughters, to whom I express my love and thanks: Hamidah Babirye, Hanifah Nakato

and Hibah Kizza. Thank you for enduring my travels and long leaves of absence from home and for your continued prayers and encouragement. Thoughts of you put countless smiles on my face during the stressful times.

Funding: This research was funded in part by the Swedish International Development Cooperation Agency (Sida) and Makerere University under Sida contribution No: 51180060; Project No. 317; Building Research Capacity in Innovative Information and Communication Technologies for Development (ICT4D) for Sustainable Socio-economic Growth in Uganda (BRIGHT).

CONTENTS

INTRODUCTION 19
1.1. Maternal healthcare 20
1.2. Maternal healthcare in low-resource setting 21
1.3. Approaches to address the situation of maternal healthcare 22
1.3.1. Task-shifting strategy 23
1.3.2. A value-based system of healthcare 24
1.3.3. Healthcare information technologies 27
1.4. A value-based system of healthcare and information technology 30
1.5. Research aims and research questions 31
1.6. Outline of the thesis 33

THEORETICAL POSITIONING 35
2.1. Service-dominant logic and information systems research 35
2.2. Participation, co-production, and value co-creation 39
2.3. Value co-creation in service research 41
2.4. The role of IT in value co-creation and service innovation 44
2.5. Resource integration and IT as a resource 47
2.6. Concluding remarks 51

METHOD 53
3.1. Research setting 53
3.1.1. Maternal healthcare in Uganda 53
3.1.2. Context of the research 54
3.1.3. Structure of the maternal healthcare system in Uganda 57
3.2. Research approach 59
3.3. Research design and research process 60
3.4. Data collection methods 64
3.4.1. Interviews 65
3.4.2. Focus group discussions 66
3.4.3. Field-based observation 67

3.4.4. Documents 68
3.4.5. Surveys 69
3.5. Data analysis 70
3.6. Concluding remarks 74

SUMMARY OF PAPERS' CONTRIBUTIONS 77
Paper I 77
Paper II 79
Paper III 80
Paper IV 81
Paper V 82

DISCUSSION 85
5.1. Synthesis of findings 85
5.1.1. Practices in which IT has been used to benefit maternal healthcare in low- and high-resource settings 86
5.1.2. Opportunities for IT to be designed and used to benefit maternal healthcare in low-resource settings 90
5.1.3. Value as perceived by actors when they use IT in maternal healthcare 93
5.2. Addressing the main aim of the thesis 95
5.2.1. Recreating relationships among actors 95
5.2.2. Transforming actors' capacities 98
5.2.3. Reorganizing tasks in maternal healthcare 101
5.3. Limitations of the study 103
5.4. Overall research contributions and implications 105

REFERENCES 109

CHAPTER 1
INTRODUCTION

Maternal healthcare is a global concern, especially in developing countries, which experience high rates of maternal deaths (WHO 2016a). Maternal deaths are partly attributed to limited access to healthcare and a shortage of medically trained health professionals who can provide maternal and child healthcare services (Nabudere et al. 2011). In addition, most people who need maternal healthcare live in hard-to-reach rural areas (MoH et al. 2012). Various approaches have been adopted to improve the access to and quality of healthcare. However, these approaches have been challenged by the existing care quality and limited infrastructure (Fritz et al. 2015). Research suggests that healthcare quality can be improved (Aithal and Aithal 2017) through transformation in which healthcare is managed and organized according to a value-based system (Porter 2009). In a value-based system, healthcare is viewed as a service that involves multiple actors who integrate resources to co-create value in order to benefit themselves and others (McColl-Kennedy et al. 2012; Batalden et al. 2016; Frow et al. 2016). This transformation requires changes to institutions, information technology (IT), and structures (Porter 2009; McColl-Kennedy et al.

2012; Akaka and Vargo 2014; Batalden et al. 2016). IT has been identified as a key factor driving actors to co-create value. However, there is limited research on the role and nature of IT in co-creating value in healthcare. This thesis aims to address this research gap by enhancing our knowledge of how IT as a resource contributes to value-based maternal healthcare in low-resource settings.

1.1. MATERNAL HEALTHCARE

Improving maternal healthcare is a high priority for the World Health Organization (WHO 2016a). Maternal health is "the health of women during pregnancy, child birth, and the postpartum period" (WHO 2018). Despite improvement activities, the United Nations' fifth Millennium Development Goal of a 75% reduction in the maternal mortality ratio (MMR; i.e. number of maternal deaths per 100,000 livebirths) between 1990 and 2015 was not met. In 2015, about 830 women died every day from pregnancy or childbirth-related complications around the world, with 99% of the deaths reported from developing countries (WHO 2016a). Maternal deaths result from complications of pregnancy, complications of childbirth, and postpartum complications (Kassebaum et al. 2014). Worldwide, the number of maternal deaths dropped by only 43% between 1990 and 2015 (WHO 2016a). In response to this, the United Nations has set Sustainable Development Goal 3.1, which aims at reducing the global MMR to less than 70 per 100,000 live births by 2030 (WHO 2016a). Unacceptably high maternal mortality rates can be reduced through strengthening healthcare systems and addressing inequalities in the access to and quality of healthcare services (WHO 2016a). The health system, sometimes also referred to as the healthcare system, consists of all organizations, people, and actions whose primary intent is to promote, restore, or maintain health and includes efforts to influence the determinants of health as well as more direct health-improving activities (WHO 2007). Healthcare systems differ across settings, including between developed and less-developed nations, in terms of infrastructure and affordability (Frow et al. 2016).

In addition to strengthening health systems, the World Health Organization recommends viewing maternal health from a wellbeing perspec-

tive (WHO 2020). Quality of life is viewed as "subjective wellbeing" and comprises four domains, i.e. the physical, psychological, existential, and support domains (Cohen et al. 1996, p. 1421). According to McColl-Kennedy et al. (2012), the physical domain concerns the individual's most problematic physical symptoms, including pain, weakness, and fatigue. The psychological domain concerns feelings of depression, nervousness, sadness, and fear of the future. The existential domain concerns an individual's belief about their life in terms of meaningfulness, worthiness, and having a sense of control over life. The support domain concerns feelings associated with being supported and cared for. Maternal psychosocial wellbeing includes the psychological and social or support (e.g. support from family and community, culture, and empowerment) aspects of motherhood (Zafar et al. 2014). This thesis views maternal healthcare from a wellbeing perspective.

1.2. MATERNAL HEALTHCARE IN LOW-RESOURCE SETTING

Low-resource settings refer to "parts of the world in which resources for healthcare (money, human resources and technical infrastructure) are scarce" (Fritz et al. 2015, p. 480). Regarding IT implementation in healthcare, low-resource settings have been characterized in terms of "a weak healthcare infrastructure with inadequate funding and a lack of trained healthcare personnel, a rudimentary level of healthcare technology and an inappropriate IT and power infrastructure and the existence of basic health IT training in the curriculum" (Fritz et al. 2015, p. 480). The term "low-resource setting" has been mainly used to apply to developing countries, but can also refer to developed countries where people have inadequate access to resources partly due to geographical disparities.

Thaddeus and Maine (1994) recognize three delays that lead to maternal mortality in low-resource settings: 1) *Delays in deciding to seek care* are associated with socio-economic and cultural factors that affect the decision-making of actors. These actors include pregnant women, spouses, relatives, and families. An example of a socio-economic factor is unequal allocation of funding to male and female health services. An example of

a cultural factor is the status of women in terms of limited mobility outside the community and lack of authority to make decisions. Fisher et al. (2012) observed that mental disorders are prevalent in socially and economically disadvantaged pregnant women, especially those from rural areas. In addition, gender-based factors such as excessive unpaid workloads and role-based restrictions regarding housework and infant care increase the risk of depression (Fisher et al. 2012). 2) *Delays in accessing or reaching care* are associated with infrastructure, transportation costs and availability, and distances to healthcare facilities. 3) *Delays in receiving timely and effective care* are associated with the efficiency and quality of healthcare at health facilities in terms of inadequacy of the referral system, shortage of medical supplies and equipment, and too few healthcare personnel. In low-resource settings, there is limited access to healthcare and a shortage of medically trained health professionals who can provide maternal and child healthcare services (Nabudere et al. 2011). Half of the World Health Organization member countries, mostly from the African continent, have fewer than one physician per 1000 individuals (e.g. 0.908 in Uganda, 0.399 in Tanzania, and 0.898 in Cameroon) (WHO 2015a). Furthermore, in some countries, such as Uganda, the distribution of resources for healthcare, particularly specialized health professionals, is skewed toward urban areas, leading to very limited access to high-quality healthcare in rural, remote, and hard-to-reach areas (MoH et al. 2012).

1.3. APPROACHES TO ADDRESS THE SITUATION OF MATERNAL HEALTHCARE

To address the situation of maternal healthcare, three approaches have been suggested. One approach is to strengthen healthcare systems by improving the numbers and skills of healthcare workforce through the task-shifting strategy (WHO 2007). Another approach is to support the limited number of existing medical professionals with IT to enable them to access information about their patients and to record medical data in a structured way (Fritz et al. 2015). A third approach is to transform healthcare by managing and organizing care based on a value-based system, as a way of reducing the costs of and increasing access to healthcare (Porter 2009). These approaches are elaborated on in the following sections.

1.3.1. TASK-SHIFTING STRATEGY

To strengthen and extend the healthcare workforce to rural areas, the World Health Organization (WHO) in collaboration with the Office of the US Global AIDS Coordinator (OGAC) launched a task-shifting strategy (WHO 2007).

The main objective of the task-shifting strategy is to make more efficient use of human resources (WHO 2007). The strategy enables healthcare professionals such as doctors and specialized clinicians to shift tasks to less trained and qualified health practitioners, such as nurses and community health workers (CHWs) organized in village health teams (VHTs) in rural areas (WHO et al. 2008). A definition of CHWs agreed on by a WHO study group is as follows: "CHWs are members of the communities where they work, should be selected by the communities, should be answerable to communities for their activities, should be supported by the health system but not necessarily part of its organization, and have shorter training than professional workers" (WHO 1989, p. 6). Different countries have used different terms to refer to CHWs, such as "community health volunteers, community drug distributors, community health promoters, community nutrition workers, community health representatives, village health helpers, village health workers" (Bhattacharyya et al. 2001, p.2), frontline health workers (Agarwal et al. 2015), and task shift acceptors (Aithal and Aithal 2017). Task shifting aims at enhancing service quality while reducing costs (Aithal and Aithal 2017).

Task shifting has been implemented in many countries to improve maternal healthcare by training lower-level cadres to provide pregnancy and childbirth care (Deller et al. 2015). The task-shifting strategy is based on a traditional healthcare system in which CHWs are quickly trained to deliver healthcare services to patients (Aithal and Aithal 2017). CHWs are the first point of contact for people who seek care in low-resource settings (Agarwal et al. 2015). CHWs do not have professional knowledge and skills but are given a few days of training, which can hinder service provision (Okuga et al. 2015). The strategy is opposed by patients and their families due to fear of being prescribed the wrong medications, so efforts are required to promote greater acceptance (Aithal and Aithal 2017). Shifting aspects of maternal healthcare to existing cadres of mid-level health work-

ers in low-resource settings requires simple evidence-based tools for monitoring pregnant women and accurately identifying the women at greatest risk of complications well before that outcome occurs (Payne et al. 2014).

Without proper designs, task shifting may increase system costs by worsening overall population health due to poor clinical quality or an increased number of staff in the healthcare system without changing care-seeking patterns among patients (Seidman and Atun 2017). Expanding access to maternal healthcare services through the task-shifting strategy requires an interplay of different components, including policy and regulatory support, determination of roles and responsibilities, determination of qualifications, education and training, and service delivery support (Deller et al. 2015). Service delivery support encourages "shifted to" cadres and their supervisors to provide services more efficiently and includes: (1) management and supervision through mentoring and motivation; (2) incentives and or remuneration through reward systems; (3) material support through tools, equipment, supplies, and service protocols; and (4) referral systems in cases of complications and emergency care (Deller et al. 2015).

Omachonu and Einspruch (2010) suggested that innovation can balance the costs of and access to healthcare. Traditionally, healthcare systems, including the task-shifting strategy, have been designed with a focus on the role of the healthcare provider but with limited consideration of patient involvement (Berry and Bendapudi 2007). This perspective, which suggests that healthcare is a product manufactured by healthcare systems for use by healthcare consumers, limits improvements in healthcare (Batalden et al. 2016) and leads to poor quality of (McColl-Kennedy et al. 2012).

1.3.2. A VALUE-BASED SYSTEM OF HEALTHCARE

Healthcare quality is achieved not only through service delivery but also through improved healthcare outcomes and the value obtained from the healthcare service delivery process (McColl-Kennedy et al. 2012). Improved healthcare outcomes require innovative ways of healthcare service delivery (see "A?" in Figure 1). The traditional view of patients as passive recipients separate and outside the organization is prevalent in healthcare (Berry and Bendapudi 2007), despite acknowledgement that, within

healthcare, treatment plans and related activities can extend beyond interactions with healthcare professionals to include broader aspects of individual life (Michie et al. 2003; McColl-Kennedy et al. 2012). The information revolution has empowered individuals with knowledge and skills leading to movement from one-to-one communication to one-to-many communication, transforming the way healthcare is provided (Joiner and Lusch 2016). Transforming the healthcare delivery system at the micro level and beyond enables co-creation relationships between patients and healthcare professionals (Batalden et al. 2016). Furthermore, healthcare managers should shift their focus beyond a micro dyadic value co-creation view, and extend their view to encompass all actors in the service ecosystem (Beirão et al. 2017). This transformation means conceiving healthcare as a service that requires changes in organizational culture, forms, and structures, to actively engage patients in their care (McColl-Kennedy et al. 2012; Batalden et al. 2016) and to organize and manage healthcare based on the value created rather than the services provided (Porter 2009).

A shift from health provider-centred to patient-centred care requires behavioural, physical, and emotional changes that lead to: 1) increased self-management of care; 2) shared decision making between the patient, family, and health providers; and 3) improved communication and shared understanding (Frow et al. 2016). Hardyman et al. (2015) stressed that patient engagement in healthcare service interactions at the micro level can be understood in terms of value co-creation. Value co-creation is defined as "the processes or activities that underlie resource integration and incorporate different actor roles in the service ecosystem" (Lusch and Nambisan 2015). Patient value co-creation has been perceived as a benefit realized by integrating resources through activities and interactions with collaborators in the health service ecosystem (McColl-Kennedy et al. 2012; Frow et al. 2014). Evidence has shown that the involvement of patients in their treatment creates value, as they actively seek and share information with health professionals, friends, family, support groups, and colleagues (McColl-Kennedy et al. 2012). This involvement helps to redesign treatment programmes (McColl-Kennedy et al. 2012) and prevent diseases through proper diet and exercise (Groves et al. 2013). Co-creation activities and interactions shape the relationships between actors and their respective resources at different levels of the healthcare service ecosystem

but are regulated by structures and institutions (Frow et al. 2016). However, limited research explores the dynamics of the healthcare ecosystem from the viewpoints of multiple actors and their collaborative practices (Frow et al. 2016). Higa and Davidson (2017) and McColl-Kennedy et al. (2017a) have called for research on the roles, contributions, and limitations of different actors in value co-creation and on the "capabilities for actors to manage institutional change" (Pop et al. 2018). In addition, little is known about what patients do to co-create value in healthcare (McColl-Kennedy et al. 2012; Frow et al. 2016). To actively involve patients in the value co-creation of healthcare, interactional resources such as knowledge, technology, and institutions are necessary (Srivastava and Shainesh 2015).

The definition of healthcare has affected the inclusion of social care as part of healthcare (NAS 2019). A value-based system of healthcare requires consideration of the social determinants of health (NEJM 2020). The social determinants of health are the circumstances in which individuals are born and live that impact their health (Marmot et al. 2012), including political, socioeconomic, cultural, and location-based conditions such as accessible healthcare and education systems, safe environmental conditions, and well-designed neighborhoods. These circumstances are shaped by power, money, and resource distribution at various levels (Marmot et al. 2012). The social determinants of health are the underlying causes of societal health dilemmas; for instance, low income reduces access to healthcare and increases hardships that lead to stress (NEJM 2020).

NAS (2019) has suggested five types of activities that better integrate social care with healthcare: awareness, adjustment, assistance, alignment, and advocacy. According to NAS (2019), awareness activities are those that identify the social risks and resources of defined patients and populations. Adjustment activities are those that focus on altering clinical care to accommodate identified social barriers. Assistance activities are those that reduce social risk by providing assistance in connecting patients with relevant social care resources. Alignment activities are those undertaken by healthcare systems to understand existing social care assets in the community, organizing them to facilitate synergies, and investing in and deploying them to positively affect health outcomes. Advocacy activities are those in which healthcare organizations work with partner social care organiza-

tions to promote policies that facilitate the creation and deployment of resources to address health and social needs.

To successfully integrate social care into healthcare, NAS (2019) recommends: 1) an appropriately staffed and trained workforce that includes interprofessional teams of healthcare professionals, social workers, home health aides, and family caregivers; 2) health IT innovations that address health-related social needs via the five types of activities to enhance integration, and support for community partners and their infrastructure needs; and 3) new financing models that move away from healthcare providers that receive payment for service to accountable care organizations that align incentives for the provision of social care.

1.3.3. HEALTHCARE INFORMATION TECHNOLOGIES

The World Health Organization (WHO) argues that high maternal mortality rates can be reduced by addressing inequalities in the access to and quality of healthcare services (WHO 2016a). Improving the quality and safety of care through health information technology (HIT) innovations is a priority research area (Blumenthal and Tavenner 2010). HITs are defined as the technologies that collect, store, and display patient information across the whole range of functions that may affect the health of citizens and patients (Brender et al. 2006). Such technologies include clinical information systems, electronic patient records, telemedicine (Nguyen et al. 2016), and mHealth (WHO 2011). mHealth is defined as "medical and public health practice supported through mobile devices for collecting community and clinical health data, delivery of healthcare information to practitioners, researchers, and beneficiaries, real-time monitoring of beneficiary vital signs, and direct provision of care" (Braa and Sanner 2011, p. 1). Appropriate deployment of HIT leads to safer and higher-quality care through improved communication and better handovers (Sood and McNeil 2017). HIT enables the electronic transfer of patient data and health information between healthcare providers (Esmaeilzadeh and Sambasivan 2016). Despite the benefits of HIT, in "most low-resource settings, the role of IT in healthcare is mainly focused on aggregating data in the so-called health management information systems for reporting and resource planning purposes" (Mutale et al. 2013; Fritz et al. 2015, p. 479). Imple-

menting HIT is difficult due to the complex organizational structure of healthcare and requires further theorization (Nguyen et al. 2016) addressing both technology and implementation processes (Abbott et al. 2014).

The adoption and use of HIT in low-resource settings is limited due to poor infrastructure, unreliable power, low IT literacy, and poor management structures (Asangansi and Braa 2010) – hence the term "low-resource setting" (Fritz et al. 2015). The fast-growing mobile infrastructure with seven billion mobile cellular subscriptions worldwide (UCC 2015) has potential for spurring the evolution of mobile health (mHealth) services in both the low-resource and high-resource settings. mHealth extends the health information infrastructure to villages and provides an opportunity to strengthen healthcare systems in developing countries (Braa and Purkayastha 2010). mHealth overcomes geographical and organizational barriers to delivering healthcare services, providing an opportunity for healthcare innovation (Silva et al. 2015). mHealth not only supports people in rural areas with limited access to healthcare but also provides people in urban areas and developed countries with access to care while on the move (Varshney 2014).

In low-resource settings with high mortality rates, mHealth has attracted great interest as an innovative method for achieving Sustainable Development Goal 3.1 (Sondaal et al. 2016). In the task-shifting strategy, mHealth has potential to facilitate and improve the delivery of healthcare by community health workers (CHWs) (Agarwal et al. 2015). mHealth can improve maternal healthcare by increasing antenatal care attendance, facility-based deliveries, skilled attendance at birth, and vaccination rates (Sondaal et al. 2016). Full utilization of mHealth in developing countries is challenged by technical issues such as costs (e.g. of mobile phones, installation, and mobile network infrastructure), mobile application usability issues, and sociopolitical issues such as communication patterns and lack of power (Braa and Purkayastha 2010; Braa and Sanner 2011). In addition, the adoption of mHealth by CHWs is affected by three types of barriers: (1) cultural barriers, especially in cases where mobile phones are shared between CHWs and members of their families, affecting care delivery; (2) lack of CHW engagement in developing and implementing mHealth tools; and (3) lack of optimal mHealth platform designs to facilitate both adoption and sustained use (Agarwal et al. 2015). Devel-

oping an integrated mobile-based infrastructure in low-resource settings requires a systems perspective that encompasses other types of infrastructure, such as computers, servers, social networks, and mobile supporting networks. Such infrastructure should form the basis for suitable designs and the integration of mobile applications in developing countries (Braa and Purkayastha 2010).

Most mHealth services are designed based on existing traditional health system constructs (McCurdie et al. 2012) and support minimal user input (Schnall et al. 2016). In addition, the underutilization of mHealth is partly due to failure to embed it in broader health information systems (Nasi et al. 2015). Traditional models of technology separate the development phase from the use phase and view technology as comprising material artifacts that emerge as outputs of human action or as a product rather than a process (Akaka and Vargo 2014). The product-based view limits the ability of a technology to influence or contribute to the co-creation of value and service systems (Akaka and Vargo 2014). Therefore, the research presented in this thesis suggests a change from the product-based view of IT to a perspective in which IT contributes to healthcare at a systems level. This is mainly because adopting systems-level thinking makes complex contexts such as healthcare more understandable (Beirão et al. 2017). In such thinking, healthcare is viewed not as a hierarchical, producer-driven network (Batalden et al. 2016) but as a service ecosystem in which multiple actors at various levels collaborate and interact to improve individual healthcare service (Frow et al. 2016). Within the ecosystem perspective, technology supports interactions and collaborations among actors (Beirão et al. 2017).

The research presented in this thesis builds on a broader ecosystem perspective on technology to suggest ways in which the design and use of IT can trigger or support service exchange and resource integration in the maternal healthcare service ecosystem.

1.4. A VALUE-BASED SYSTEM OF HEALTHCARE AND INFORMATION TECHNOLOGY

IT is a central component and a key factor driving actors to share information within and across the ecosystem (Akaka and Vargo 2014). In the broader service ecosystem, IT is viewed as a combination of practices, processes, and symbols that fulfil a human purpose (Akaka and Vargo 2014). Therefore, IT plays a dual role in enabling and triggering service exchange in service ecosystems, thereby creating opportunities for actors to integrate resources (Lusch and Nambisan 2015). The service ecosystem view calls for consideration of multiple structures or institutions that guide the development as well as use of IT as a resource at different levels (Vargo and Lusch 2011) of healthcare.

The use of health information technologies (HITs) across the healthcare system and the engagement of patients through digital channels changes the way care is coordinated and provided (Sood and McNeil 2017). HIT can lead to efficient healthcare services by actively engaging patients in the healthcare experience (Rozenblum et al. 2015). The role of HIT is central in establishing a value network for sharing and integrating information and resources (Srivastava and Shainesh 2015). Patient-centred exchange models have been used to exchange clinical data and have enabled the sharing of patient data and laboratory results with patients as required (Esmaeilzadeh and Sambasivan 2016). Patient portals defined as "multi-function, multi-purpose technologies offered by providers as a means of engaging patients in their care" have enabled patients and their authorized caregivers to view personal health information and to communicate with providers (Deering and Baur 2015, p. 93). Involvement of end-users in the HIT design and implementation process leads to good user acceptance and has positive impacts on work practices (Nguyen et al. 2016). Few studies of IT processes and structures actively embrace patient participation in improving healthcare services at the organizational or system level (Sharma et al. 2014). In addition, limited research considers the role of IT (Akaka and Vargo 2014) and how IT can support diverse roles of actors (Lusch and Nambisan 2015) in healthcare.

The thesis takes into consideration IT processes and structures that enable the active participation of all actors, including patients, commu-

nity health workers, and healthcare professionals, in improving maternal healthcare at a system level. The thesis suggests ways in which IT contributes to maternal healthcare based on the service conceptualization of healthcare and a broader perspective on IT.

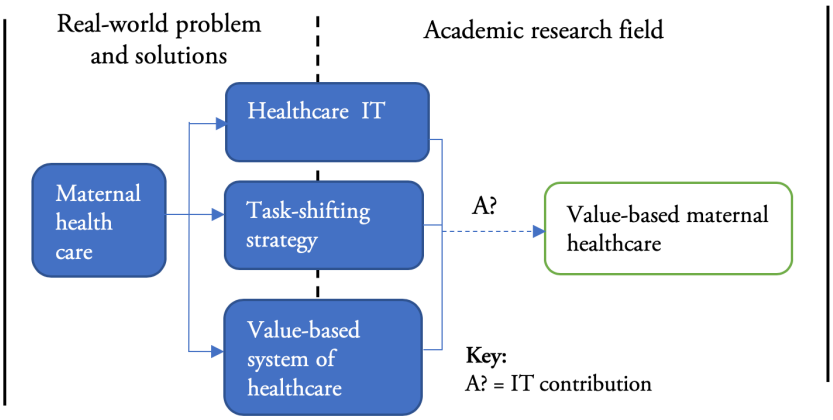

Figure 1: Description of the research problem.

1.5. RESEARCH AIMS AND RESEARCH QUESTIONS

The main aim of the thesis is to enhance our knowledge of how IT as a resource contributes to value-based maternal healthcare in low-resource settings. Another aim is to contribute to practice and policy for achieving value-based maternal healthcare in low-resource settings.

To address the multifacetedness of the phenomenon, this work adopts a socio-technical perspective in which we consider contextual, individual, and technological (Bostrom et al. 2009). In this thesis, the context of maternal healthcare is studied by understanding institutions and institutional arrangements in terms of the standardized procedures and practices that facilitate resource integration and service-for-service exchange (Vargo and Lusch 2016) in maternal healthcare, and by understanding how these institutions affect actor roles and co-creation behaviour in shaping the ecosystem (Frow et al. 2016; Voss et al. 2016). Individual factors are studied by understanding the actors involved in maternal healthcare service, as

well as their roles, knowledge, and skills (Vargo and Lusch 2016). Technology is studied by understanding the use and designs of IT resources, including knowledge and skills embedded in these IT resources and the value anticipated by the actors as they use the resources to deliver services in maternal healthcare (Lusch and Nambisan 2015).

The following specific research questions were formulated:

1. To describe practices in which IT has been used to benefit maternal healthcare in low- and high-resource settings
   - RQ 1: In what ways does IT support value co-creation in maternal healthcare in low-resource settings? (Paper I)
   - RQ 2: How does IT contribute to value co-creation in a best practice maternal healthcare setting? (Paper II)

2. To identify opportunities in which IT can be designed and used to benefit maternal healthcare in low-resource settings
   - RQ 3: How are the designs of existing mHealth applications incorporating value co-creation aspects and how can mHealth applications be designed to improve value co-creation in maternal healthcare within the context of a service-dominant logic? (Paper III)
   - RQ 5: Which tasks are shifted in maternal healthcare service delivery, by whom and to who? What opportunities exist for IT to enable /trigger execution of shifted tasks? (Paper V)

3. To reveal value as perceived by actors when they use IT in maternal healthcare
   - RQ 4: What value is co-created by the use of mHealth apps in maternal healthcare service delivery and how is it co-created? (Paper IV)

This thesis builds on four empirical studies that adopt an interpretive case study approach. Cases from Uganda and Sweden were used to explore qualities of the resource settings. The studies focused on: the use of IT in predicting pregnancy complications; practices in which IT has contributed to maternal healthcare; the design and use of mHealth apps in mater-

nal healthcare; and ways in which IT supports the task-shifting strategy in maternal healthcare. The studies resulted in the five published papers appended below.

Papers I and II offer a deeper understanding of the existing practices in which IT contributes to value-based maternal healthcare in both low- and high-resource settings. Specifically, Paper I identifies aspects in which IT is used to support predictions of pregnancy complications in a low-resource setting. Paper II describes practices in which IT has been used as a resource to benefit maternal healthcare in a high-resource setting. Papers III and V identify opportunities for IT to contribute to value-based maternal healthcare in low-resource settings. In particular, Paper III identifies IT design implications that lead to value-based maternal healthcare in low-resource settings. In addition, Paper V identifies ways in which the task-shifting strategy can be redesigned for value-based maternal healthcare in low-resource settings. Paper IV reveals ways in which value is perceived by actors when they use IT in maternal healthcare. The papers are summarized in Chapter 4.

1.6. OUTLINE OF THE THESIS

The chapters outlined below and the five appended papers constitute this thesis.

Chapter 1 introduces the research topic and background to the problem area from the practical and academic perspectives. In addition, the chapter presents the aims and research questions of the thesis that guide the research.

Chapter 2 presents the theoretical foundation of the thesis by clarifying concepts and reviewing research related to the area. The reviewed research relates to the service-dominant (S-D) logic in IS research; participation, co-production and value co-creation; value co-creation in service research and the role of IT in value co-creation and service innovation. In addition, it elaborates on resource integration and IT as a resource.

Chapter 3 describes how the research has been conducted. It presents the research approach, empirical setting, methods for collecting data, and how data analysis was conducted.

Chapter 4 summarizes the findings and contributions of the appended papers.

Chapter 5 discusses the findings and conclusions of the appended papers. In addition, it presents the overall contributions and implications of the thesis, as well as suggestions for future research.

CHAPTER 2

THEORETICAL POSITIONING

This chapter presents the theoretical foundation of the thesis. First, a discussion of the importance of S-D logic in the information systems field is presented, followed by a discussion of participation, co-production, and co-creation, and value co-creation in service research. Then, the role of IT in value co-creation and service innovation is presented and, lastly a discussion on resource integration and IT as a resource is presented.

2.1. SERVICE-DOMINANT LOGIC AND INFORMATION SYSTEMS RESEARCH

Service-dominant (S-D) logic (Vargo and Lusch 2004, 2008) has its origins in marketing and has been adopted in other disciplines both inside and outside of business, including information systems (IS) (Vargo and Lusch 2017; Brust et al. 2018). IS researchers apply S-D logic as a metatheoretical foundation for their research (Brust et al. 2018). The S-D logic metatheoretical narrative of value co-creation is iterative, as actors integrate resources and co-create value through ecosystems governed by

institutional arrangements. The narrative is based on five fundamental premises (Vargo and Lusch 2016):

1. Service is the fundamental basis of exchange
2. Value is co-created by multiple actors always including the beneficiary
3. All social and economic actors are resource integrators
4. Value is uniquely and phenomenologically determined by the beneficiary
5. Value co-creation is coordinated through actor-generated institutions and institutional arrangements.

Institutions are defined as "humanly devised rules, norms and beliefs that enable and constrain action" and institutional arrangements as "a set of interrelated institutions" (Scott 2001; Vargo and Lusch 2016, p.11). The resource-integrating, service exchange activities coordinated through institutional arrangements establish service ecosystems. A service ecosystem is defined as a "relatively self-contained, self-adjusting system of resource-integrating actors connected by shared institutional arrangements and mutual value creation through service exchange" (Vargo and Lusch 2016).

S-D logic provides IS researchers the vocabulary and assumptions they need in order to develop new theoretical insights into service systems, configurations, and interactions (Maglio and Spohrer 2008). Adopting S-D logic as a lens is advantageous over prior approaches in the IS discipline that explored the intersection of IT and service (Barrett et al. 2015; Brust et al. 2018). The relevance of this research has been highlighted in the *MIS Quarterly* special issue on service innovation in the digital age (Barrett et al. 2015). For example, Lusch and Nambisan (2015) applied S-D logic to provide a broader view of service innovation and developed a framework that encompasses service ecosystems, service platforms, and value co-creation. Breidbach and Maglio (2015) explored the role of IT in service innovation by conceptualizing service innovation as a service system reconfiguration, suggesting resource shifting and resource access as core innovation mechanisms. Breidbach and Maglio (2016) adopted an S-D lens to explore the roles of actors, resources, and practice in technology-enabled value co-creation processes for the consulting industry. Srivastava

and Shainesh (2015) used S-D logic to investigate the role of IT in bridging the service divide in healthcare and suggested configurations of three interactional resources (i.e. knowledge, technology, and institutions) used to co-create value. Moreover, Higa and Davidson (2017) used S-D logic to develop a value co-creation chronic care model that integrates resources from social support, health IT for service delivery, and patient engagement.

S-D logic is used as a theoretical lens in this thesis mainly because it provides an understanding of how actors co-create value through resource integration and service exchange constrained or enabled by institutions within an ecosystem. This thesis views healthcare as a service involving multiple actors with differing roles, knowledge, skills, and competences that can be integrated and exchanged through value co-creation. The service ecosystem or multi-actor perspective leads to the exploration of actors beyond the dyadic doctor–patient interaction. This perspective broadens our understanding of the contributions of various actors in the value co-creation processes and of how this eventually leads to service innovations in maternal healthcare. Applying an S-D logic perspective to the co-creation of value leads to greater interdependence among the main actors, thereby building trust and sustaining relationships (Sheth and Uslay 2007). Storbacka et al. (2016) argued that it is difficult to observe value co-creation without considering the individual actions, practices, and interactions undertaken by actors embedded in a service ecosystem, as well as the resources that facilitate such interactions.

Second, S-D offers a synthesizing perspective on service innovation that goes beyond investigating the adoption of IT in service systems and distinguishing between product and service innovations. The thesis benefits from this perspective by using S-D to investigate collaborations and competences among actors, which are important aspects of innovation because they lead to new resources (e.g. knowledge, skills, and competences) and new ways of co-creating value. In a digital service context, value co-creation is made possible through service platforms that facilitate interaction between actors (Lusch and Nambisan 2015). S-D logic identifies service as what is exchanged in value co-creation, i.e. the application of resources by one entity for the benefit of another (Vargo and Lusch 2018). It also suggests that a resource is anything that an actor can draw on to generate

value (Lusch and Nambisan 2015; Vargo and Lusch 2018). Thus, resource integration is enabled or triggered by IT as actors interact. The thesis benefits by taking into consideration the dual role of IT in value co-creation.

Lastly, S-D logic has been informed by several theories, such as institutional, practice, systems, complexity, and evolutionary theory (Vargo and Lusch 2017). This research is aware of the usefulness of the above theories in studying the roles of and interactions among actors. Practice theory highlights the importance of the customer's role (representational practices), activities (normalizing practices), and interactions with others (exchange practices) (Kjellberg and Helgesson 2006, 2007), illustrating the roles of operant resources and institutional arrangements in service ecosystems such as healthcare. For instance, McColl-Kennedy et al. (2012) applied practice theory, S-D logic, and customer culture theory to identify roles, activities, and interactions that underlie co-creation of value in healthcare, although they did not identify the role of IT in the co-creation process. In addition, institutional theory helps us understand relationships between actors and how actors influence institutions by creating, maintaining, and disrupting them (Lawrence and Suddaby 2006). For instance, Pop et al. (2018) used an S-D logic view of institutions to propose a typology of institutions that enable or constrain value co-creation in the healthcare service ecosystem. Thus, S-D logic is a lens through which institutions and practices can be linked (Nariswari 2018).

In addition to the above theories, this thesis acknowledges that participatory theory has been used to investigate participation in IS development and implementation. The theory views user participation as "a set of behaviors or activities that users perform in the system development process" (Barki and Hartwick 1989, p. 53). Work and technology are situation specific and socially constructed, so user participation is beneficial for design (Bødker and Kyng 2018). Halskov and Hansen (2015) argued that although participation focuses on the domain-specific experiences of involved participants, it does not address the product of the design process. The concept of participation has been revitalized by Bødker and Kyng (2018) to enable users to influence important matters in their lives. This involves supporting processes in which actors partner "to develop long-term visions for technology, skills, and redistribution of power and resources" (Bødker and Kyng 2018, p. 3). This thesis concurs

with this ambition and adopts a service-centric focus in which multiple actors involuntarily and routinely interact to integrate resources so as to co-create value (Frow and Payne 2018).

2.2. PARTICIPATION, CO-PRODUCTION, AND VALUE CO-CREATION

Participation has been one of the core topics in IS research since the 1960s (Swanson 1974; Barki and Hartwick 1994) and has been studied through the lens of participatory theory (Mckeen et al. 1994; Markus and Mao 2004) and behavioural theory (Kappelman and McLean 1991). For decades, discussions have revolved around the participation or involvement of customers in the process of service production and delivery (Oertzen et al. 2018), since it has been known to enhance perceived service quality (Cermak et al. 1994). The earlier view of customers as "productivity inputs and resources", or as "temporary participant[s]" (Mills and Morris 1986, p. 726) also referred to as passive players (Prahalad and Ramaswamy 2000), posits that customers have to be enabled and invited to participate by the provider (Normann and Ramírez 1993) according to a provider-centric mindset (Dabholkar 1990). Since the 2000s, the mindset around customer–provider collaboration shifted towards the customers and their experiences (Prahalad 2004), treating customers as "active collaborators" (Prahalad and Ramaswamy 2004; Oertzen et al. 2018, p. 643) or coproducers (Bendapudi and Leone 2003).

Co-production is viewed as a process whereby the customer undertakes activities and interactions that have traditionally been undertaken by employees (McColl-Kennedy et al. 2012; Vargo and Lusch 2016). McColl-Kennedy and Cheung (2018) argued that co-production is optional and narrowly focused, as in the less compulsory, more operational involvement of customers in service-provider processes such as self-service, design of service delivery, and new service development (McColl-Kennedy et al. 2012). Vargo and Lusch (2008) advocated moving beyond co-production viewed in terms of dyadic interactions between service providers and customers, to multi-actor interactions that lead to value co-creation. Researchers have debated about distinguishing between co-production and value co-crea-

tion (Galvagno and Dalli 2014). In this regard, Vargo and Lusch (2008, 2016) viewed co-production as a component of value co-creation that captures participation during a particular phase (e.g. design or distribution) in the development of the service offering or value proposition. Frow et al. (2014, p. 340) defined a value proposition as "a dynamic and adjusting mechanism for negotiating how resources are shared within a service ecosystem".

Participation has been used interchangeably by researchers to mean co-creation, though, as discussed, it is not directly synonymous with co-creation, but rather acts as a necessary but not sufficient precondition for co-creation to *occur* (Oertzen et al. 2018). According to Prahalad and Ramaswamy (2004), co-creation is not the transferring or outsourcing of activities to customers, nor the staging of customer events around the firm's various offerings. Rather, it involves the co-creation of value through personalized interactions that are meaningful and sensitive to the specific consumer, making the co-creation experience the basis of unique value for each individual (Prahalad and Ramaswamy 2004). Involving customers as active collaborators extends throughout the innovation process of a service, from idea generation to end use (Mele et al. 2014), and requires frequent, bidirectional, and transparent dialogue (Prahalad and Ramaswamy 2004). However, other researchers have used co-production interchangeably with co-creation.

Galvagno and Dalli (2014, p. 644) defined value co-creation as a "joint, collaborative, concurrent, peer-like process of producing value, both materially and symbolically". In addition, value co-creation has been defined as "the processes or activities that underlie resource integration and incorporate different actor roles in the service ecosystem" (Lusch and Nambisan 2015, p. 162). Resource integration is the process of combining or bundling resources for usefulness or value (Lusch and Nambisan 2015). Service exchange is the process of coordinating, sequencing, and integrating tasks and activities (Lusch and Nambisan 2015, p. 13). Furthermore, McColl-Kennedy and Cheung (2018, p. 70) defined value co-creation as the "integration of resources from a range of sources by multiple actors, always involving the customer, to realize benefit in use for the beneficiaries involved in a given context".

This thesis uses Lusch and Nambisan's (2015) definition to study value co-creation in maternal healthcare. Based on this definition, actors at different levels of healthcare (i.e. macro, meso, and micro) mix and match their resources (e.g. knowledge, competences, and skills) and exchange service for value. In the context of this thesis, examples of service include referring pregnant women to hospitals, diagnosing pregnant women, and sharing information among actors. In addition, IT enables or triggers the actors to integrate resources and exchange service.

2.3. VALUE CO-CREATION IN SERVICE RESEARCH

As noted earlier (section 2.1), value co-creation is a central concept in service theory and practice (Vargo and Lusch 2008; McColl-Kennedy and Cheung 2018) and thus a key research priority (Ostrom et al. 2010, 2015). The dynamic view of systems of service exchange centres on the investigation of the interactions among various actors, organizations, and technologies and on how the integration of various resources contributes to value co-creation for wider socio-technical systems (Vargo et al. 2008). Value is derived from an active process through which actors work together to co-create benefits for themselves and others through resource integration (Vargo and Lusch 2008; McColl-Kennedy et al. 2012). Hence, value is co-created through multi-actor interactions within service ecosystems (Vargo and Lusch 2011; Frow et al. 2016; McColl-Kennedy et al. 2017a). Interactions among actors are guided by institutions that play a role in the functioning of the service ecosystem (Vargo and Lusch 2016), so institutions and institutional arrangements are key drivers of value co-creation interactions (Vargo and Akaka 2012; Edvardsson et al. 2014). Vargo et al. (2017) emphasized the importance of understanding how value emerges through the interaction and application of resources within systems of service-for-service exchange.

Healthcare represents a service ecosystem of multiple actors with different roles, skills, and competences and is more complex than a simplistic consideration of the doctor–patient model (Gummesson 2008; Hardyman et al. 2015). Understanding value co-creation implies an interplay between the micro, meso, and macro levels (Chandler and Vargo 2011). According to Beirão et al. (2017), in healthcare, the micro level comprises individual

actors such as professionals, patients, and family. At this level, service-for-service exchange occurs directly and reciprocally between actors in dyads. The meso level consists of public and private hospitals, primary care units, and health support organizations, i.e. actors that connect directly and indirectly to serve one another and co-create value. Macro-level actors such as the government, the ministry of health, and the organizations responsible for defining national health policies coordinate their service to permit service exchange.

Relationships between patients and clinicians have been variously referred to as shared decision making (Braddock 2010), patient engagement (Carman et al. 2013), patient activation (Hibbard et al. 2004), and relationship-centred care (Beach et al. 2006). Patient activation reflects a patient's knowledge, skills, ability, and willingness to manage his or her own health (Hibbard et al. 2004). Patient engagement is a broader concept that combines patient activation with interventions designed to increase activation and promote positive behaviour such as preventive care and regular exercising (Hibbard and Greene 2013). Joiner and Lusch (2016) argued that in patient activation, the value for the patient is determined by the healthcare system, so interactions with other individuals such as family, friends, and peers and co-creation with providers are not considered when assessing the level of patient activation. The active participation of patients requires the integration of resources from healthcare providers and activities engaged in by the self (e.g. positive thinking and accessing one's own knowledge) to co-create value and accessible third-party resources (McColl-Kennedy et al. 2012). Third-party resources can be seen as a value constellation included in the health ecosystem; such resources include co-creation activities with family and friends (Joiner and Lusch 2016, p. 32). Value co-created in healthcare includes enhanced quality of life (McColl-Kennedy et al. 2012) as well as intellectual, cultural (Seraj 2012), and social value (Seraj 2012; Loane et al. 2014; Goh et al. 2016). McColl-Kennedy et al. (2012) argued for the importance of understanding how individuals co-create value to better manage their healthcare.

Value co-creation has been studied in the healthcare field (e.g. McColl-Kennedy et al. 2012; Sweeney et al. 2015). Such studies provide new ideas about co-creation practice styles and the role of positivity in participation (Gallan et al. 2013; Voss et al. 2016). In their meta-narrative review of

healthcare research, McColl-Kennedy et al. (2017b) noted that patients are becoming more active in value co-creation practices of care. Drawing on the level of activities and number of interactions with the organization and other sources, McColl-Kennedy et al. (2012) identified eight broad themes of activities: cooperating; collating information (e.g. sorting and assorting); combining complementary therapies; co-learning (e.g. actively seeking and sharing information and providing feedback); connecting with family and friends, doctors, other healthcare professionals, and support groups; changing ways of doing things; coproduction (e.g. assisting with administering treatments, redesigning treatments, and reconfiguring the medical team); and cerebral activities (e.g. positive thinking, emotional labor, reframing, and sense-making). From these themes, they developed a typology of value co-creation practice styles comprising: team management, insular controlling, partnering, pragmatic adapting, and passive compliance (McColl-Kennedy et al. 2012). Of these styles, team management and partnering relate to high quality of life and are consistent with co-creation (Joiner and Lusch 2016), while insular controlling and passive compliance relate to low quality of life (McColl-Kennedy et al. 2012).

In addition, Frow et al. (2016) developed a typology of co-creation practices that shape a dynamic service ecosystem in order to increase efficiency and achieve better health outcomes. According to Frow et al. (2016), these practices comprise those that: 1) endow actors with social capital (e.g. knowledge sharing in online forums); 2) provide shared language, symbols, signs, and stories in an ecosystem; 3) shape an actor's mental model (e.g. patient-centred practices that lead to sharing knowledge resources through interactions); 4) impact the ecosystem created or constrained by the context, i.e. physical structures and institutions (e.g. structures that support the active involvement of relatives' knowledge in the patient's healthcare); 5) shape existing value propositions and inspire new ones (e.g. collaborative use of knowledge resources from various actors); 6) impact access to resources within an ecosystem (e.g. knowledge sharing among patients about drugs); 7) forge new relationships, generating interactive and experiential opportunities (e.g. knowledge sharing through patient online forums to seek new treatments); and 8) are intentionally co-destructive, creating imbalance in the ecosystem (e.g. industrial action

leading to delays in assisting emergency patients and disrupting the admission process).

These practice styles indicate changes in the organizational culture of healthcare that lead to value co-creation. This cultural change means that healthcare organizations reduce the levels of control that they traditionally exercise over patients (McColl-Kennedy et al. 2012). Patients should learn from the healthcare organization and vice versa, in order to successfully co-create value (Payne et al. 2008), though this may require that institutions adapt to the above styles of practice. Pop et al. (2018) developed a typology of institutions that enable or constrain value co-creation in healthcare.

2.4. THE ROLE OF IT IN VALUE CO-CREATION AND SERVICE INNOVATION

A key priority in information systems research is to understand the role of IT in services (Brust et al. 2018), specifically in service innovation, value co-creation (Barrett et al. 2015; Beirão et al. 2017), and the formation and functioning of service ecosystems (Barrett et al. 2015). Innovation occurs as actors seek improved ways to co-create value (Lusch and Nambisan 2015). Akaka et al. (2012) argued that as actors interact and form new ways of creating value, they can potentially recreate and reconfigure existing relationships and resources into new networks of relationships and resources. Value co-creation drives innovation through the recombination of existing resources and ongoing efforts to maintain and develop new relationships (Akaka and Vargo 2014). Lusch and Nambisan (2015, p. 161) suggested that service innovation is the "re-bundling of diverse resources that create novel resources that are beneficial to some actors in a given context".

For decades, IT has been recognized as a significant enabler of service innovation. Barras (1986, 1990) recognized the IT revolution as the core of the industrialization of services through improvements in quality and efficiency. Service innovation takes advantage of new combinations of resources derived from existing technology and knowledge (Witell et al. 2017). IT developments provide new opportunities for service innovation; for instance, intra-organizational structures and interorganizational value

networks create demand for firm-internal professional coordination activities (Barrett et al. 2015). In addition, technologies increase citizen expectations and demands for personal services such as healthcare (Barrett et al. 2015). In developing economies with limited resources and infrastructure, service innovation has been demonstrated through transformative new services (Barrett et al. 2015), such as increased access to healthcare through mobile infrastructure.

Different perspectives have been used in studying service innovation; these include the assimilation (or technologist), demarcation, and synthesis perspectives (Coombs and Miles 2000). According to Witell et al. (2015), *the assimilation perspective* views service innovation as the introduction of new technology, *the demarcation perspective* views service innovation as innovation in the service sector, and *the synthesis perspective* views all innovations as service innovations. These perspectives are elaborated on below.

In the assimilation perspective, IT has been understood as the technological tools in the service delivery process that enhance the efficiency and productivity of service firms, leading to new categories of services (Barras 1986, 1990). The assimilation perspective perceives service innovation as the adoption of IT in the service economy (Breidbach and Maglio 2015), particularly linking service innovation to IT developments in firms (Gallouj and Savona, 2009). From this perspective, firms collaborate and co-create IT-enabled products and services in interorganizational networks (Grover and Kohli 2012). The relevance of this research to the IS discipline is articulated through publications in the 2012 *MIS Quarterly* special issue on co-creating IT value (Grover and Kohli 2012). In this issue, researchers identified aspects of IT-based value co-creation such as: 1) complementing resources and co-creating value through IT-based capabilities and knowledge sharing (Rai et al. 2012); 2) the integration of IT assets by platform owners and firms to create joint value that complements the platform (Ceccagnoli et al. 2012); and 3) using open innovation alliances for the co-development of new IT through governance and knowledge sharing (Han et al. 2012).

According to Breidbach and Maglio (2015), the demarcation perspective differentiates between service and product innovation (Drejer 2004; Nijssen et al. 2006; Gallouj and Savona 2009). Specifically, demarcation studies are grounded in the argument that some forms of innovation are

service specific and that services are distinct from goods, so product innovation that follows a technological trajectory (Abernathy and Utterback 1978; Anderson and Tushman 1991) does not properly explain innovations in service organizations (Damanpour et al. 2009). Innovation concepts unique to services are therefore needed (Nijssen et al. 2006; Gallouj and Windrum 2009). Researchers who apply the demarcation approach focus on the product–service divide rather than on the role of IT when exploring innovation processes and patterns (Breidbach and Maglio 2015). For instance, den Hertog (2000) referred to the service logic to identify four dimensions of service innovation: the service concept, client interface, service delivery system, and technology. Some theorists argue that distinguishing products and services is meaningless because products require services and services involve products (Bryson et al. 2006; Von Nordenflycht 2010). The interpenetration of products and services known as servitization, whereby firms shift from selling a product to selling an integrated product and service offering, is a major development in the IT field (Barrett et al. 2015).

In contrast to these two perspectives, Vargo and Lusch (2004, 2008) argued for an alternative theoretical positioning according to S-D logic, which is increasingly used as a foundation for understanding innovation in general (Barrett et al. 2015). Thus, S-D logic offers a "synthesizing" perspective on innovation that emphasizes 1) the limitations of assimilation and demarcation regarding service innovation and 2) the importance of collaboration and competences for innovation (Ordanini and Parasuraman 2011). S-D conceptualizes service as a process of using one's resources for someone's benefit, as compared with a more traditional conceptualization of service as a unit of output. S-D logic led to service innovation research that focuses on interactions between actors in order to understand their needs (Sebastiani and Paiola 2010). This perspective posits that service innovation results from understanding the role of beneficiaries in co-creating value (Michel et al. 2008). Lusch and Nambisan (2015) posited that IT plays a central role in the formation and functioning of service ecosystems and, therefore, in innovation. Innovation occurs as resources (e.g. information, skills, and knowledge) are recombined and exchanged in ways that create value for those actors engaged in service exchange (Lusch and Nambisan 2015). In line with this, Breidbach et al. (2013) argued that

it is noteworthy that IT is not a sole driver and enabler of all innovation but includes other resources within the service system, such as people. Thus, a service-centric lens enables an understanding of the interactions of all entities using all available resources (both technical and non-technical) in the service system (Breidbach and Maglio 2015).

2.5. RESOURCE INTEGRATION AND IT AS A RESOURCE

S-D suggests that a resource is anything on which an actor can draw for support (Vargo and Lusch 2004, 2018; Lusch and Nambisan 2015). In addition, Vargo and Lusch (2004, p. 2) argued that "resources are not, they become". A particular IT may or may not be considered a resource, based on the unique viewpoint of a particular actor and the context in which the IT is applied and evaluated for value (Akaka and Vargo 2014). Institutions and technologies are sources of resources, which then become resources based on whether they are integrated and employed for service (Akaka and Vargo 2014). In addition, other sources of resources include nature (i.e. matter, energy, and information) and skills and knowledge as applied by actors (Löbler 2018). All these can become resources depending on the context and other resources that are integrated (Löbler 2018).

The service ecosystem view of value co-creation treats the integration of resources as a central means for connecting social and technological aspects (Vargo and Akaka 2012). Resource integration is shaped by multiple actors, resources, and practices, including social forces (Edvardsson et al. 2011). The connections between actors are shaped by the social system's beliefs, norms, and rules, constituted by signification, domination, and legitimation (Edvardsson et al. 2011). Thus, resource integration within a service ecosystem is not random but is coordinated by institutions (Edvardsson et al. 2014). Vargo and Lusch (2004, p. 6) argued that humans have two basic operant resources, i.e. physical and mental skills; these resources are unevenly distributed in the population (Koskela-Huotari et al. 2018). Any resource an actor obtains can never be used in isolation but must be combined with other resources for usefulness (Lusch and Nambisan 2015). Thus, through collaboration, the integration of

unevenly distributed resources leads to specialization (Koskela-Huotari et al. 2018). Such specialization becomes self-reinforcing, inducing actors to further learn and specialize (Koskela-Huotari et al. 2018).

Interaction represents a necessary condition for resource integration processes, though it is not in itself a sufficient condition for all instances of resource integration (Peters 2016). Peters (2016, 2018) argued that resource integration processes can be homopathic or heteropathic. Homopathic resource integration is based on the concept of aggregation or summation (Peters 2016, 2018), meaning that it leads to a summative effect in which the joint effect of several causes is the sum of their separate effects (Peters 2016). Heteropathic resource integration is based on the concept of emergence summation (Peters 2016, 2018), meaning that the "joint action of multiple causes acting is not merely the sum of effects of the relevant causes" (Peters 2016, p. 3006). Emergence has been defined by Bhaskar (2008, p. 49) as "new beings generated out of pre-existing material from which they could have been neither induced nor deduced". The emergent whole is therefore more than the sum of its constituent parts (Peters 2018). Resource integration is a process that generates new emergent properties (Peters 2016); each emergent property is "not a combination of individual base resources, but is distinctly and uniquely different from the resources from which it emerged" (Peters 2018, p. 350). The S-D logic considers the emergence perspective and the dispositional nature of actors, including human and material actors, in understanding value co-creation as a process-driven activity characterized by feedback and coordination, resulting in shared understanding and intentions (Peters 2018). Storbacka et al. (2016, p. 3012) suggested that "actor disposition is a capacity of the actor to appropriate, reproduce or innovate upon connections in the current time and place, in response to a specific past and or towards a specific future"; both human and non-human actors are considered to have dispositions (Storbacka et al. 2016). Whenever people act, they use their operant as well as operand resources to create or produce things (Löbler 2011) with emergent properties that are unique to the resource integration process (Peters 2018).

Research in S-D logic suggests that new resources come from existing resources through combinational processes (Vargo et al. 2015; Koskela-Huotari and Vargo 2016), which means that new resources are formed

by combining existing resources. This holds true for technology, based on Arthur's (2009) suggestion that new technologies are created from parts and sub-parts of previous technologies. This means that the emergence of new resources is continuous, as each new resource triggers the formation of other new resources through the integration of previously impossible resource combinations (Arthur 2015). Peters (2016) stressed that this combinational process is not summative but emergent with resulting heteropathic effects: thus, new resources are an emergent property of combinational heteropathic resource integration.

S-D logic views technology as a process for doing something and as an outcome of human action and interaction (Arthur 2009). IT is therefore viewed as a fundamental and transformative resource in service innovation (Vargo and Lusch 2004, 2008; Lusch and Vargo 2014). IT as a transformative resource transforms the structure of value co-creation processes from co-located contexts to dynamic, distributed, technology-enabled ones (Breidbach and Maglio 2015). The perspective allows for the combination of IT with other resources, such as skills and knowledge, to create new opportunities for service exchange and innovation as information is transported and repackaged in different contexts (Akaka and Vargo 2014). In addition, the generative nature of digital technologies (Henfridsson and Bygstad 2013) facilitates the combinational potential of service innovation (Yoo et al. 2012). IT as a generative resource can itself create new opportunities to integrate resources, thereby creating new knowledge and becoming part of the innovation itself (Lusch and Nambisan 2015).

Lusch and Nambisan (2015) distinguished between IT as an operand (enabler) and operant (trigger) resource, outlining the implications of this for service innovation. IT plays a dual role in enabling and triggering service exchange in service ecosystems, creating opportunities for actors to integrate resources (Lusch and Nambisan 2015). IT as an operand resource is tangible and is acted on to generate benefits; it is thus a technological tool that enables actors to share resources within a service platform (Lusch and Nambisan 2015). A service platform provides an organizing structure for resources and serves as a venue for service exchange. Lusch and Nambisan (2015, p. 166) defined a service platform as "a modular structure that comprises tangible and intangible components (resources) and facilitates the interaction of actors and resources (or resource bun-

dles)". On the other hand, IT as an operant resource is intangible and dynamic (Lusch and Nambisan 2015). Operant resources act on other resources (both operand and operant) to contribute to value co-creation (Vargo and Lusch 2004) and are central in developing new ways for creating value (Akaka and Vargo 2014). IT as an operant resource triggers service exchange and creates opportunities for resource integration (Lusch and Nambisan 2015). The trigger concept has been used by researchers to refer to events that are noticed or that initiate action. For example, Koutsikouri et al. (2017) viewed triggers as series of events generated by human actors to initiate generative mechanisms that lead to the evolution of digital infrastructures. In addition, Griffith (1999) suggested that triggers are "making events or cues noticed". In this thesis, IT triggers are viewed as initiators of actions that lead to service exchange and resource integration, for example, signaling or alerting actors by giving them information in order for them to take action.

Although operand resources contribute to the co-creation of value, S-D logic emphasizes that value co-creation can only result from the application of operant resources (Vargo and Lusch 2004; Akaka and Vargo 2014). Conceptualizing technology as an operant resource enables value co-creation to continue through both the design and use phases of technology, and enables service innovation to be driven by an iterative process of collaboration and learning between actors (Akaka and Vargo 2014). In addition, it provides an encompassing view for studying the way in which technologies are integrated as resources, with value being collaboratively created and service being innovated (Akaka and Vargo 2014).

Research on IT as a resource in co-creating value for healthcare is developing. Lee (2019) noted that actors undertake certain activities to attain their needs through interactions, either face to face or using IT. A value co-creation environment that integrates IT in the healthcare industry is therefore important (Lee 2019). Collaborations among actors in healthcare ecosystems (Beirão et al. 2017) can be facilitated by technology. mHealth provides an example of S-D logic being applied in healthcare by permitting patients to acquire and transmit information regarding their physiological functions and potential health-promoting activities (Joiner and Lusch 2016). Online health communities have enabled rural and urban patients to interact and share knowledge about their diseases and

treatments (Goh et al. 2016). E-health kiosks have enabled illiterate villagers to gain knowledge of infant healthcare, thus improving practices (Venkatesh et al. 2016).

2.6. CONCLUDING REMARKS

S-D logic suggests that resource integration and service exchange happen within service ecosystems. Through applying a systems-based, service ecosystem perspective, the perceived configurations of people, technology, and institutions help us understand the interactions and activities that connect actors, helping them integrate resources and exchange services, thus co-creating value. This perspective applies well in healthcare, in which actors at different levels (i.e. macro, meso, and micro) and with differing roles, competences, and skills are connected by shared institutions to mutually co-create value through service exchange. The service exchange and resource integration can be enabled and/or triggered by IT, leading to the iterative creation of new resources that can also be reintegrated, leading to service innovation. This gives us a basis on which to explore IT as an operant resource that triggers value co-creation in maternal healthcare.

CHAPTER 3

METHOD

This chapter describes how the research has been conducted: first, the research setting is described; second, the research approach is presented, followed by a description of the research design and research process; and lastly, a discussion of how the data were collected and analysed is presented.

3.1. RESEARCH SETTING

The thesis is based on four studies, three carried out in Uganda and one in Sweden.

3.1.1. MATERNAL HEALTHCARE IN UGANDA

Uganda was used as a country of study because it is a developing country with a high maternal mortality rate of 343 per 100,000 live births (WHO 2015b) that declined by only 53% between 1990 and 2013 (WHO 2014). The country's slow progress in reducing maternal mortality is the result of various factors, including limited access to healthcare and a shortage of

medically trained health professionals to deliver maternal and child healthcare services (Nabudere et al. 2011). Most of the specialized healthcare professionals serve urban areas, leading to very limited access to high-quality healthcare in rural areas where most of the population resides (MoH et al. 2012). Uganda has also taken on task shifting for decades to improve access to healthcare (Dambisya 2012), making it a good case in which to explore how the task-shifting strategy works. Furthermore, it is a developing country that has adopted the use of mHealth apps by actors to deliver maternal healthcare services.

The research was conducted in 11 low-resource settings located in 11 sub-counties and five districts in Uganda. Districts were selected based on terrain and infrastructure. Selected sub-counties within districts were those: 1) that are hilly; 2) that have poor road infrastructure; 3) where pregnant women have to walk long distances to reach health facilities for care; and 4) that have registered high rates of teenage pregnancy. In addition, districts where mHealth apps are used by community health workers or village health teams (VHTs) to provide services to pregnant women were selected. To obtain more data on the use and design of mHealth apps, an app developed in Cameroon and used in five countries (i.e. Uganda, Nigeria, Cameroon, Kenya, and Ivory Coast) with low-resource settings (Fritz et al. 2015) was considered in the study. To explore collaborations at different levels of healthcare, districts with referral hospitals were also selected. Lastly, districts were selected due to ease of access to health workers through Assistant District Health Officers (ADHOs), who are in charge of all maternal and child healthcare activities in their districts.

3.1.2. CONTEXT OF THE RESEARCH

This section presents the social context of maternal healthcare in Uganda. It elaborates on the structures and policies that support maternal healthcare, the status of women in rural areas, and traditional practices in accessing maternal healthcare.

a. Structure and policies

The decentralized government structure in Uganda puts individual district administrators at the forefront of providing health services to a large rural

community. In line with this, the Maternal and Child Health and Family Planning Department focuses on building the capacity of districts to plan and manage maternal and child health and family planning services.

One of the high-priority national health policy outcomes is to reduce maternal morbidity and mortality. In addition, health policy for sub-districts aims at improving district-level facilities, including for emergency maternal care. Strategies for improving the access to and quality of maternal services through the expansion of the service delivery infrastructure have been adopted. The national safe motherhood programme is one such strategy for promoting maternal health. This programme has established a number of initiatives, including: 1) building a supportive community network of traditional birth attendants (TBAs) to support the facility-based maternal health system; 2) identifying women at risk; and 3) strengthening the referral system (WHO 1998). Another strategy is the establishment of the Uganda Private Midwives Association, through which private midwives are supported by national and international donors to set up private maternity homes in communities.

These initiatives are challenged by the lack of a financial base and the high disease burden in poor communities. Public initiatives rely on development assistance that is insufficient to address the high disease burden. In addition, public initiatives are affected by poor work ethics, informal charges, and poor mindset of communities. On the other hand, private-sector initiatives have been affected by the inability of poor families to pay their healthcare bills.

b. Family structure and the status of women

As in most African countries, the family structure in Uganda is extended in that one does not need direct bloodline or legal relations to be considered a family member. Kinship is determined through laws, marriage, and ancestry. The line of descent is followed through the male line, and it determines inheritance and identity. After marriage, women move to the husband's family and a bride price is paid by the groom or groom's kin to the bride's kin. Marriage are to some extent polygamous and the reasons for this range from economic reasons to social prestige.

Traditionally, having many children is a sign of social prestige, a source of labor, and an investment in the future (in that when children grow up,

they take care of the family). Men are the decision makers in the family, so women are exposed to repeated pregnancies and childbirths. Most households in rural areas are poor as they cannot take care of the large numbers of children. Women are expected to work when pregnant and near delivery to support the extended family. Some of their work includes farming, cooking, and fetching water.

Pregnant women are not allowed to make decisions on their own and require permission from their husbands or relatives to seek maternal healthcare services. In addition, they are not in control of domestic resources and lack information about household income, so they lack the financial means to access maternal services. Furthermore, due to domestic workload, they lack time to visit health facilities, which are located far from their households. This situation is exacerbated by societal expectations that regard pregnancy as a normal process that does not require health worker assistance. Women who deliver at home are regarded as strong by society.

If women do reach health facilities and need admission due to a complication, most of them do not agree to admission due to their many social responsibilities. They prefer to get support from relatives or traditional birth attendants near their homes, since they have young children to take care of.

c. Traditional practices in accessing maternal healthcare

Pregnant women in rural areas use traditional medicine during pregnancy and birth. Traditional medicines are viewed as: 1) preventive mechanisms against miscarriage; 2) remedies for pain caused by stomach upset during pregnancy; and 3) means of softening the birth canal and quickening the birth process. Some of these medicines are not scientifically proven and lead to life-threatening pregnancy complications and health defects for the women and their unborn children.

Pregnant women in rural areas deliver at home and are usually assisted by relatives and traditional birth attendants (TBAs) with no formal midwifery training. TBAs are community members who have acquired skills through apprenticeship but have limited knowledge of the signs of pregnancy complications. However, they are socially acceptable and trusted by women, leading to long-lasting relationships that offer ongoing care and dialogue during pregnancies.

To reduce maternal mortality rates, a strategy was implemented to train TBAs in conducting safe births. The trained TBAs were certified to boost their perceived role in the community to act as alternatives to midwives. However, delays in referrals and poor delivery practices were identified among TBAs despite their training. It was realized that TBAs continued to use local herbs as remedies, leading to more complications. It was based on this experience that the Ministry of Health decided to exclude TBAs and instead train community health workers (CHWs) to identify pregnant women and refer them to health facilities to seek maternal services.

3.1.3. STRUCTURE OF THE MATERNAL HEALTHCARE SYSTEM IN UGANDA

In Uganda, health services are provided by both the private and public sectors. The public sector includes national and regional hospitals and a tiered system of health centres (HCs) (MoH et al. 2012). Healthcare services are provided at the macro, meso, and micro levels of healthcare, as shown in Figure 2.

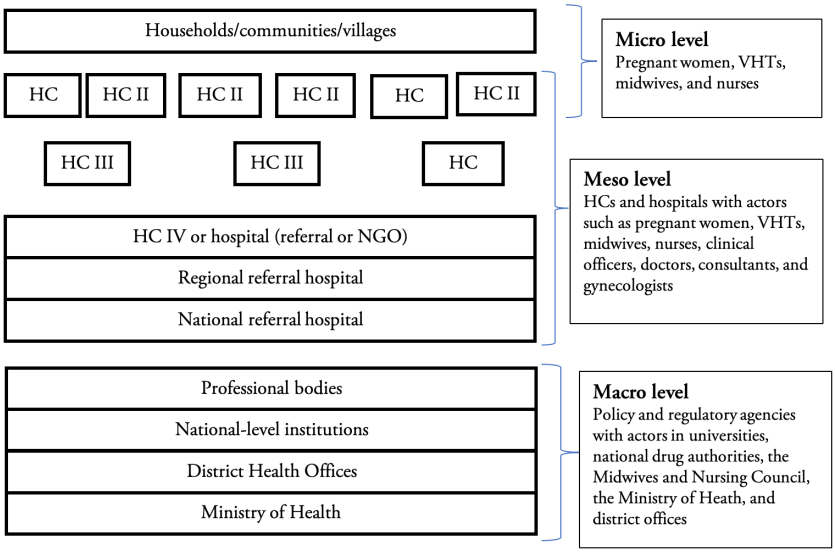

Figure 2: The public healthcare system in Uganda at different levels of healthcare.

As shown in Figure 2, at the macro level, there are professional bodies, national-level institutions, district health offices, and the Ministry of Health (MoH), which provides overall policy direction and managerial oversight for health services (MoH et al. 2012).

At the meso level, there is a tiered system of HCs that comprises: 1) the HC II facility at the parish level that runs an outpatient clinic; 2) the HC III facility at the sub-county level that runs an outpatient clinic and a maternity ward; and 3) the HC IV facility at the county level that runs an outpatient clinic, a maternity ward, and wards for men, women, and children. HCs work on a referral system whereby if a centre cannot handle a medical case, it refers the case to the next higher level. At the higher levels of HCs are the regional referral hospitals, and above these are the national referral hospitals (MoH et al. 2012). Specialists, physicians, gynaecologists, and consultants are found at the higher meso levels of care, mainly at referral hospitals.

At the micro level are the village health teams (VHTs), which serve as the first contact for people living in a rural area. VHTs work with midwives at HC II facilities to serve pregnant women in the communities. Maternity wards are not found in HC II facilities but at the meso levels of care. In addition, mHealth apps are used mainly by VHTs and midwives at the meso and micro levels of healthcare. Furthermore, HC IV facilities and hospitals have access to the district health information system (DHIS2), which is used for reporting healthcare indicators (MoH et al. 2012).

As indicated earlier, as well as in Uganda, data were also collected in Sweden. Sweden's developed healthcare infrastructure enables citizens and health professionals to access eHealth services to search for and retrieve health information for both clinical and non-clinical purposes (Currie and Seddon 2014). In addition, Sweden had a low maternal mortality rate of four per 100,000 live births in 2015 (WHO 2016b). The research was carried out in Gothenburg because it was easy to access healthcare managers in the region through the University of Gothenburg. The research explored practices by which IT contributed to Swedish maternal healthcare. The study provided a basis for more studies to explore similar practices in low-resource settings.

3.2. RESEARCH APPROACH

The research applies a case study approach to collect empirical data on the use and design of IT in maternal healthcare. As mentioned earlier, the research adopts a socio-technical view of IT use in maternal healthcare. This requires interacting with actors in maternal healthcare to obtain their viewpoints on aspects in which IT is used. These viewpoints were interpreted to gain an understanding of the context, actors, and technology in regard to value-based maternal healthcare. To explore different aspects of maternal healthcare, multiple data sources were used to inform various stages in the research process. This was done to gain an understanding of how IT contributes to value-based maternal healthcare in low-resource settings.

Four studies were conducted that examined the following cases: 1) the maternal healthcare system in Uganda, 2) the maternal healthcare system in Sweden, 3) designs of mHealth apps for maternal healthcare in Uganda and Cameroon, and 4) the use of mHealth apps in maternal healthcare in Uganda. Cases from Uganda and Sweden were used because this research is funded by a bi-lateral collaboration between Makerere University in Uganda and the University of Gothenburg in Sweden. This facilitated the collection of empirical data from participants in the two countries. Edvardsson et al. (2011) has argued that the social setting in which value creation takes place plays a part in the value co-creation process. It has also been emphasized by Chandler and Vargo (2011) that the context frames service exchange and resource integration from the unique perspective of each actor and of the service ecosystem. Therefore, the use of IT by various actors in maternal healthcare influences and is influenced by the social context. Based on these suggestions, coupled with the differences in contexts and the opportunity for the researcher to be in Sweden for half of her research, research in Sweden was considered advantageous. The Swedish study was mainly intended to act as a reference point, so as to better understand aspects in which IT contributes to maternal healthcare, given Sweden's well-developed IT infrastructure. However, it should be noted that this research does not consider Sweden an ideal model for a value-based system of healthcare.

The cases provided an opportunity to learn about maternal healthcare from different perspectives and in different settings. The settings helped to explore the work situations of healthcare professionals and how they interact with pregnant women and other actors, including healthcare professionals, CHWs, and IT designers. In addition, the cases helped to understand actors' perceptions of the design and use of IT in maternal healthcare. This provided an opportunity to gain more knowledge of the various viewpoints of actors who use and design IT applications for maternal healthcare. The knowledge gained from the cases provided insights into how IT contributes to value-based maternal healthcare.

The included studies are mainly qualitative, although complementary quantitative data were also collected. In the empirical studies, the data were reflected on and interpreted to generate a deeper understanding of the use and designs of IT for value-based maternal healthcare. Qualitative data collection methods, which included interviews, focus group discussions, and document reviews, were employed. In addition, quantitative data were collected using an online survey questionnaire.

3.3. RESEARCH DESIGN AND RESEARCH PROCESS

The original research idea focused on improving maternal healthcare through predicting pregnancy complications. This was because it had been reported in the literature that most maternal deaths are due to pregnancy complications (Say et al. 2014). The idea was to adopt a socio-technical perspective with the intention of designing predictive models that would be applied by the users in the task-shifting strategy in low-resource settings to improve access to maternal healthcare. As the research progressed (Paper I), it was realized that the literature reported the existence of various computerized predictive models that were not used in healthcare for reasons of complexity and lack of computer support (Kleinrouweler et al. 2016). In addition, it was realized that most of the models were designed for healthcare professionals and were based on the traditional healthcare system (Berry and Bendapudi 2007; Batalden et al. 2016) in which patients are passive in the healthcare experience (McColl-Kennedy et al. 2012). It was also noted that pregnant women in Uganda were passive, leading to delays in deciding to seek care and in reaching health facilities to access care.

Based on these insights, literature about the transformation of healthcare to involve patients actively in the healthcare experience (McColl-Kennedy et al. 2012; Hardyman et al. 2015) was reviewed. The health IT and mHealth apps used by the studied healthcare workers did not actively involve patients in the healthcare experience (Paper I). Sharma et al. (2014) found that few studies examine IT processes and structures that actively embrace patient participation in healthcare. In addition, few studies consider how mHealth can improve health outcomes (Agarwal et al. 2015). Based on these gaps, the focus was shifted to explore practices in maternal healthcare settings and how actors were actively involved in healthcare. This focus led to the research aims addressed through the four studies.

As a first step towards answering the research questions, it was necessary to explore practices in service delivery, particularly the use of IT to predict, prevent, and manage pregnancy complications in a low-resource setting. Therefore, data collection was conducted in Uganda. This first study found a lack of IT use in predicting pregnancy complications and suggested aspects of maternal healthcare in which IT could improve value co-creation in predicting pregnancy complications. The suggested aspects and research gaps in exploring the dual role of IT (Lusch and Nambisan 2015) and how it applies to patient participation in healthcare (Akaka and Vargo 2014; Sharma et al. 2014; Frey et al. 2017) motivated the second study. The second study explored practices in maternal healthcare delivery that are supported or triggered by IT. This study was conducted in a high-resource setting, which we define as an e-health frontrunner with a well-developed IT infrastructure (Currie and Seddon 2014) and low maternal mortality rates (WHO 2015b). Sweden was used as a case to represent such a setting (Currie and Seddon 2014). The second study identified practices by which IT contributed to value-based maternal healthcare, triggering thoughts about whether similar practices existed in low-resource settings. Therefore, the second study inspired additional studies aimed at further and broader exploration of practices in IT use and design for maternal healthcare in low-resource settings. Specifically, these further studies focused on the task-shifting strategy and the design and use of mHealth, which is used in low-resource settings to extend the healthcare infrastructure (Braa and Sanner 2011).

Studies of mHealth were further motivated by research indicting the importance of mHealth in pursuing new healthcare models (Nasi et al. 2015), making it possible to design patient-centred healthcare service (Chen et al. 2018). In addition, the literature noted a lack of evidence on how mHealth can improve health outcomes and health system efficiencies (Agarwal et al. 2015). The third study accordingly explored practices in the design and use of IT for maternal healthcare in low-resource settings. Cases used for the study were in Uganda and Cameroon, partly because they use mHealth apps as a means to improve access to healthcare in rural areas with high maternal mortality rates (WHO 2015b). The study helped to 1) identify design implications for mHealth apps that contribute to value co-creation in maternal healthcare and 2) describe value co-creation activities and types of value obtained by actors using mHealth apps in maternal healthcare.

Study four explored the task-shifting strategy (see section 1.3.1) in maternal healthcare in a low-resource setting and opportunities for IT to support the strategy. The study was motivated by the relatively few studies of shifting key clinical tasks among healthcare professionals in maternal healthcare and of the involvement of non-professionals in task shifting (Dawson et al. 2014). In addition, there have been calls to explore changing care-seeking patterns among patients through redesigning the task-shifting strategy (Seidman and Atun 2017). The study was useful in identifying opportunities for IT to contribute to task shifting in maternal healthcare.

Figure 3 and Table 1 summarize the research process as described above, indicating the general contributions of the studies. These contributions are further described in the following sections.

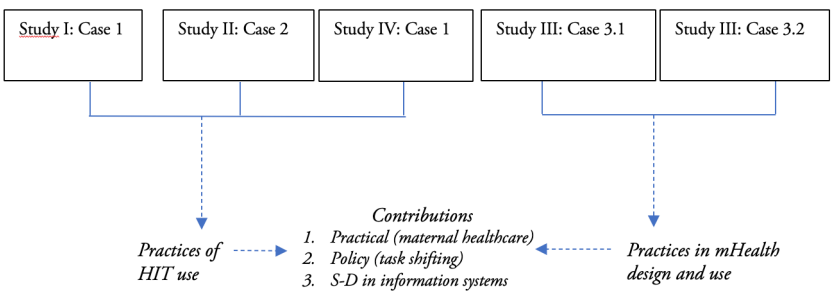

Figure 3: Connection between studies and cases.

Data were collected for the four studies at different times, as shown in Table 1. Interviews, observations, focus group discussions (FGDs), and document reviews were used in data collection. Table 2 shows the participants included in the data collection process.

Table 1: Studies conducted, cases, and data collection.

Study	Case	Data collection	Time
Study I: Study of the role of IT in a low-resource setting	**Case 1:** Maternal healthcare system in Uganda	Interviews	June 2016
Study II: Study of the role of IT in a high-resource setting	**Case 2:** Maternal healthcare system in Sweden	Interviews, survey, and document reviews	February–May 2017
Study IIIa: Study of mHealth designs in low-resource settings	**Case 3.1:** Designs of mHealth applications developed in Uganda and Cameroon	Interviews, FGDs, and document reviews	May–June 2018
Study IIIb: Study of the use of mHealth in low-resource settings	**Case 3.2:** Use of mHealth apps developed in Uganda and Cameroon		
Study IV: Study of the task-shifting strategy in maternal healthcare	**Case 1:** Maternal healthcare system in Uganda	Interviews	February–March 2019

PARTICIPANTS

For the 11 low-resource settings in Uganda, data were collected mainly at the meso and micro levels because this is where most of the value co-creation activities in maternal healthcare service delivery take place. However, all healthcare facilities in all districts in Uganda have common institutions and institutional arrangements at the macro level of healthcare. In addition, in Sweden, data were collected mostly at the meso and micro levels.

Table 2: Data collection and participants at different levels of healthcare.

Levels	**Interviews**	**FGDs (participants)**
Macro (e.g. actors at policy and regulatory agencies)	13	
Meso (e.g. actors in HC III and IV facilities and in hospitals)	26	4
Micro (e.g. actors at the community and village levels)	21	71
Total	60	8 FGDs (75)

A total of 60 interviews were conducted with key respondents from Uganda and Sweden in the four studies. The participants were three healthcare administrators, 27 healthcare professionals, eight VHTs, six pregnant women, three mHealth app designers, two consultants and one programme manager involved in developing mHealth apps, two IT managers, four records officers, four subject-area experts in terms of two professors from a university in Uganda, and two professors from two universities in Sweden. Interviews in Uganda were conducted at district offices, a health surveillance site, and healthcare facilities, while those in Sweden were held at the University of Gothenburg in a conference room.

In addition, a total of eight FGDs were held with 75 participants, mainly from the micro level (see Table 2). All participants were users of mHealth apps developed for maternal healthcare service delivery. The participants were 18 midwives, 13 pregnant women, 31 VHTs, a chief administrative officer, two health inspectors, four opinion leaders, five decision makers, and a hospital In-Charge. Lastly, a survey was sent to 165 midwives, 55 of whom responded.

3.4. DATA COLLECTION METHODS

The data collection methods used in the thesis and the concerns associated with them are elaborated on below.

3.4.1. INTERVIEWS

An interview is a data collection method that involves an interviewer and one or two interviewees discussing specific topics for the purpose of gaining insights into certain issues (Hennink et al. 2011). Both the interviewer and interviewee engage in a knowledge producing activity to co-construct reality (Hennink et al. 2011). Interviews were used to collect data in all four studies (see Table 1). Interviews were conducted to explore the use of IT in predicting pregnancy complications, with the intention of identifying activities and interactions among healthcare professionals, VHTs, and pregnant women. In addition, interviews were held to explore: how resources are used by actors; how information is collected and utilized; how information system support is provided; how mHealth apps are designed and used in maternal healthcare; and how models are used to predict pregnancy complications. Furthermore, interviews were conducted to explore: how the task-shifting strategy works; the negative and positive effects of task shifting on maternal healthcare service delivery; and how patients are involved in task shifting. The data collected from interviews helped: 1) identify aspects of maternal healthcare in which IT supports value co-creation in the prediction of complications; 2) describe practices in maternal healthcare that enable actors to integrate resources and exchange service; 3) identify the design implications of mHealth apps that support value co-creation in low-resource settings; 4) demonstrate how value is co-created by the use of mHealth apps and the types of value co-created; and 5) identify opportunities for IT use by health workers after tasks are shifted to them.

The researcher was actively involved in all interviews with the help of a research assistant. The interviews were semi-structured in order to focus on specific aspects of the case under study while keeping them open for spontaneous input from interviewees. Interview instruments were designed before each study to act as a guide for both the interviewer and the interviewees. To prepare the interview instruments, meetings were held with participants at the managerial level to gain an understanding of the case under study. For case 1 (studies 1 and IV) and case 3.2 (Study IIIb), interview instruments were translated into local languages to make it easy for participants to understand the questions and comfortably respond as

needed. Such participants included pregnant women and village health team members who were not conversant in English as a language of communication. The translation was done with the help of a research assistant from a community in which the interviews were conducted. In addition, consent letters were prepared before the interviews. The letters were communicated to the participants at the beginning of each interview to make them aware of the conditions of the interview and their rights to refuse to answer or to withdraw at any time.

The leading questions in the interview guide were consciously included to encourage the free exchange of experiences and viewpoints. The interviewees were provided the opportunity to ask for clarifications as needed, which helped to mitigate the risk of biasing participants and to address aspects not previously considered by the researcher. In addition, the interviewer asked follow-up questions when necessary to probe for more responses. In this way, it was possible to perform wider and deeper enquiries into the rich reality of specific aspects represented in the cases. For one of the participants in case 3.1, a Skype interview was held because the participant was located in Cameroon at that time. All interviews were recorded with permission from the interviewees. This was done to mitigate the risk of the interviewer misunderstanding what the interviewees meant, especially for the interviews held in a local language.

3.4.2. FOCUS GROUP DISCUSSIONS

An FGD involves an interactive discussion between a lead facilitator and preselected participants with the aim of gaining a broad range of views of a research topic (Hennink et al. 2011). It creates an environment where participants feel comfortable expressing their views (Hennink et al. 2011). FGDs were used in Study III in both cases 3.1 and 3.2. The focus groups were intended to obtain data on the design and use of mHealth apps for value co-creation. The discussions provided descriptions of the service ecosystem and of actor roles, relationships, activities, and interactions during the design and use of mHealth apps. In addition, the discussions helped demonstrate the collective and individual value of using mHealth apps in maternal healthcare.

The FGDs were each led by a moderator who, in this case, was either the researcher and/or the research assistant, depending on the language used in the discussion. As in the interviews, predefined questions were used to guide the discussions and consent letters were communicated to and signed by the participants. Participants could express themselves based on the aspects under discussion. Follow-up questions were asked by the moderators; in some situations, demonstrations were solicited from participants to clarify the use of mHealth app features. Such demonstrations would also be discussed to capture the different views of the participants. The discussions were guided to ensure that important aspects were covered within the allocated timeframe. In addition, discussions were recorded to avoid researcher misinterpretation and to act as a reference during the analysis process.

A challenge with the FGDs was that, although participants were encouraged to openly discuss and share their opinions, some participants were limited in their openness. This was true for participants who had been delegated to act on behalf of their superiors at the time of the research, and were placed in focus groups with other superiors or managers, who were also their managers. As a mitigation measure, such participants were given specific turns to reflect on and share their views with the group. In addition, some participants were seen to dominate the discussions, while others would simply affirm their views. To mitigate this, probing was done for some participants to cast more light on their affirmation, given their responsibilities.

3.4.3. FIELD-BASED OBSERVATION

Observation involves observing the behaviour, actions, and interactions of people when they are in their own social setting (Hennink et al. 2011). Observation enables researchers to obtain a detailed description of a social setting in order to situate people's behaviour in their own socio-cultural context (Hennink et al. 2011). Observations were made at one maternity clinic and at health facilities in Uganda in order to understand the work practices of midwives and other healthcare professionals. Before the observations, the participants were interviewed, which enabled the researcher and the participant to familiarize themselves with each other. This helped

mitigate the risk of the participant feeling uncomfortable during the observation. In addition, the interview and studied documents provided insights into issues that might impinge on the observation, such as visual aspects of the work flow of the prediction models, features and layout of the obstetric system, timelists, and mHealth app features and dashboards. In addition, observations enabled the researcher to identify additional resources in the form of available medical equipment and aspects of the working environment in terms of room structure, space, nearest child care centres, shops, and nearest bus stops.

3.4.4. DOCUMENTS

Documents are produced in particular social settings, so the ideas, arguments, and diagrams embedded in documents provide a deeper understanding of contexts and practices (Prior 2003). Documents were reviewed in case 2 (Study II) and case 3.1 (Study III) to gain insights into the cases. Documents were in the form of PDF files, workplans, proposals, monthly reports, and user and training manuals. Documents were reviewed to obtain information about available resources, technologies, and institutions that enable and constrain actors to integrate resources and exchange service in maternal healthcare. In addition, documents provided data about the architectures of mHealth apps, actors involved in the app development process, and knowledge and skills required by actors to use the apps. The data obtained helped to identify key aspects to consider when designing and using mHealth apps for value co-creation of maternal healthcare service delivery in low-resource settings.

Documents in case 2 provided information that was used during the observation, while documents in case 3.1 provided information on mHealth apps that was further discussed during the FGDs. The risk associated with studying documents was bias in interpreting the information, since it was viewed from a certain perspective by the researcher. This risk was mitigated by validation during the observations and FGDs. The information in the documents that was found to be correct was used by the participants.

3.4.5. SURVEYS

In case 2 (Study II), surveys were used mainly to complement the data collected through interviews and to investigate specific aspects of the case, based on prior knowledge from the theoretical framework. The purpose was to obtain more data, from midwives working in various clinics in the studied region, on how institutions enable and constrain actors in a value co-creation environment of maternal healthcare service delivery. Before preparing the survey instrument, meetings were held with professors and midwife managers to understand the practices of IT use in maternal healthcare, including how the system is organized and how IT systems and data collection forms are used. These meetings helped develop questions that were included in the survey instrument. Surveys have a drawback in that respondents do not understand the questions in a uniform way. The instrument was therefore prepared and iteratively revised with midwife managers to mitigate the risk of the questions being misinterpreted. The revisions allowed managers to ask for clarifications of expected answers in cases when questions were not well understood. The revisions provided a "safety net" in which unclear questions were caught and resolved. In addition, to mitigate the risk of survey answers not providing an in-depth understanding (Robson 2002), for example, of reasons for a given opinion, free-text fields were added to the survey questions to allow participants to provide supplementary explanations as required.

After revisions, the instrument was translated into Swedish by a subject-area expert. Questions were captured using a survey tool from Gothenburg University, and a link to the survey was shared with the midwife managers for testing. Testing helped to ensure that the data captured in the form would be saved after submission and could later be extracted to other formats for further analysis. After the testing process and incorporating the feedback, the instrument was sent by the midwife managers to all the midwives in Västra Götaland region. Sharing the survey helped easily collect more specific feedback from a wider audience than would have been possible through interviews. In addition, the survey offered respondents a way to provide individual feedback that might not have been obtained from FGDs, mitigating the risk of participants not freely expressing themselves in the focus groups (Robson 2002). A one-month timeframe was commu-

nicated to the respondents to allow them to think through the questions. After a month, very few midwives had responded to the survey, and it was realised that some respondents had answered the survey questions but had not pressed the "send" button, and therefore had to repeat the process; this may have affected the response rate, which was 33.3%. Survey responses were exported into Excel and later imported into SPSS for further analysis.

3.5. DATA ANALYSIS

Study 1

The research was initially inspired by grounded theory as a method of coding empirical data. Interviews were transcribed and open coding (Strauss and Corbin 1990) was used to identify, name, and categorize phrases and words, giving rise to codes. Codes were grouped into categories, including: human resources for health, maternal healthcare services, the referral system, relationships between healthcare practitioners, predicting pregnancy complications, and use of IT tools to provide maternal healthcare services.

Studies II–IV

As the research progressed, the analysis moved from grounded theory to thematic analysis (Braun and Clarke 2006). Thematic analysis was used in Studies II–IV in order to progress from description (in which data are organized and summarized to reveal patterns) to interpretation (in which the significance of the patterns and their broader meanings and implications are theorized in relation to the literature) (Braun and Clarke 2006). Braun and Clarke (2006) have argued that thematic analysis is a foundational method of qualitative analysis and that it is either data driven or theoretically driven.

Once a theory had been identified, a theoretically driven thematic analysis method was used to describe practices in the use and design of IT for value co-creation in maternal healthcare. For this method, a step-by-step guide provided by Braun and Clarke (2006) was followed that covers: familiarizing oneself with the data, generating initial codes from the data, searching for themes, reviewing themes, defining and naming themes, and producing a report. The analytical process started with *familiarizing one-*

self with the data through verbatim transcription of the interviews, FGDs, and observations. Verbatim transcription is making a written record of a recorded interview or field observation for data analysis (Hennink et al. 2011). Verbatim transcription enables the creation of meanings from the data through interpretation (Braun and Clarke 2006). For interviews conducted in local languages, the research assistant translated as well as transcribed the audio recordings, and timestamps were inserted into the transcripts to enable returning to specific parts of the audio recordings when necessary. The transcripts were reviewed by the researcher and the research assistant to ensure accuracy.

Inductive codes were generated from the verbatim transcripts. Inductive codes can be either *in vivo codes* that capture what is going on in the data and hence signal cultural norms, or *analytic codes* that analytically explain what is happening (Hennink et al. 2011; Holton and Walsh 2016). The initial codes that related to one another were grouped together. In addition to the inductive codes, topics from the interview guide and concepts from the S-D logic literature were used to develop *deductive codes*. Both the inductive and deductive codes were related together with their coded data extracts to form *themes*. Braun and Clarke (2006, p. 10) suggested that a theme "captures something important about the data in relation to the research question and represents some level of patterned response or meaning within the data set".

The latent themes generated were iteratively reviewed, defined, and matched with the concepts from the S-D logic meta-theoretical narrative for studies II and III. Latent themes were identified based on underlying ideas, assumptions, and concepts from theory (Braun and Clarke 2006). Finally, findings were presented by supporting themes with data extracts and showing how they relate to the research question. For Studies II and III, themes were matched to the S-D value co-creation model as shown in Table 3.

For Study II, in addition, quantitative data collected through the survey questionnaire were analysed using SPSS. The questionnaires were coded and variables were created in SPSS based on these codes. Variables were then used to capture responses to each question. The analysis was intended to compile statistics on the responses to complement the qualitative data,

so descriptive analysis was used to generate frequencies from the data. The analysis did not test any statistical hypothesis.

Study IV

In the fourth study, thematic analysis (Braun and Clarke 2006) was used as discussed above. Using NVivo, transcripts were imported and used to identify, name, and categorize phrases and words in order to develop initial codes. The initial codes were reviewed and refined to form final codes that were grouped into themes. The themes were reviewed iteratively with reference to the initial codes. The themes were refined and named to generate final themes. The final themes were categorized as *non-technical*, *intermediate*, *technical*, and *clinical tasks*, while the IT themes were *data collection systems*, *reporting systems*, *communication systems*, *diagnostic tools*, and *tracking tools.* The themes were categorized as enablers and triggers.

Table 3: Themes matched to the concepts of S-D logic in studies I–III.

S-D logic framework and value co-creation model	**Themes from the data analysis**			
	Study I: Case 1 *Study of the role of IT in a low-resource setting*	**Study II: Case 2** *Study of the role of IT in a high-resource setting*	**Study III a: Case 3.1** *Study of mHealth designs in a low-resource setting*	**Study III b: Case 3.2** *Study of the use of mHealth in a low-resource setting*
Institutions and institutional arrangements	Human resources for health Maternal healthcare services	Standardized process	N/A	Practices in seeking maternal healthcare Skilled attendance at birth
Service ecosystem	N/A	Digital infrastructures	Architecture of supporting digital infrastructure Limitations of the architecture Rewards for participation	Supporting digital infrastructure
Service platform	Referral system Relationships between different healthcare practitioners	N/A	Value offerings of mHealth apps Design models Valuable features	N/A
Actors	N/A	Actors connected by shared institutional arrangements	Actors involved in the design of the apps and their roles	Actor roles Roles are supported/triggered by apps
Resource integration		Resource-rich environment	Sharing of health information Providing app reviews	Enabling/triggering resources Information and knowledge sharing
Service exchange	Predicting pregnancy complications Use of IT tools for provision of maternal healthcare services	Accessibility of resources and information Sharing of information Collaborations among actors	Accessibility Content relevance and presentation Rules of service exchange	Mechanisms for service exchange among actors

In all studies, the role of IT as an operant that triggers value co-creation in maternal healthcare was identified in the form of: 1) colour-coding in the system to trigger compulsory tests; 2) knowledge sharing to trigger actors to communicate value propositions; 2) digitalized resources that initiate actions among midwives, for example, digitalized checklists, timelists, and integrated summaries; 3) signalizing or notification of questions posted; and 4) triggering actors to interpret information through rapid information sharing. In addition, actors were considered operant resources because the knowledge and skills reside in them.

3.6. CONCLUDING REMARKS

Using a case study approach allowed for a research process iterating between 1) interdependent aspects of IT use, design, and value obtained using IT, and 2) the whole that they form, which is an understanding of how IT contributes to maternal healthcare. This helped to identify the next set of data to collect, thereby gradually improving the research design as new knowledge was gained. In addition, research was carried out in real-world settings of maternal healthcare with different IT infrastructures. This facilitated the use of references on the use of IT from settings with well-developed infrastructure, in order to enhance knowledge of the contribution of IT in settings with limited infrastructure. Data were collected by the researcher through interactions with participants at health facilities, to provide a familiar atmosphere for the participants. During interactions, clarifications were offered on the role of the researcher and consent was obtained from participants before the data collection process began. In addition, participants were provided the opportunity to ask for clarifications and to withdraw during the process. Thus, the research was performed to gain empirical insights and not to control or influence events during the investigations. Studies were mainly exploratory with the aim of learning about the context in which IT is used in maternal healthcare. Concepts from the framework of S-D logic were used to analyse the data collected.

Results obtained through the present case studies are internally and externally generalizable. Regarding internal generalizability, despite the small number of participants involved in the present studies, controlled

convenience sampling of participants was performed. The suitability of participants was considered mainly to ensure the representative sampling of their roles and experiences in using or designing IT for maternal healthcare. In addition, external generalizability was considered in terms of the reporting of results. The contexts and case characteristics were therefore reported together with the results, so generalizability could be evaluated by comparing results with those of other similar cases.

In addition, at the start of the process, the researcher had preconceptions about pregnancy complications and the use of IT in maternal healthcare. Knowledge of the view of healthcare as a service to achieve value-based maternal healthcare was gained during the research. During the research, preconceptions were reflected on during discussions with participants. Interpretations of the data were thus open to emergent themes and not limited to theoretically informed concepts. In addition, multiple interpretations of how IT contributes to value-based maternal healthcare were obtained from the views of various participants with various roles, including health workers, CHWs, IT managers, and mHealth app designers.

On the other hand, data collection was mainly challenged by the ethical approval process, which was cumbersome. This process required that the researcher change the research proposal, focusing it more on the healthcare research discipline than the IT discipline. Therefore, the option of gaining access through district health officials and mHealth app designers was adopted. It was not possible to observe activities among pregnant women and other actors outside the health facilities. In addition, it was not possible to observe healthcare professionals as they interacted and integrated resources with pregnant women. Therefore, pregnant women were involved only through interviews and FGDs at the health facilities.

CHAPTER 4

SUMMARY OF PAPERS' CONTRIBUTIONS

This chapter summarizes the papers' contributions to the thesis, as described below. This summary is used as the basis of the discussion section to illustrate the thesis' contributions to theory, practice, and policy.

PAPER I

Nyende, H., Ask, U., & Nabende, P. (2017). Adopting a service-dominant logic to prediction of pregnancy complications: An exploratory study of maternal healthcare in Uganda. In *Proceedings of the European Conference on Information Systems (ECIS)*, 5–9 June 2017, Guimeras, Portugal.

The aim of this paper was to identify aspects in which IT has been used to support pregnant women in Uganda, focusing on predictions of pregnancy complications. Limited studies examine how IT processes and structures actively embrace patient participation in the improvement of healthcare services and how health value can be co-created. In addition, the literature reported a gap in the application of S-D logic in healthcare.

Based on this gap in previous research, the following research question was addressed: "In what ways does IT support value co-creation in maternal healthcare in low-resource settings?" The paper draws on an S-D logic perspective (Vargo and Lusch 2004, 2008) and the service innovation framework (Lusch and Nambisan 2015). This study lays a foundation for this thesis research by addressing aspects of how the traditional perspective of healthcare, in which patients are passive, can be transformed to a perspective in which patients are actively involved in their own care. The paper does this by suggesting ways of improving value co-creation practices at the micro level and of using IT as an operant to trigger the prediction of pregnancy complications.

The paper is based on a maternal healthcare case in a low-resource setting, in Uganda. The empirical data were collected via interviews and conversations with health workers. The findings illustrate a fragile service ecosystem with a shortage of healthcare professionals, cognitively distant actors, and unproductive attitudes of pregnant women towards timely access to service. In addition, findings show that IT has not been used to support collaborations and interactions among actors, leading to an inadequate service platform. This inadequate service platform affects the effectiveness of the referral process, leading to the lack of a shared view of the resources for and status of pregnant women. Lastly, the findings show that IT has not been used in the prediction of pregnancy complications, leading to an imperfect value co-creation process. This results in inaccurate or missed predictions and a lack of involvement of pregnant women in the prediction process. Applying the lens of S-D logic to healthcare in this setting enabled the identification of aspects of maternal healthcare in which IT can support and/or trigger value co-creation. These aspects were: 1) supporting and strengthening the limited number of actors in maternal healthcare by (i) shifting the focus from processes to services and (ii) having IT play an operant role to trigger service exchange in maternal healthcare; 2) improving the referral process by providing a shared view of resources and enabling value co-creating activities; and 3) improving the prediction process and thereby creating value in maternal healthcare by involving pregnant women as co-creators of value in maternal healthcare services. These aspects were used to identify changes required for the creation of value-based maternal healthcare, including changes in structure, technology, and institutions.

PAPER II

Nyende, H. (2018). The role of technology in value co-creation of maternal health care: A service-dominant logic perspective. In *Proceedings of the European Conference on Information Systems (ECIS),* 23–28 June 2018, Portsmouth, UK.

Paper II was inspired by contributions from Paper I and describes practices of maternal healthcare in which IT as both an operant and operand resource has been used to benefit maternal healthcare. Limited research examines the role and nature of IT in service systems such as healthcare, especially the operant role of IT and patient participation (Akaka and Vargo 2014; Frey et al. 2017). The research question asked in this paper was "How does IT contribute to value co-creation in a best practice maternal healthcare setting?" The paper draws on the S-D value co-creation model (Vargo and Lusch 2016) and dual role of IT from an S-D perspective (Lusch and Nambisan 2015). This study contributes to the thesis by providing insights into the role of IT in healthcare service, through explicitly showing ways that technology acts as a driver of value co-creation in providing healthcare services, as both an operand and operant resource.

The paper is based on a case study of maternal healthcare in a setting with well-developed IT infrastructure, Sweden. The empirical data were collected via interviews with and a survey of health workers. The findings show that IT as both an operand and operant resource drives value co-creation. As an operand, IT supports practice standardization, activity transparency, collaboration, complication prediction, and knowledge and information sharing among actors. As an operant, IT triggers resource integration activities such as complementing and adding new resources, collective decision making, handling emergencies, and service exchange through referrals and feedback. It was also noted that IT is mainly used by healthcare professionals rather than by pregnant women in the maternal healthcare service experience. Therefore, the paper also identifies knowledge gaps regarding IT as a driver helping pregnant women to actively engage in maternal healthcare. A broader IT perspective enabled exploration of the nature and role of IT in the value co-creation practices of maternal healthcare and the anticipated value obtained from such practices.

PAPER III

Nyende, H. (2019). Value co-creation in design of mHealth applications for maternal healthcare service delivery. In *Proceedings of the International Federation for Information Processing Working Group 9.4 (IFIP 9.4)*, 1–3 May 2019, Dar es Salaam, TZ.

Given the nature of low-resource settings with limited IT infrastructure, IT systems that depend on the availability of power and network infrastructure in the form of computers are not used in such settings. Instead, mHealth is used to extend this infrastructure. To understand how IT can be designed for active participation in low-resource settings, in Paper III, I set out to investigate the designs of mHealth apps to find out whether they drive value co-creation from the S-D logic perspective. This is because the design of IT influences its use. In addition, limited research focuses on the effectiveness of mHealth strategies for frontline health workers and on how mHealth improves health outcomes, health system efficiencies, and the cost effectiveness of service delivery. Moreover, previous research has pointed out the poor methodological quality of studies of mHealth in maternal healthcare in low-resource settings. Based on these research gaps, the following research question was addressed: "How are the designs of existing mHealth applications incorporating value co-creation aspects and how can mHealth applications be designed to improve value co-creation in maternal healthcare within the context of S-D logic?" The paper draws on the S-D value co-creation model (Vargo and Lusch 2016). This study contributes to the thesis by identifying the design implications of IT that lead to value-based maternal healthcare in low-resource settings.

The paper is based on a case study of mHealth apps developed for the purpose of reducing maternal deaths in low-resource settings, i.e. Uganda and Cameroon. The empirical data were collected via interviews with mHealth developers, FGDs with mHealth app users, meetings with consultants and project managers, and document reviews of mHealth app manuals and presentations. The findings show that the designs of existing mHealth applications for maternal healthcare consider only limited aspects of value co-creation. These include architectural limitations, limited involvement of beneficiaries in the design process, and limited value offerings in terms of knowledge sharing, participation rewards, and user

feedback reviews. The paper proposes five guidelines for improving the designs of mHealth apps for value co-creation in maternal healthcare from the S-D logic perspective: transparency in the architecture of participation and rewards, architectural integration, actor involvement in the design process, mixed-model designs with different value offerings and mechanisms for knowledge sharing, and content presentations and collaborations that support resource integration and service exchange. The identified design guidelines foster rethinking of the nature of mHealth beyond a mere material artifact or physical product, to also consider mHealth apps as collections of processes and practices that trigger and support value co-creation in maternal healthcare. The guidelines therefore outline the practices and processes in both the design and use of mHealth apps through which value is co-created. This conceptualization guides the development and use of technology that enables new resources to be generated as actors integrate resources and exchange services, making it useful in value-based maternal healthcare in low-resource settings.

PAPER IV

Nyende, H. (2019). Value of mHealth apps for maternal healthcare. In *Proceedings of the Information Systems Research Seminar in Scandinavia (IRIS)*, 11–14 August 2019, Nokia, Finland.

Paper IV set out to demonstrate how different actors in the maternal healthcare service ecosystem use mHealth to co-create types of value from an S-D perspective. Few studies have demonstrated the role of mHealth apps in maternal healthcare service utilization. Few studies consider the value that individuals co-create as a result of their interactions with mHealth services. In addition, there is a gap in the literature on patient value co-creation through using technologies. Based on these gaps in previous research, the following research question was addressed: "What value is co-created by the use of mHealth apps in maternal healthcare service delivery and how is it co-created?" The paper draws on an S-D logic perspective (Vargo and Lusch 2004, 2008) and the S-D value co-creation model (Vargo and Lusch 2016). This study contributes to the thesis by examining the role of IT in healthcare transformation beyond the healthcare organization in low-resource settings. The study does this by iden-

tifying value co-created by using mHealth apps within and beyond the healthcare setting.

The paper is based on a case study of mHealth apps used to provide maternal healthcare services in Uganda. The empirical data were collected via interviews and FGDs with health workers and pregnant women. The findings indicate the types of value co-created by healthcare organizations, including improvements in healthcare provision (e.g. improved resource planning and service provision), prevention of complications, and increased knowledge acquisition and information sharing. Individual value co-created by using mHealth apps includes improved knowledge and experience, wellbeing, productivity, collaboration, and decision making. The collective and individual value types identified are important to the communication of the shared meanings of actors in this specific context of maternal healthcare. This provides insights into reconsidering institutional orders and hierarchies that integrate collective and individual value.

PAPER V

Nyende, H. (2020). Maternal healthcare service transformation: Exploring opportunities for IT use in task shifting. In *Proceedings of the Hawaii International Conference for Systems Sciences (HICSS)*, 7–10 January 2020, Maui, HI, USA.

Paper V identifies ways in which the task-shifting strategy can be redesigned to fit within healthcare transformation. This study responds to a call for research into task shifting in maternal healthcare, specifically into how to engage teams of workers and community members in delivering and advocating for interventions at various levels. In addition, previous research calls for redesigning the task-shifting strategy to change care-seeking patterns among patients. Few studies have examined the shifting of key clinical tasks among professionals in maternal healthcare, and few have noted the involvement of non-professionals in task shifting. Based on these research gaps, the following research questions were addressed: "Which tasks are shifted in maternal healthcare service delivery, by whom and to who? What opportunities exist for IT to enable/trigger the execution of shifted tasks?" The paper applies the S-D dual role of IT (Lusch and Nambisan 2015) and the WHO guidelines on optimizing healthcare

roles through task shifting (WHO 2012). This study contributes to the thesis by providing insights into contextualizing the dual role played by IT in healthcare transformation from an S-D perspective in low-resource settings. The study does this by providing an understanding of the consequences of task shifting beyond the vertical and horizontal dimensions. In addition, it provides insights into the dual role of IT in the contextual aspects of professional and non-professional relationships; it thereby establishes a foundation on which managerial implications can be suggested for health workers, as a result of IT use in the categorized tasks shifted in maternal healthcare.

The paper is based on a case study of maternal healthcare in a low-resource setting, Uganda. The empirical data were collected via interviews with health workers. The findings identify opportunities for IT use in supporting/triggering the shift of tasks (i.e. technical, intermediate, non-technical, and clinical) of professionals (i.e. senior midwives and midwives) to non-professionals (i.e. VHTs and pregnant women) and other professionals. The shifted tasks and IT opportunities identified in this paper help in recommending changes in the technology development and use processes as well as in the institutional arrangements in building relationships among professionals and non-professionals at different levels of healthcare. This leads to policy implications for considering IT as a resource in task shifting in low-resource settings.

CHAPTER 5
DISCUSSION

This chapter discusses key findings of the studies and how they contribute to answering the research questions. The main objective of the thesis is "to enhance knowledge of how IT as a resource contributes to value-based maternal healthcare in low-resource settings". Contributions of the thesis are discussed based on the findings and conclusions of the appended papers, as described in chapter 4, and in relation to previous research, as described in chapters 1 and 2.

5.1. SYNTHESIS OF FINDINGS

This section synthesizes the findings of the five appended papers and shows how the findings answer the research questions.

5.1.1. PRACTICES IN WHICH IT HAS BEEN USED TO BENEFIT MATERNAL HEALTHCARE IN LOW- AND HIGH-RESOURCE SETTINGS

Practices in maternal healthcare are described in terms of a) current maternal healthcare institutions and structures and b) the existing IT infrastructure and platforms that help actors to co-create value. These practices are discussed in the following sections.

a. Current maternal healthcare institutions and structures

Findings show that healthcare is in many ways still perceived in the traditional way, in which pregnant women passively comply with treatment and information provided by healthcare professionals and CHWs (all papers). Thus, practice styles such as partnering and team management, as proposed by McColl-Kennedy et al. (2012), have not been fully adopted. The traditional view of healthcare leads to a fragile ecosystem, an inadequate service platform, and flawed value co-creation, all of which negatively affect health outcomes (Paper 1). In low-resource settings, a fragile service ecosystem includes a shortage of healthcare professionals, multiple actors with varying skill and knowledge levels, and unproductive attitudes of pregnant women towards timely access to service. A shortage of healthcare professionals can be addressed through a task-shifting strategy (Paper V).

The task-shifting strategy includes both professionals and non-professionals (all papers) in order to provide healthcare services to pregnant women. Non-professionals include CHWs, family, and friends. These various actors are found at different levels of healthcare. At the micro level, there are pregnant women, women's support groups, family and friends, CHWs, and midwives. At the meso level, there are healthcare facilities at various hierarchical levels of healthcare; in Uganda, these levels are the health centre II, health centre III, health centre IV, district hospital, regional hospital, and national hospital levels. At the macro level, there are actors who are responsible for policies. These include the Ministry of Health, district health officials, and the national drug authority. The thesis agrees with Frow et al. (2016), contending that thinking beyond immediate strategic relationships to encompass collaborations between actors within ecosystem levels is important for value-based maternal healthcare. At the

meso level, actors connect directly and indirectly to serve one another. This has mainly been found in the referral process (Paper I). In addition, relationships have been observed between the micro and meso levels, where CHWs refer pregnant women to health facilities (Papers I, III, and IV). These referrals are constrained and enabled by institutions and structures; for instance, referrals are challenged by poor collaboration, poor communication, unproductive women's attitudes, and a lack of transport to reach health facilities (Paper I).

This thesis points out a misapprehension of the task-shifting strategy in that the strategy is designed based on the traditional healthcare system (Paper V). The thesis concurs with other researchers (Colvin et al. 2013; Dawson et al. 2014; Aithal and Aithal 2017) that, in maternal healthcare, tasks are mainly shifted among healthcare professionals and a few CHWs. In addition, both professionals and CHWs are not supported with sufficient resources to execute the tasks shifted to them (Paper V). However, this research has identified a new type of task shifting, i.e., the shifting of tasks (specifically, health education talks) from midwives to women leaders or mentor mothers. Mentor mothers give health education talks to pregnant women at health facilities (Paper V). The thesis argues that this type of task shifting requires changes in institutions to enable it to scale to communities far from health facilities. Thus, IT-based collaboration mechanisms such as timelists (Paper II) that ensure resource integration and service exchange among actors when tasks are shifted should be considered.

This research concurs with Seidman and Atun (2017) about changing care-seeking patterns among patients by redesigning the task-shifting strategy. Thus, the results display a more nuanced understanding of the consequences of task shifting beyond the vertical and horizontal dimensions, encompassing the importance of understanding the contextual aspects of professional and non-professional relationships (Paper V). The results of this thesis have implications for institutional arrangements that encourage relationship building among professionals and non-professionals when tasks are shifted.

b. Existing IT infrastructure and platforms that help actors to co-create value

Findings of all four papers show that the digital infrastructure in maternal healthcare both enables and constrains actor involvement in value co-creation. To extend the maternal healthcare digital infrastructure in low-resource settings, mHealth apps have enabled and triggered value co-creation among actors (Papers III–V). Papers II–V recognise that the digital infrastructure has helped actors to actively participate in value co-creation, though limitations exist in low-resource settings. The digital infrastructure holds together diverse actors and enables collaboration in the ecosystem (Lusch and Nambisan 2015). This thesis argues that extending the digital infrastructure with mHealth is not sufficient on its own, but also requires integration with existing digitalized health information systems (Papers III and IV). However, integration has not been considered within the institutional arrangements that govern the design and use of IT and mHealth apps (Paper III). This integration enables patient journals to be shared among actors at various healthcare facilities, leading to broader healthcare coverage and care continuity (Paper II). This finding concurs with those of Akaka and Vargo (2014), who indicated that technology contributes to value co-creation by enabling the sharing of information within and across service systems. Furthermore, designers of mHealth apps have not been understood as important actors in maternal healthcare, even though they influence the designs of the apps.

Findings indicate that in a high-resource setting, a good practice is to adopt ISO digitalized quality standards systems to standardize processes and guidelines, leading to better healthcare provision (Paper II). Examples of such guidelines include the prioritization of diagnostic tests, which leads to time and cost savings (Paper II). In addition, a digital infrastructure that includes an intranet-based obstetrics system and a central registrar enables actors to access patient journals throughout a region, leading to care continuity (Paper II). IT has enabled professionals with different kinds and levels of knowledge and experience to collaborate and integrate resources when serving pregnant women (Paper II). This process leads to knowledge sharing, which is a key resource with which other actors in the service ecosystem co-create value (Paper II). On the other hand, findings show that digital infrastructure in low-resource settings is limited to

reporting and collecting data rather than resource integration and service exchange (Papers III–V).

In addition, findings show that IT service platforms, including mHealth apps, have enabled actors to access and recombine resources to co-create value in maternal healthcare (Papers II and III). Whenever resources are integrated, new resources are created, improving the ecosystem (Frow et al. 2016). In a high-resource setting, IT is used by professionals to share patient information between health facilities, which facilitates care continuity and leads to better healthcare provision through broader healthcare coverage (Paper II). In addition, collaboration and knowledge sharing tools such as timelists, checklists, and integrated summaries are used by professionals to integrate resources (Paper II). On the other hand, findings show that in low-resource settings, mHealth apps have been used by pregnant women to share information, including about their own experiences, with peers on social media and to ask questions to professionals, therefore improving service exchange (Paper III). IT service platforms such as online health communities (Goh et al. 2016) and e-health kiosks (Venkatesh et al. 2016) create value for patients in low-resource settings.

However, the research identifies a limitation of service platforms in low-resource settings intended to communicate available resources at various levels of healthcare, to enable resource integration (Papers I and V). For instance, the referral process in low-resource settings has often been constrained by an inadequate service platform. This has led to poor coordination and collaboration among actors and frustration among pregnant women (Paper I).

In low-resource settings, findings show that IT has not been used in the prediction of pregnancy complications, leading to flaws in value co-creation processes (Paper I). This results in inaccurate or missed predictions and the lack of involvement of pregnant women in the prediction process. In addition, findings show that in some settings, an mHealth self-diagnostic device was used by midwives and CHWs to assess and monitor pregnancy status (Paper IV). However, the app could not be used by the pregnant women mainly because they could not afford it. In cases in which it was used, it helped actors make accurate diagnoses, thereby preventing complications. In addition, it improved information sharing and guided

decision making among professionals, pregnant women, and their relatives (Paper IV).

This thesis notes that existing digital infrastructures mainly support and/or trigger maternal healthcare activities conducted by healthcare professionals and CHWs rather than by the pregnant women themselves.

5.1.2. OPPORTUNITIES FOR IT TO BE DESIGNED AND USED TO BENEFIT MATERNAL HEALTHCARE IN LOW-RESOURCE SETTINGS

This thesis examined existing IT designs and use practices to identify opportunities for IT to benefit maternal healthcare in low-resource settings. The opportunities for a) designs of IT that benefit maternal healthcare in low-resource settings and b) the use of IT to benefit maternal healthcare in low-resource settings are discussed in the following sections.

a. Opportunities for designs of IT that benefit maternal healthcare in low-resource settings

Findings indicate that, in low-resource settings, IT is mainly designed for use by healthcare professionals and CHWs but not by pregnant women. The thesis argues that the designs of IT in low-resource settings are limited in terms of mechanisms for value co-creation (Paper III). Existing mHealth apps are mostly designed as resources that need to be acted on to create value, limiting their functionalities to mainly enabling, rather than triggering, service exchange and creating opportunities for resource integration. In addition, such designs limit the reuse of new resources generated as a result of using the mHealth apps.

To design IT for active participation, the design mechanisms of mHealth apps that support or trigger service exchange and incorporate a resource-rich environment are identified (Paper III). Paper II points out that IT can enable actors to access resources, helping them to co-create value. For instance, IT can be designed with features that provide for the translation of health information based on the actor's preferences. In addition, triggers in the form of timelists, checklists, reminders, and other platforms can call for action among actors in the form of alerts and keep actors active in the value co-creation process (Paper II). The use of differ-

ent content presentation formats appropriate to particular actors facilitates value co-creation (Paper III). The thesis suggests that the integration of the digital infrastructure and the use of architectural components that provide opportunities for resource integration within the limited infrastructure of low-resource settings would support and/or trigger service exchange. Paper III shows that the integration of mHealth apps with local digitalized health information systems and other mHealth apps strengthens the health system by enabling better resource planning and integration. This ensures that actors have access to health information, promote learning through knowledge sharing and collaboration (Papers II and V), share maternal healthcare information, and provide participation rewards for collaborative value co-creation (Papers I–III). In addition, rules of service exchange embedded within mHealth apps lead to new relationships among actors in the ecosystem (Papers III and IV). For instance, mHealth apps offer direct communication between pregnant women and healthcare professionals, triggering new relationships between them. In addition, mHealth apps improve collaborations between midwives and CHWs.

By identifying opportunities in the design of mHealth apps, this thesis contributes to research on mHealth as a resource in improving healthcare outcomes, as advocated by Hurt et al. (2016) and Agarwal et al. (2015).

b. Opportunities for the use of IT to benefit maternal healthcare in low-resource settings

All four appended papers suggest that in low-resource settings in healthcare, non-professionals have an important role in the value co-creation process and that these non-professionals require appropriate IT to support their roles. IT supports and/or triggers collaboration in a service ecosystem with many actors, leading to new service requests (Papers II, III, and V). IT enables actors to choose who can share their value propositions and resource offers, leading to relationships that foster resource integration. In addition, IT communicates value propositions embedded within institutions, thereby shaping expectations of value that lead to the active participation of actors. For instance, IT helps to document practices such as the prioritization of diagnostic tests that have value propositions related to time and cost savings (Paper II). The thesis points out that IT communicates value propositions that lead to interactions, thereby reducing

knowledge gaps among actors, also viewed as "reducing cognitive distance" (Lusch and Nambisan 2015, p. 165) or "shaping actor mental models" (Frow et al. 2016, p. 33). In addition, new value propositions co-created by multiple actors can help to establish the resources required and ways in which resources can be applied to achieve value-based maternal healthcare. Value propositions help to negotiate how resources are shared within a service ecosystem (Frow et al. 2014).

Findings show that IT can support limited human resources and trigger resource integration by non-professionals, enabling them to actively participate in the co-creation process (Paper I). Actors' need for a shared view of resources has been identified as a way in which IT can improve processes, making it easy for actors to collaborate (Papers I and II). The referral process can be improved by providing a shared view of resources at various levels of healthcare (Papers I and II). In addition, the immunization process can be improved through use of mHealth apps. For example, some immunization tasks could be shifted from midwives to CHWs by incorporating the use of mHealth by CHWs to capture immunization data at community and health facilities and using it to prompt vaccination visits by pregnant women (Paper V). This would help midwives easily plan resources needed for immunization outreach-related activities. Immunization registries and SMS reminders improve immunization coverage and timeliness (Nguyen et al. 2017). Findings show that IT enables actors to access information that can create shared understanding among actors and can strengthen professional and non-professional relationships at various levels of the ecosystem by reducing uncertainties. (Paper II). These findings concur with those of Beirão et al. (2017), who found that IT fosters resource access and recombination across different levels of healthcare by providing faster access to information at all levels. In addition, access to a new resource pool offers opportunities for additional resource sharing relationships, as indicated by Frow et al. (2016).

To sum up, the identified opportunities for the design and use of IT have implications for the functional roles of IT in value-based maternal healthcare in low-resource settings.

5.1.3. VALUE AS PERCEIVED BY ACTORS WHEN THEY USE IT IN MATERNAL HEALTHCARE

This section discusses findings based on examples of value co-created using mHealth apps, as perceived by actors in maternal healthcare at the time when the data were collected. It is important to note that value is perceived experientially and differently by varying actors to varying contexts in a service ecosystem (Edvardsson et al. 2011; Vargo and Lusch 2016; Vargo et al. 2017). The following paragraphs discuss how value is co-created and perceived by actors.

This research acknowledges that individual actors depend on triggering and enabling resources to enhance their own wellbeing through exchange, as found by Vargo and Lusch (2004). Findings show that in low-resource settings, value is co-created within and beyond the maternal healthcare context, as actors use mHealth apps (Paper IV). Value emerges through interaction and the application of resources within systems of service-for-service exchange (Vargo et al. 2017). Findings show that actors integrate resources in the form of their knowledge and skills, and use features embedded in mHealth apps to engage in value co-creation activities (Papers III–V). It is within the maternal healthcare service that resources are integrated and services are exchanged among actors. Examples of maternal healthcare services include referring pregnant women to health facilities, sharing information among actors, promoting healthy behaviours, and predicting pregnancy complications. Each type of service entails particular value co-creation activities; for example, referring pregnant women involves CHWs using mHealth apps and other resources to register and map pregnant women in communities, sending them to appropriate health facilities. On the other hand, district health officers use dashboards to view women who have been mapped in order to plan for resources. In addition, based on the colour coding in the app, these officers notify CHWs about those who have missed appointments. Moreover, women are also notified by mHealth apps through SMS. In this example, mHealth apps trigger resource integration and service exchange among actors in tracking missed appointments, analysing information on dashboards, and notifying and signalling through colour codes and SMS reminders (Papers III–V). In

addition, district health officers use the district health information system for resource planning and reporting.

The creation of value influences the usability of a particular resource and its worthiness in exchange. This thesis contributes to the worthiness and usability of mHealth apps as a resource in value co-creation for low-resource settings by identifying the role and value of mHealth apps for patients and other actors – a matter that has been under researched (Silva et al. 2015; Atnafu et al. 2017; Motamarri 2017). In addition, by identifying co-creation activities engaged in by actors as they use mHealth apps in maternal healthcare, the thesis contributes to ongoing research on how actors co-create value in healthcare as a result of their interactions with technology, as advocated by Motamarri (2017) and (Lee 2019). Identifying actors involved in certain activities enables managers to introduce new services and to identify actors to collaborate with and resources needed for such collaboration.

Findings show that value is co-created at all levels of healthcare. At the macro and meso levels, value is perceived as mainly collective by healthcare managers in low-resource settings. Examples of collective value include increased antenatal care visits, skilled attendance at birth, early diagnosis of complications, improved resource planning, and knowledge acquisition and sharing (Papers III and IV). At the micro level, value is individually experienced by actors. Examples of individual value include improved knowledge, experience, wellbeing, productivity, collaboration, and decision making among actors who use mHealth apps (Paper IV). Integrating collective and individual value draws attention to the network of actors within which value is created (Chandler and Vargo 2011; Vargo et al. 2017). The thesis contributes by shedding light on the complexity of value co-creation that calls for restructuring the whole maternal healthcare system. The thesis thus provides insights into the reconsideration of institutional orders and hierarchies that integrate collective and individual value and communicate the shared meanings of actor value.

In addition, this thesis provides novel insights into how mHealth app's inbuilt features motivate actors to participate in value co-creation. The findings identify a new practice of mHealth use by pregnant women in low-resource settings. In this practice, women are rewarded for participation in the form of answering quizzes and sharing practices with peers

(Paper III). This insight has implications for institutions that encourage participation through offering incentives. Furthermore, this insight has managerial implications regarding scaling up mHealth apps, as advocated by Hurt et al. (2016) and Lee et al. (2016)

5.2. ADDRESSING THE MAIN AIM OF THE THESIS

Based on the findings presented in section 5.1, this section discusses three aspects in which IT as a resource contributes to value-based maternal healthcare in low-resource settings. As an operant, IT triggers value co-creation by 1) recreating relationships among actors, 2) transforming actors' capacities, and 3) reorganizing tasks in maternal healthcare. These aspects are elaborated on below.

5.2.1. RECREATING RELATIONSHIPS AMONG ACTORS

For professional-to-professional relationships, IT triggers relationships among professionals by connecting them. An example of such triggering is through a digital resource called a timelist, which is dependent on an information system and made visible as a digitalized schedule on a computer. A timelist is a resource in the obstetrics system, enabling communication among professionals (Paper II). Using a timelist, professionals (e.g. midwives) log in and post their schedules so that their colleagues know which pregnant women they are working with at specific times of day. In addition, they use the timelist to indicate emergencies that need to be addressed by obstetricians, triggering them to integrate resources and exchange services with other professionals as they plan for such emergencies (Paper II). This in turn helps professionals to communicate their value propositions and connect with other professionals by making their work schedules transparent. Such transparency triggers avenues for communication and service exchange among professionals (Paper II). IT enhances clarity by making actor roles in value co-creation and underlying activities explicit through embedded guidelines (Lusch and Nambisan 2015). In low-resource settings, IT as a digital scheduling resource has not been utilized (Paper V), making it difficult to know which pregnant women are to be seen at given dates and times, in turn making service exchange in maternal healthcare

less transparent. This lack of transparency leads to delays in receiving adequate maternal healthcare when pregnant women reach health facilities (Paper I). This further results in unproductive attitudes of women towards the healthcare system and in poor planning and coordination of resources at health facilities (Paper I).

In addition to timelists, in low-resource settings, IT also triggers service exchange as communication among health workers happens through social media and messaging tools such as WhatsApp and SMS. For example, WhatsApp messages are exchanged among district health management team members regarding urgent health issues that need addressing. Through a specific code, SMS messages are used to share information (e.g. about disease outbreaks) among health workers and records officers who are registered in the notification system at the district offices (Paper V). Once information is shared, it triggers actions that need to be taken by professionals, leading to service exchange and resource integration.

For professional-to-non-professional relationships, in low-resource settings, rules of service exchange embedded within mHealth apps lead to new relationships by enabling non-professionals to exchange messages with professionals (Papers III and IV). For instance, an embedded digital calendar in mHealth apps, with a reminder functionality, triggers connections among pregnant women and midwives (Papers III and IV). Automatic SMS reminders about antenatal care visits are sent to the pregnant women's mobile phones three days in advance. In addition, signals about those women who miss appointments, in the form of colour-coded names, appear on the dashboard at the healthcare facility, triggering midwives and CHWs to track such women (Papers III and IV). The tracking of women who miss appointments triggers relationships between pregnant women, midwives, and CHWs, leading to value co-creation. Such appointment reminders based on gestational age increase skilled delivery attendance, as has been noted by Lund et al. (2012).

In addition, mHealth apps offer a platform where pregnant women post questions and professionals are notified to respond to the questions when they log into the platform, triggering service exchange and leading to the formation of relationships (Paper III). An SMS platform with a specific code is used by pregnant women to send messages and receive responses from professionals, triggering new relationships (Paper III).

Other communication tools such as toll-free lines are used by pregnant women and the public to connect with midwives about maternal healthcare support, and they are responded to by midwives and other healthcare administrators (Paper IV). The implementation of rules of exchange facilitates the coordination of actor contributions and interactions (Lusch and Nambisan 2015).

Furthermore, non-professionals connect to professionals as they use IT to search for and access knowledge. For example, pregnant women use health information sites to access and search for health information, in the form of videos and text, that suits their needs (Paper II). Using this information, pregnant women post pregnancy-related questions to midwives, which triggers service exchange as midwives are prompted to respond to them (Paper II). Websites support patient participation through healthcare information portals that bring together healthcare providers, physicians, and patients and enable them to access resources such as medical literature, physician skills, and personal data, thereby co-creating value (Caridà et al. 2014).

For non-professional-to-non-professional relationships, CHWs connect and exchange services with pregnant women and health facilities by using mHealth apps to register, assess, communicate, and share information. For instance, IT in the form of digitalized data collection forms embedded in mHealth apps enables CHWs to collect appropriate information from pregnant women, which in turn triggers the selection of appropriate health facilities to which to refer women based on their locations and the information captured (Papers III and IV). In the process of data collection, value is co-created as pregnant women exchange information with the CHWs following the criteria provided by the professionals at the health facilities. In addition, mHealth apps have an embedded feature that computes the expected date of delivery, based on the date of the last menstrual cycle entered by the CHWs (Paper IV). The expected date of delivery is not known by most pregnant women in low-resource settings, which eventually leads to home-based deliveries that may result in death in case of complications (Paper IV). Computation of the expected delivery date triggers pregnant women and their families to plan for the delivery by saving money to cover the cost of transport to health facilities (Paper IV), triggering relationships among non-professionals and skilled birth atten-

dants for informed decision making. Birth preparedness increases the use of skilled care at birth and the timely use of facility care (WHO 2015c) through improved resource planning.

5.2.2. TRANSFORMING ACTORS' CAPACITIES

IT transforms actors' capacities based on new resources acquired by actors as they interact in the service ecosystem (Paper V). Technology contributes to value co-creation by enabling the sharing of information within and across service systems (Akaka and Vargo 2014). Findings of the studies indicate that CHWs and midwives are trained to use mHealth apps to share and exchange knowledge about maternal healthcare, greatly reducing knowledge gaps between actors. The more the interaction, the more resources are gained by actors. This finding is in line with that of Frow et al. (2016), who found that whenever resources are integrated, new resources are created, improving the ecosystem. Actors share knowledge through interactions, which helps them co-craft relevant offers and shape their expectations of their usage experiences. The new capacities lead to new value propositions co-created by actors, which in turn lead to changes in institutions. Institutions determine resource commitments and ways in which resources can be applied to achieve beneficial outcomes (Frow et al. 2014).

Findings of the studies indicate that IT could transform the capacities of professionals by guiding them to integrate resources, thus acquiring new knowledge during service exchange. For instance, IT in the form of digitized predictive models triggers midwives to acquire knowledge by using digitized step-by-step scripts in the form of flow charts to measure and test pregnant women. This helps them quickly and easily identify and handle pregnancy complications (Paper II). Such models trigger midwives to make informed and timely decisions based on the knowledge acquired. Thus, value in the form of better health outcomes can be co-created through informed decisions. In addition, costs can be saved through directing resources towards women at high risk well before complications occur (Paper II). Findings of the studies indicate that in low-resource settings, digitized predictive models are not used; instead, midwives rely on a risk approach to identify complications (Paper I). The risk approach classifies

women as at-risk using variables such as the height of the pregnant woman and complications in previous pregnancies. However, this approach is not effective, since any pregnancy can incur complications even if the pregnant woman is not categorized as at high risk (Paper I). Predictive models could thus trigger a shift in the capacities of midwives by filling a knowledge gap that might otherwise have to be filled by specialists. In addition, IT in the form of digitized job aids might trigger service exchange as midwives use them to handle complicated tasks such as prescriptions and breach deliveries that were shifted to them by senior professionals (Paper V). The use of digitalized job aids has been advocated by Deller et al. (2015), who demonstrated that simple digitalized job aids and service protocols tested for comprehensibility and ease of use can enable midwives to fulfil their new tasks.

Furthermore, findings of the studies indicate that value propositions embedded in IT might transform capacities by ensuring that professionals have access to health information and promote learning through knowledge sharing and collaboration (Papers II and V). For instance, integrated summaries embedded in the obstetrics system provide flexibility to integrate new resources in the service system by triggering healthcare professionals to supplement information on pregnant women in the obstetrics system (Paper II). The summaries contain information in the form of diagnostic and treatment notes and updates on the status of pregnant women throughout their pregnancies. This information is shared with other professionals handling the delivery. Integrated summaries could trigger the shift of the capacities of professionals as they access and interpret information posted by other professionals, possibly leading to an intellectual shift through learning and knowledge exchange (Paper II). Integrated summaries, collaborations, and team decision making have been identified as activities that support value co-creation in healthcare (Beirão et al. 2017). Integrated summaries might improve service quality in the maternal healthcare ecosystem by saving time that would instead be spent gathering information and understanding the status of pregnant women before providing required services, leading to care continuity and broad healthcare coverage (Paper II).

Findings of the studies indicate that IT might transform the capacities of CHWs in low-resource settings by triggering a shift of their capac-

ities from only collecting data to diagnosing. For instance, CHWs use a mobile-based diagnostic app connected via Bluetooth to a hand-held self-diagnostic device attached to a sensor belt tied on the pregnant woman's stomach (Papers III and IV). This device triggers service exchange by assessing the pregnancy condition, sensing the condition of the foetus and notifying CHWs (Papers III and IV). The diagnostic information includes the temperature, foetal heart rate, and uterine contractions. This information would trigger knowledge acquisition by CHWs to make informed decisions (Papers III and IV), rather than physically observing pregnant women for danger signs (Paper I). This might enhance their capacities and reduce uncertainty. Payne et al. (2014) have also noted that mHealth enables CHWs to identify women at risk of hypersensitive disorders of pregnancy.

Findings of the studies indicate that IT might transform the capacities of pregnant women, shifting them from passively receiving and seeking knowledge to peer participation through sharing knowledge and experiences. An example of such a transformation is when pregnant women become cross-pollinators of knowledge by using mHealth apps with a feature that links them to social media sites that prompt them to share experiences with peers and rewards them for such participation (Paper III). Rewarding participation motivates the users of the apps and leads to collaborative value co-creation. This finding is similar to findings by Hardyman et al. (2015), who found that establishing different types of incentives to drive participation in networks provides an opportunity to design new methods to share value among actors, leading to new innovations that support value co-creation. In addition, findings indicate that at health facilities in low-resource settings, midwives delegate tasks to mentor mothers; these women leaders give health education talks to pregnant women to help them avoid stigma, especially for pregnant women infected with HIV/AIDs (Paper V). This finding leads to value co-creation among pregnant women, as indicated by Loane et al. (2014), who found that peers create and obtain value through the generalized exchange of social support. However, findings of the studies show that IT has not been utilized as a trigger for exchanging health education talks among peers (Paper V). However, Goh et al. (2016) have argued that online health communities enable rural patients to communicate and share knowledge with

their peers, to maintain a positive outlook and better manage their disease conditions. In addition, Venkatesh et al. (2016) have argued that e-health kiosks trigger the exchange of healthcare practices among illiterate villagers. This thesis accordingly argues that such digital IT resources might trigger the transformation of pregnant women's capacities, especially if digitalized content is translated into a language that can easily be interpreted and understood by the women and is presented in an appropriate format (Paper III). In addition, findings of the studies show that mHealth apps push messages, in the form of health tips and educative messages, that trigger pregnant women to acquire knowledge (Paper III). This could lead to attitude change and the self-management of care, and guide decision making with family and friends. Self-management of care and shared decision making between patients, families, and the healthcare team have been identified as avenues that inspire doctors to seek the opinions of patients and their families in designing supportive healthcare packages (Frow et al. 2016).

5.2.3. REORGANIZING TASKS IN MATERNAL HEALTHCARE

Findings of the studies indicate that IT enables the sharing of patient information between health facilities, which facilitates care continuity and leads to broader healthcare coverage (Paper II). For example, patient journals in the obstetrics system are shared between hospitals and maternity clinics throughout a region. The obstetrics system contains complete information about pregnant women, including about earlier pregnancies, which leads to better healthcare provision. Tasks are reorganized and shared when resources are rearranged for easy accessibility among actors in service systems (Breidbach and Maglio 2015).

Findings of the studies indicate that tasks connected to value co-creation processes such as referral and immunization could be reorganized by using IT to trigger information sharing between the micro and meso levels at which CHWs refer pregnant women to health facilities (Papers I, III, and IV). For example, IT in the form of digitalized checklists is used by midwives in maternity clinics to capture information about pregnant women, including their family history, earlier complicated deliveries, and any pregnancy fears suffered by them. The information collected might

trigger decisions by midwives as to whether the pregnant women should be referred to obstetricians or should follow the normal pregnancy care programme at the maternity clinic. In this way, tasks are reorganized by identifying which women need additional care from an obstetrician, thereby reorganizing tasks to enable the obstetrician to meet with the identified women. Findings of the studies indicate that during the referral process in low-resource settings, actors physically interact and relate with each other. However, at the moment, the process is challenged by the way in which the different actors collaborate at both the community and health facility levels (Paper I). IT has not been utilized to trigger reorganization of the referral tasks, leading to poor collaboration, poor communication, unproductive women's attitudes, and a lack of transport to reach health facilities (Paper I). IT in the form of digitalized checklists could improve the referral process by enabling professionals to coordinate easily at different levels and to have a shared view of the available resources and the health status of the pregnant woman (Paper I). This shared view would improve communication between actors at different levels of maternal healthcare, enabling midwives at the facilities to plan for resources when necessary.

In the area of immunization, IT could trigger the reorganization of tasks in a way that improves coverage and timeliness. For example, shifting some immunization tasks from midwives to CHWs would entail the use of digitalized forms in mHealth apps by CHWs to capture immunization data in the community and health facilities and use it to trigger vaccination visits by pregnant women (Paper V). This would help midwives easily plan for resources needed for immunization outreach-related activities. Immunization registries and SMS reminders would improve immunization coverage and timeliness (Nguyen et al. 2017). Findings of studies indicate that summary information captured by mHealth apps is viewed by district administrators using dashboards located at the health facilities, improving the reporting process (Paper III). Integration of information captured by mHealth apps with information in local digitalized health information systems (DHISs) would strengthen the health system by enabling better resource planning and triggering service exchange (Paper III). This information would enable healthcare providers to plan for the resources required in order to serve the pregnant women and to plan outreach programmes within the district.

Findings of the studies indicate that IT could trigger the reorganization of health education talks by promoting health information in the form of digitalized education charts, health tips, and videos to CHWs, mentor mothers, and pregnant women to raise their awareness of health issues (Paper V). The health information provided would trigger CHWs and mentor mothers to better communicate specific health information rather than relying on their memories to recall knowledge from training (Paper V). Kampmeijer et al. (2016) have recommended the use of IT in the form of visuals on apps, websites, video consultations, and webinars as a way of advocating for better health practices. Mobile phone-based videos and direct observation of treatment can be used to disseminate knowledge of diseases (Agarwal et al. 2015), thereby improving wellbeing.

5.3. LIMITATIONS OF THE STUDY

As with all research, the results presented here are not without limitations. These limitations concern: 1) the S-D framework applied in the study; 2) the scope of the study; and 3) the internal validity of the analysis. These limitations are discussed below.

As mentioned earlier, this thesis advocates a move from health provider-centred care to value-based maternal healthcare. To gain insights into the contribution of IT to value-based maternal healthcare, concepts from the S-D logic framework enabled an understanding of actors, their interactions with various resources, and how IT triggers actors to integrate resources, thereby co-creating value. S-D logic asserts that all actors are resource integrators. In healthcare, power and responsivity are important aspects to consider for resource integration to occur. In this research setting, women have no decision-making power and cannot independently assume an active role in making medical decisions. However, this thesis shows that involving other actors, such as CHWs, family, and friends, creates opportunities for such women to address health-related social needs. Moreover, IT as a resource triggers and enables such women to integrate resources. In addition, according to the S-D logic perspective, pregnant women are not the only beneficiaries of maternal healthcare, so value is co-created not only for them but for all other actors as well. Hence, S-D logic

provided an opportunity to understand value as perceived by all actors. Despite these benefits, this thesis finds limitations in the use of S-D logic.

First, S-D logic's view that operant resources are the most important for resource integration may not be applicable in low-resource settings. Findings in this thesis indicate that the participation of pregnant women in resource integration was affected by a lack of operand resources in the form of mobile phones, devices, and transport to reach health facilities. Second, not all actors, including pregnant women, are willing to participate in the co-creation process; they may need to be motivated, but motivation has not been addressed in the S-D literature. Third, since S-D logic originates from the marketing domain, its application in healthcare and information system research provides different interpretations of certain concepts, such as value, which may be viewed differently by various researchers. Value cannot not be determined ex ante, but is perceived experientially and in different ways. The collective and individual values presented here serve as examples and may not be perceived in the same way by actors in another area of healthcare or in the same context.

Another type of limitation is reflected in the research scope and affects the generalizability of the results. The present results are based on empirical data from a few countries that are very different from one another. Most of the data were collected from the meso and micro levels of 11 low-resource settings from one of the studied countries. These meso and micro levels have institutions and institutional arrangements in common with the macro level in this country. Therefore, the findings can be generalized to settings similar to those included in the studies. Future work could extend this research with additional cases having similar settings. It should be noted that, despite describing the research process with transparency, the limitation of replicability remains. It might not be possible to obtain the same results if the study were carried out again. In addition, the cases studied target a specific industry, i.e. maternal healthcare, so the results may differ in other areas of healthcare. The ways in which the results are interpreted by participants in the chosen settings may or may not reflect the interpretations of similar participants in other similar settings.

Another limitation concerns the internal validity of the analysis. The results were analysed by one researcher: this threatens internal validity due to researcher bias, as the results were seen through the lens of just one

researcher's understanding and interpretation. This limitation could have been mitigated by involving another researcher in the analysis process. Lastly, due to limitations arising from the ethical approval process, some studies did not directly involve pregnant women as respondents. However, the views of pregnant women were indirectly obtained through other respondents, including midwives, CHWs, and mHealth app designers. Such indirect views may not reflect the views of pregnant women, possibly leading to misinterpretation of the results.

5.4. OVERALL RESEARCH CONTRIBUTIONS AND IMPLICATIONS

The overall aim of this thesis is to enhance our knowledge of the contribution of IT to value-based maternal healthcare. The research presented here consists of contributions within the area of IT as a resource in service provision. These contributions consist of empirical knowledge, theoretical contributions, and practical and policy contributions.

Empirical knowledge of the practices in maternal healthcare and ways in which IT has been used to benefit maternal healthcare. Novel insights include, first, the way in which healthcare is perceived by actors and the existing processes and structures that support actors in maternal healthcare. Second, the importance of relationships among professionals and non-professionals at various levels of healthcare in achieving value-based healthcare is another insight. Third, the integration of digital infrastructures, such as a district health information system and mobile infrastructure, was found to facilitate and trigger resource integration by all actors at various levels of healthcare. In addition, *empirical knowledge of opportunities in the design and use of IT* for value-based maternal healthcare was identified. Design opportunities included architectural components that fit within the limited infrastructure of low-resource settings and trigger resource integration. Such components may support ways of accessing resources, sharing knowledge, collaborating, facilitating social support among actors, and rewarding participation. In addition, use of IT can foster resource integration by communicating value propositions, providing a shared view of resources, and creating new relationships among actors at

various levels. Lastly, empirical knowledge was gained *of value as perceived by actors when they use IT to engage in co-creation activities*. Value is perceived as collective at the macro and meso levels, but as individual at the micro level. Co-creation activities that generate this value include referring pregnant women, registering pregnant women, and promoting healthy behaviours. These activities are co-created when actors interact with others and with IT, thereby providing insights into the worthiness and usability of mHealth as a resource to achieve value-based maternal healthcare in low-resource settings.

Theoretically, this thesis contributes to information systems research by enhancing knowledge of the role of IT in service innovation, specifically drawing on the S-D perspective, an underexplored area in IS research (Brust et al. 2018). In particular, this thesis contributes to research on the operant role of IT in service innovation, an area that has been underexplored, as indicated by Akaka and Vargo (2014) and Frey et al. (2017). As an operant, IT triggers value co-creation by recreating relationships among actors, transforming actor capacities, and reorganizing tasks in maternal healthcare; this research argues that when these take place, new resources are created leading to service innovation. Such innovations contribute to maternal healthcare in low-resource settings by creating new resources (i.e. knowledge and skills) that are applied by actors to co-create value rather than depending on the limited number of healthcare professionals. In addition, these innovations lead to improved healthcare coverage and continuity as health-related information is shared and accessed by actors at various levels of healthcare. This thesis identifies the importance of IT in resource integration that leads to value, thereby supporting the assertion in S-D logic research that resource integration is key to understanding value co-creation.

Second, the interplay of the three identified aspects reveals a "self-adjusting system of resource integrating actors" (Lusch and Nambisan 2015, p. 161) that considers IT a resource. Thus, connecting actors to trigger the recreation of relationships leads to the transformation of their capacities, as new resources are created during interactions. Transforming actor capacities leads to the reorganization of tasks. On the other hand, when we reorganize tasks, capacities are transformed, and if the capacity is transformed, the relationships among actors are recreated. The interplay among

all three aspects extends our understanding of the dynamics and transformative perspective required to achieve value-based maternal healthcare. This resembles the S-D logic ecosystem perspective that views all actors as resource integrators, so knowing how actors integrate resources using IT provides clues as to how they co-create value-based maternal healthcare.

Practically, the thesis contributes to a value-based system of care that reduces costs and increases access to healthcare, as advocated by Porter (2009), Batalden et al. (2016), and Frow et al. (2016). Specifically, the thesis conceptualizes healthcare as a service to identify processes and structures that help multiple actors adopt value-based maternal healthcare. The thesis has managerial implications for value-based maternal healthcare, including: 1) Institutions and institutional arrangements should encourage all actors to perform resource integration activities. Insights into value as perceived by actors overcomes opposing demands in the co-creation activities at various levels of healthcare. 2) Digital infrastructures should communicate value propositions and provide resource-rich service platforms for resource integration. Revealing individual and collective values provides important insights into the functional roles of IT. Such roles define and enable access to value propositions for many actors at different levels, thus enabling resource integration. In addition, revealing value may facilitate the scale-up of mHealth in low-resource settings, as advocated by Hurt et al. (2016) and Lee et al. (2016).

Lastly, the thesis contributes to *policy* by suggesting a better way of applying the task-shifting strategy in low-resource settings, by triggering relationships that encourage resource integration among professionals and non-professionals using IT. Policy implications include: 1) technology use and designs should support professionals and non-professionals in the task-shifting strategy; 2) the integration of health information systems and mHealth apps should facilitate resource integration at the meso and micro levels of healthcare; and 3) the resource commitments needed for better maternal healthcare outcomes should be determined.

REFERENCES

Abbott PA, Foster J, Marin H de F, Dykes PC (2014) Complexity and the science of implementation in health IT-knowledge gaps and future visions. Int J Med Inform 83:e12–e22. doi: 10.1016/j.ijmedinf.2013.10.009

Abernathy, William J. and Utterback JM (1978) Abernathy and Utterback, 1978 Patterns of Industrial Innovation. Technol. Rev. 80:40–47

Agarwal S, Perry HB, Long LA, Labrique AB (2015) Evidence on feasibility and effective use of mHealth strategies by frontline health workers in developing countries: Systematic review. Trop. Med. Int. Heal. 20:1003–1014

Aithal A, Aithal PS (2017) Task Shifting - An alternative survival strategy for health care organizations. J Sci Res Mod Educ 2:34–48

Akaka MA, Vargo SL (2014) Technology as an operant resource in service (eco)systems. Inf Syst E-bus Manag 12:367–384. doi: 10.1007/s10257-013-0220-5

Akaka MA, Vargo SL, Lusch RF (2012) An exploration of networks in value cocreation: A service-ecosystems view. Rev Mark Res 9:13-50

Anderson P, Tushman ML (1991) Managing Through Cycles of Technological Change. Res Manag 34:26–31. doi: 10.1080/08956308.1991.11670739

Arthur W. (2009) The Nature of Technology: What It Is and How It Evolves. Futures 42:1031–1032. doi: 10.1016/j.futures.2010.08.014

Arthur WB (2015) Complexity and the economy. Oxford University Press, New York, NY

Asangansi I, Braa K (2010) The emergence of mobile-supported national health information systems in developing countries. Stud Health Technol Inform 160:540–544. doi: 10.3233/978-1-60750-588-4-540

Atnafu A, Otto K, Herbst CH (2017) The role of mHealth intervention on maternal and child health service delivery: findings from a randomized controlled field trial in rural Ethiopia. mHealth 3:39–39. doi: 10.21037/mhealth.2017.08.04

Barki H, Hartwick J (1989) Rethinking the concept of user involvement. MIS Q Manag Inf Syst 13:53–63. doi: 10.2307/248700

Barki H, Hartwick J (1994) Measuring user participation, user involvement, and user attitude. MIS Q Manag Inf Syst 18:59–79. doi: 10.2307/249610

Barras R (1986) Towards a theory of innovation in services. Res Policy 15:161–173. doi: 10.1016/0048-7333(86)90012-0

Barras R (1990) Interactive innovation in financial and business services: The vanguard of the service revolution. Res Policy 19:215–237. doi: 10.1016/0048-7333(90)90037-7

Barrett M, Davidson E, Prabhu J, Vargo SL (2015) Service innovation in the digital age: Key contributions and future directions. MIS Q 39:135–154. doi: 10.1016/S0090-2616(98)90006-7

Batalden M, Batalden P, Margolis P, et al (2016) Coproduction of healthcare service. BMJ Qual Saf 25:509–517. doi: 10.1136/bmjqs-2015-004315

Beach MC, Inui T, Frankel R, et al (2006) Relationship-centered care: A constructive reframing. J Gen Intern Med 21:S3–S8

Beirão G, Patrício L, Fisk RP (2017) Value cocreation in service ecosystems. J Serv Manag 28:227–249. doi: 10.1108/JOSM-11-2015-0357

Bendapudi N, Leone RP (2003) Psychological implications of customer participation in co-production. J Mark 67:14–28. doi: 10.1509/jmkg.67.1.14.18592

Berry LL, Bendapudi N (2007) Health Care. J Serv Res 10:111–122. doi: 10.1177/1094670507306682

Bhaskar R (2008) Dialectic: The Pulse of Freedom. Routledge

Bhattacharyya K, Winch P, LeBan K, Tien M (2001) Community Health Worker Incentives and Disincentives: How They Affect Motivation, Retention, and Sustainability. Basic Support Institutionalizing Child Surviv Proj (BASICS II) 1–52

Blumenthal D, Tavenner M (2010) The "Meaningful Use" Regulation for Electronic Health Records. N Engl J Med 363:501–504. doi: 10.1056/NEJMp1006114

Bødker S, Kyng M (2018) Participatory design that matters—Facing the big issues. ACM Trans Comput Interact 25:1–31. doi: 10.1145/3152421

Bostrom R, Gupta S, Thomas D (2009) A meta-theory for understanding information systems within sociotechnical systems. J Manag Inf Syst 26:17–48. doi: 10.2753/MIS0742-1222260102

Braa K, Purkayastha S (2010) Sustainable mobile information infrastructures in low resource settings. Stud Health Technol Inform 157:127–132. doi: 10.3233/978-1-60750-569-3-127

Braa K, Sanner TA (2011) Making Mhealth Happen for Health Information Systems in Low Resource Contexts. Proc 11th Int Conf Soc Impl of Com in Dev Count, Kathmandu, Nepal, May 2011. pp 1–13

Braddock CH (2010) The emerging importance and relevance of shared decision making to clinical practice. Med. Decis. Mak. 30

Braun V, Clarke V (2006) Using thematic analysis in psychology. Qual Res Psychol 3:77–101. doi: 10.1191/1478088706qp063oa

Breidbach CF, Kolb DG, Srinivasan A (2013) Connectivity in Service Systems: Does Technology-Enablement Impact the Ability of a Service System to Co-Create Value? J Serv Res 16:428–441. doi: 10.1177/1094670512470869

Breidbach CF, Maglio PP (2016) Technology-enabled value co-creation: An empirical analysis of actors, resources, and practices. Ind Mark Manag 56:73–85. doi: 10.1016/j.indmarman.2016.03.011

Breidbach CF, Maglio PP (2015) A Service Science perspective on the role of ICT in Service Innovation. Proc 23rd Eur Conf Inf Syst 1–9

Brender J, Ammenwerth E, Nykänen P, Talmon J (2006) Factors Influencing Success and Failure of Health Informatics Systems. Methods Inf Med 45:125–136

Brust L, Antons D, Breidbach CF, Salge TO (2018) Service-Dominant Logic and Information Systems Research: A Review and Analysis Using Topic Modeling. Proc 38th Int Conf Inf Syst: Transform Soc with Digit Innov, Seoul, South Korea, December 2017. pp. 1-12.

Bryson J, Daniels P, Warf B (2006) Service Worlds: People, Organisations, Technologies. J Econ Geogr 6:246–247. doi: 10.1093/jeg/lbi007

Caridà A, Colurcio M, Melia M (2014) Rethinking and Improving the Health Care Service Through Interactive Web Technologies. In: Managing Consumer Services. Springer International Publishing, Cham, pp 191–210

Carman KL, Dardess P, Maurer M, et al (2013) Patient and family engagement: A framework for understanding the elements and developing interventions and policies. Health Aff 32:223–231. doi: 10.1377/hlthaff.2012.1133

Ceccagnoli M, Forman C, Huang P, Wu DJ (2012) Cocreation of valueina platform ecosystem : the case of enterprise software. MIS Q Manag Inf Syst 36:263–290. doi: 10.2307/41410417

Cermak DSP, File KM, Prince RA (1994) Customer Participation In Service Specification And Delivery. J. Appl. Bus. Res. 10:90–97

Chandler JD, Vargo SL (2011) Contextualization and value-in-context: How context frames exchange. Mark Theory 11:35–49. doi: 10.1177/1470593110393713

Chen H, Chai Y, Dong L, et al (2018) Effectiveness and appropriateness of mhealth interventions for maternal and child health: Systematic review. J. Med. Internet Res. 20:e7

Cohen R, Ansar H, Bernard L, Mount B (1996) Quality of life in HIV disease as measured by the McGill Quality of Life Questionnaire. AIDS 10:1421-142.

Colvin CJ, de Heer J, Winterton L, et al (2013) A systematic review of qualitative evidence on barriers and facilitators to the implementation of task-shifting in midwifery services. Midwifery 29:1211–1221. doi: 10.1016/j.midw.2013.05.001

Coombs R, Miles I (2000) Innovation, Measurement and Services: The New Problematique. In: Innovation Systems in the Service Economy, Economics of Science, Technology, and Innovation. pp 85–103

Currie WL, Seddon JJM (2014) A cross-national analysis of eHealth in the European Union: Some policy and research directions. Inf Manag 51:783–797. doi: 10.1016/j.im.2014.04.004

Dabholkar PA (1990) How to Improve Perceived Service Quality by Increasing Customer Participation. In: Developments in Marketing Science. pp 483–487

Damanpour F, Walker RM, Avellaneda CN (2009) Combinative effects of innovation types and organizational Performance: A longitudinal study of service organizations. J Manag Stud 46:650–675. doi: 10.1111/j.1467-6486.2008.00814.x

Dambisya YM MS (2012) Policy and Programmatic implication of task shifting in Uganda: A case study. BMC Health Services Research. BMC Health Serv Res 12:61. doi: 10.1186/1472-6963-12-61.

Dawson AJ, Buchan J, Duffield C, et al (2014) Task shifting and sharing in maternal and reproductive health in low-income countries: A narrative synthesis of current evidence. Health Policy Plan 29:396–408. doi: 10.1093/heapol/czt026

Deering MJ, Baur C (2015) Patient portals can enable provider-patient collaboration and person-centered care. In: Information Technology for Patient Empowerment in Healthcare. pp 93–112

Deller B, Tripathi V, Stender S, et al (2015) Task shifting in maternal and newborn health care: Key components from policy to implementation. Int J Gynecol Obstet 130:S25–S31. doi: 10.1016/j.ijgo.2015.03.005

den Hertog p (2000) Knowledge-intensive business services as co-producers of innovation. Int J Innov Manag 04:491–528. doi: 10.1142/s136391960000024x

Drejer I (2004) Identifying innovation in surveys of services: A Schumpeterian perspective. Res Policy 33:551–562. doi: 10.1016/j.respol.2003.07.004

Edvardsson B, Kleinaltenkamp M, Tronvoll B, et al (2014) Institutional logics matter when coordinating resource integration. Mark Theory 14:291–309. doi: 10.1177/1470593114534343

Edvardsson B, Tronvoll B, Gruber T (2011) Expanding understanding of service exchange and value co-creation: A social construction approach. J Acad Mark Sci 39:327–339. doi: 10.1007/s11747-010-0200-y

Esmaeilzadeh P, Sambasivan M (2016) Health Information Exchange (HIE): A literature review, assimilation pattern and a proposed classification for a new policy approach. J Biomed Inform 64:74–86. doi: 10.1016/j.jbi.2016.09.011

Fisher J, de Mello MC, Patel V, et al (2012) Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: A systematic review. Bull World Health Organ 90:139–149. doi: 10.2471/BLT.11.091850

Frey A, Trenz M, Veit D (2017) the Role of Technology for Service Innovation in Sharing Economy Organizations – a Service-Dominant Logic Perspective. Proc 25th Eur Conf Info Syst, Portugal, Guimaraes:1885–1901

Fritz F, Tilahun B, Dugas M (2015) Success criteria for electronic medical record implementations in low-resource settings: A systematic review. J Am Med Informatics Assoc 22:479–488. doi: 10.1093/jamia/ocu038

Frow P, McColl-Kennedy JR, Hilton T, et al (2014) Value propositions: A service ecosystems perspective. Mark Theory 14:327–351. doi: 10.1177/1470593114534346

Frow P, McColl-Kennedy JR, Payne A (2016) Co-creation practices: Their role in shaping a health care ecosystem. Ind Mark Manag 56:24–39. doi: 10.1016/j.indmarman.2016.03.007

Frow P, Payne A (2018) Value Cocreation: An Ecosystem Perspective. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, pp 80–96

Gallan AS, Jarvis CB, Brown SW, Bitner MJ (2013) Customer positivity and participation in services: An empirical test in a health care context. J Acad Mark Sci 41:338–356. doi: 10.1007/s11747-012-0307-4

Gallouj F, Savona M (2009) Innovation in services: A review of the debate and a research agenda. J Evol Econ 19:149–172. doi: 10.1007/s00191-008-0126-4

Gallouj F, Windrum P (2009) Services and services innovation. J Evol Econ 19:141–148. doi: 10.1007/s00191-008-0123-7

Galvagno M, Dalli D (2014) Theory of value co-creation: A systematic literature review. Manag Serv Qual 24:643–683. doi: 10.1108/MSQ-09-2013-0187

Goh JM, Gao G, Agarwal R (2016) The creation of social value : Can an online health community reduce rural – urban health disparities ? MIS Q 40:247–263

Griffith TL (1999) Technology Features as Triggers for Sensemaking. Acad Manag Rev 24:472–488

Grover V, Kohli R (2012) Cocreating IT value: New capabilities and metrics for multifirm environments. MIS Q 36:225–232

Groves P, Kayyali B, Knott D, Kuiken S Van (2013) The 'big data'revolution in healthcare: Accelerating value and innovation. McKinsey & Company

Gummesson E (2008) Extending the service-dominant logic: From customer centricity to balanced centricity. J Acad Mark Sci 36:15–17. doi: 10.1007/s11747-007-0065-x

Halskov K, Hansen NB (2015) The diversity of participatory design research practice at PDC 2002-2012. Int J Hum Comput Stud 74:81–92. doi: 10.1016/j.ijhcs.2014.09.003

Han, Oh, Im, et al (2012) Value Cocreation and Wealth Spillover in Open Innovation Alliances. MIS Q 36:291. doi: 10.2307/41410418

Hardyman W, Daunt KL, Kitchener M (2015) Value Co-Creation through Patient Engagement in Health Care: A micro-level approach and research agenda. Public Manag Rev 17:90–107. doi: 10.1080/14719037.2014.881539

Henfridsson O, Bygstad B (2013) The Generative Mechanisms of Digital Infrastructure Evolution1. MIS Q 37:907–931

Hennink MM, Hutter I, Bailey A (2011) Qualitative research methods. SAGE

Hibbard JH, Greene J (2013) What the evidence shows about patient activation: Better health outcomes and care experiences; fewer data on costs. Health Aff 32:207–214. doi: 10.1377/hlthaff.2012.1061

Hibbard JH, Stockard J, Mahoney ER, Tusler M (2004) Development of the Patient Activation Measure (PAM): Conceptualizing and Measuring Activation in Patients and Consumers. Health Serv Res 39:1005–1026. doi: 10.1111/j.1475-6773.2004.00269.x

Higa C, Davidson EJ (2017) Building Healthier Communities : Value Co-Creation within the Chronic Care Model for Rural Under-Resourced Areas. Proc 50th Hawaii Int Conf Syst Sci, Hawaii, Manoa:3527–3536

Holton JA, Walsh I (2016) Classic grounded theory: Applications with qualitative and quantitative data.

Hurt K, Walker RJ, Campbell JA, Egede LE (2016) mHealth Interventions in Low and Middle-Income Countries: A Systematic Review. Glob J Health Sci 8:183. doi: 10.5539/gjhs.v8n9p183

Joiner KA, Lusch RF (2016) Evolving to a new service dominant logic for health care. Innov Entrep Heal 3:25–33

Kampmeijer R, Pavlova M, Tambor M, et al (2016) The use of e-health and m-health tools in health promotion and primary prevention among older adults: a systematic literature review. BMC Health Serv Res 16:290. doi: 10.1186/s12913-016-1522-3

Kappelman LA, McLean ER (1991) The respective roles of user participation and user involvement in information. Proc Twelfth Int Conf Inf Syst 339–349

Kassebaum NJ, Bertozzi-Villa A, Coggeshall MS, et al (2014) Global, regional, and national levels and causes of maternal mortality during 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet (London, England) 384:980–1004. doi: 10.1016/S0140-6736(14)60696-6

Kjellberg H, Helgesson CF (2007) On the nature of markets and their practices. Mark Theory 7:137–162. doi: 10.1177/1470593107076862

Kjellberg H, Helgesson CF (2006) Multiple versions of markets: Multiplicity and performativity in market practice. Ind Mark Manag 35:839–855. doi: 10.1016/j.indmarman.2006.05.011

Kleinrouweler C, Cheong-See F, Collins G (2016) Prognostic models in obstetrics: available, but far from applicable. Am J Obstet Gynaecol 214:79-90

Koskela-Huotari K, Edvardsson B, Tronvoll B (2018) Emergence of novel resources in service ecosystems. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, 55 City Road, pp 372–386

Koskela-Huotari K, Vargo SL (2016) Institutions as resource context. J Serv Theory Pract 26:163–178. doi: 10.1108/JSTP-09-2014-0190

Koutsikouri D, Lindgren R, Henfridsson O (2017) Building Digital Infrastructures: Towards an Evolutionary Theory of Contextual Triggers. Proc 50th Hawaii Int Conf Syst Sci 4716–4725. doi: 10.24251/hicss.2017.575

Lawrence TB, Suddaby R (2006) Institutions and institutional work. The SAGE Handbook of Organisation Studies pp.215–254

Lee DH (2019) Effects of key value co-creation elements in the healthcare system: focusing on technology applications. Serv Bus 13:389–417. doi: 10.1007/s11628-018-00388-9

Lee SH, Nurmatov UB, Nwaru BI, et al (2016) Effectiveness of mHealth interventions for maternal, newborn and child health in low–and middle–income countries: Systematic review and meta–analysis. J Glob Health 6:. doi: 10.7189/jogh.06.010401

Loane SS, Webster CM, D'Alessandro S (2014) Identifying Consumer Value Co-created through Social Support within Online Health Communities. J Macromarketing 35:. doi: 10.1177/0276146714538055

Löbler H (2018) The Sustainability of Service Ecosystems. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, 55 City Road, pp 357–371

Löbler H (2011) Position and potential of service-dominant logic - Evaluated in an "ism" frame for further development. Mark Theory 11:51–73. doi: 10.1177/1470593110393711

Lund S, Hemed M, Nielsen BB, et al (2012) Mobile phones as a health communication tool to improve skilled attendance at delivery in Zanzibar: A cluster-randomised controlled trial. BJOG An Int J Obstet Gynaecol 119:1256–1264. doi: 10.1111/j.1471-0528.2012.03413.x

Lusch RF, Nambisan S (2015) Service innovation: A service-dominant logic perspective. Mis Q 39:155–175

Lusch RF, Vargo SL (2014) Service-dominant logic : premises, perspectives, possibilities. Cambridge University Press

Maglio PP, Spohrer J (2008) Fundamentals of service science. J Acad Mark Sci 36:18–20. doi: 10.1007/s11747-007-0058-9

Markus ML, Mao J-Y (2004) Participation in Development and Implementation - Updating An Old, Tired Concept for Today's IS Contexts. J Assoc Inf Syst 5:514–544. doi: 10.17705/1jais.00057

Marmot M, Allen J, Bell R, et al (2012) WHO European review of social determinants of health and the health divide. Lancet 380:1011–1029. doi: 10.1016/S0140-6736(12)61228-8

McColl-Kennedy J., Cheung L (2018) Value Cocreation: Conceptualizations, Origins, and Developments. In: The SAGE Handbook of Service-Dominant Logic. p 63

McColl-Kennedy JR, Hogan SJ, Witell L, Snyder H (2017a) Cocreative customer practices: Effects of health care customer value cocreation practices on well-being. J Bus Res 70:55–66. doi: 10.1016/j.jbusres.2016.07.006

McColl-Kennedy JR, Snyder H, Elg M, et al (2017b) The changing role of the health care customer: review, synthesis and research agenda. J Serv Manag 28:2–33. doi: 10.1108/JOSM-01-2016-0018

McColl-Kennedy JR, Vargo SL, Dagger TS, et al (2012) Health Care Customer Value Cocreation Practice Styles. J Serv Res 15:370–389. doi: 10.1177/1094670512442806

McCurdie T, Taneva S, Casselman M, et al (2012) mHealth consumer apps: the case for user-centered design. Biomed Instrum Technol Suppl:49–56. doi: 10.2345/0899-8205-46.s2.49

Mckeen JD, Guimaraes T, Wetherbe JC (1994) Four Contingency Factors Between User User Satisfaction : An Investigation of Four Contingency Factors. MIS Q 18:427–451

Mele C, Colurcio M, Russo-Spena T (2014) Research traditions of innovation: Goods-dominant logic, the resource-based approach, and service-dominant logic. Manag Serv Qual 24:612–642. doi: 10.1108/MSQ-10-2013-0223

Michel S, Brown SW, Gallan AS (2008) An expanded and strategic view of discontinuous innovations: Deploying a service-dominant logic. J Acad Mark Sci 36:54–66. doi: 10.1007/s11747-007-0066-9

Michie S, Miles J, Weinman J (2003) Patient-centredness in chronic illness: What is it and does it matter? Patient Educ Couns 51:197–206. doi: 10.1016/S0738-3991(02)00194-5

Mills PK, Morris JH (1986) Clients as " Partial " Employees of Service Organizations : Role Development in Client Participation. Acad Manag Rev 11:726–735

MoH, Health Systems 20/20, Health MUS of P (2012) Uganda Health System Assessment 2011. Uganda and Bethesda, MD: Health Systems 20/20 project, Abt Associates Inc.

Motamarri S (2017) Consumer Co-creation of Value in mHealth (Mobile Health) Service. J Creat Value 3:63–76. doi: 10.1177/2394964317697611

Mutale W, Chintu N, Amoroso C, et al (2013) Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative. BMC Health Serv Res 13:1–12. doi: 10.1186/1472-6963-13-S2-S9

Nabudere H, Asiimwe D, Mijumbi R (2011) Task shifting in maternal and child health care: An evidence brief for Uganda. Int J Technol Assess Health Care 27:173–179. doi: 10.1017/s0266462311000055

Nariswari A (2018) How Service Exchange Drives Market (Re) formation. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, pp 175–193

NAS (2019) Integrating Social Care into the Delivery of Health Care: moving upstream to improve the nation's health. The National Academic Press, Washington, DC

Nasi G, Cucciniello M, Guerrazzi C (2015) The role of mobile technologies in health care processes: The case of cancer supportive care. J Med Internet Res 17:. doi: 10.2196/jmir.3757

NEJM (2020) Social Determinants of Health (SDOH). NEJM Catal 3:. doi: 10.1056/CAT.17.0312

Nguyen HTT, Eikebrokk TR, Moe CE, et al (2016) Exploring health information technology implementation success factors: a comparative investigation in Nordic countries. Int J Healthc Technol Manag 15:

Nguyen NT, Vu HM, Dao SD, et al (2017) Digital immunization registry: evidence for the impact of mHealth on enhancing the immunization system and improving immunization coverage for children under one year old in Vietnam. mHealth 3:26. doi: 10.21037/mhealth.2017.06.03

Nijssen EJ, Hillebrand B, Vermeulen PAM, Kemp RGM (2006) Exploring product and service innovation similarities and differences. Int J Res Mark 23:241–251. doi: 10.1016/j.ijresmar.2006.02.001

Normann R, Ramírez R (1993) From value chain to value constellation: designing interactive strategy. Harv Bus Rev 71:65–77

Oertzen AS, Odekerken-Schröder G, Brax SA, Mager B (2018) Co-creating services—conceptual clarification, forms and outcomes. J Serv Manag 29:641–679. doi: 10.1108/JOSM-03-2017-0067

Okuga M, Kemigisa M, Namutamba S, et al (2015) Engaging community health workers in maternal and newborn care in eastern Uganda. Glob Health Action 8:23968. doi: 10.3402/gha.v8.23968

Omachonu VK, Einspruch NG (2010) Innovation in healthcare delivery systems: A conceptual framework. Innov J 15:1–20

Ordanini A, Parasuraman A (2011) Service Innovation Viewed Through a Service-Dominant Logic Lens: A Conceptual Framework and Empirical Analysis. J Serv Res 14:3–23. doi: 10.1177/1094670510385332

Ostrom AL, Bitner MJ, Brown SW, et al (2010) Moving Forward and Making a Difference: Research Priorities for the Science of Service. J Serv Res 13:4–36. doi: 10.1177/1094670509357611

Ostrom AL, Parasuraman A, Bowen DE, et al (2015) Service Research Priorities in a Rapidly Changing Context. J Serv Res 18:127–159. doi: 10.1177/1094670515576315

Payne AF, Storbacka K, Frow P (2008) Managing the co-creation of value. J Acad Mark Sci 36:83–96. doi: 10.1007/s11747-007-0070-0

Payne BA, Hutcheon JA, Ansermino JM, et al (2014) A Risk Prediction Model for the Assessment and Triage of Women with Hypertensive Disorders of Pregnancy in Low-Resourced Settings: The miniPIERS (Pre-eclampsia Integrated Estimate of RiSk) Multi-country Prospective Cohort Study. PLoS Med 11:e1001589. doi: 10.1371/journal.pmed.1001589

Peters L (2018) Resource integration: concepts and processes. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, 55 City Road, pp 341–356

Peters LD (2016) Heteropathic versus homopathic resource integration and value co-creation in service ecosystems. J Bus Res 69:2999–3007. doi: 10.1016/j.jbusres.2016.02.033

Pop OM, Leroi-Werelds S, Roijakkers N, Andreassen TW (2018) Institutional types and institutional change in healthcare ecosystems. J Serv Manag 29:593–614. doi: 10.1108/JOSM-02-2017-0041

Porter ME (2009) A strategy for health care reform - Toward a value-based system. N Engl J Med 361:109–112. doi: 10.1056/NEJMp0904131

Prahalad CK (2004) The co-creation of value—invited commentaries on 'evolving to a new dominant logic for marketing. J Mark 68:23

Prahalad CK, Ramaswamy V (2000) Co-opting Customer Competence. Havard Bus Rev 78:79–90

Prahalad CK, Ramaswamy V (2004) Co-creating unique value with customers. Strateg Leadersh 32:4–9. doi: 10.1108/10878570410699249

Prior L (2003) Introducing Qualitative Methods: Using documents in social research. SAGE

Rai A, Pavlou PA, Im G, Du S (2012) Interfirm IT capability profiles and communications for cocreating relational value : Evidence from the logistics industry. MIS Q Manag Inf Syst 36:233–262. doi: 10.2307/41410416

Robson C (2002) Real World Research: A Resource for Social Scientists and Practitioner Researchers. Oxford: Blackwell Publishers Ltd.

Rozenblum R, Miller P, Pearson D, et al (2015) Patient-centered healthcare, patient engagement and health information technology: the perfect storm. Inf Technol patient Empower Healthc 3–22

Say L, Chou D, Gemmill A, et al (2014) Global causes of maternal death: a WHO systematic analysis. Lancet Glob Heal 2:e323–e333. doi: 10.1016/S2214-109X(14)70227-X

Schnall R, Rojas M, Bakken S, et al (2016) A user-centered model for designing consumer mobile health (mHealth) applications (apps). J Biomed Inform 60:243–251. doi: 10.1016/j.jbi.2016.02.002

Scott WR (2001) Institutions and organizations, 2nd ed. Thousand Oaks, Sage, London

Sebastiani R, Paiola M (2010) Rethinking service innovation: four pathways to evolution. Int J Qual Serv Sci 2:79–94. doi: 10.1108/17566691011026612

Seidman G, Atun R (2017) Does task shifting yield cost savings and improve efficiency for health systems? A systematic review of evidence from low-income and middle-income countries. Hum Resour Health 15:1–13. doi: 10.1186/s12960-017-0200-9

Seraj M (2012) We create, we connect, we respect, therefore we are: intellectual, social, and cultural value in online communities. J Interact Mark 26:209-222

Sharma S, Conduit J, Hill S (2014) Organisational capabilities for customer participation in health care service innovation. Australas Mark J 22:179-188

Sheth JN, Uslay C (2007) Implications of the revised definition of marketing: From exchange to value creation. J. Public Policy Mark. 26:302–307

Silva BMC, Rodrigues JJPC, de la Torre Díez I, et al (2015b) Mobile-health: A review of current state in 2015. J. Biomed. Inform. 56:265–272

Sondaal SFV, Browne JL, Amoakoh-Coleman M, et al (2016) Assessing the Effect of mHealth Interventions in Improving Maternal and Neonatal Care in Low- and Middle-Income Countries: A Systematic Review. PLoS One 11:e0154664. doi: 10.1371/journal.pone.0154664

Sood H, Mcneil K (2017) How is health information technology changing the way we deliver NHS hospital care? Futur Healthc J 4:117–20

Srivastava SC, Shainesh G (2015) Bridging the Service Divide Through Digitally Enabled Service Innovations: Evidence From Indian Healthcare Service Providers. MIS Q 39:245-267

Storbacka K, Brodie RJ, Böhmann T, et al (2016) Actor engagement as a microfoundation for value co-creation. J Bus Res 69:3008–3017. doi: 10.1016/j.jbusres.2016.02.034

Strauss A, Corbin J (1990) Basics of qualitative research. SAGE Publications Ltd, CA

Swanson B (1974) Management Information Systems : Appreciation and Involvement. Manage Sci 21:178–188

Sweeney JC, Danaher TS, McColl-Kennedy JR (2015) Customer Effort in Value Cocreation Activities: Improving Quality of Life and Behavioral Intentions of Health Care Customers. J Serv Res 18:318–335. doi: 10.1177/1094670515572128

Thaddeus S, Maine D (1994) Too far to walk: Maternal mortality in context. Soc Sci Med. 38:1091-1110 doi: 10.1016/0277-9536(94)90226-7

UCC (2015) Postal , Broadcasting and Telecommunications Market & Industry Report Third Quarter 2014/15 Kampala, Uganda

Vargo S, Lusch R (2018) An Overview of Service-Dominant Logic. In: The SAGE Handbook of Service-Dominant Logic. SAGE Publications Ltd, pp 3–21

Vargo SL, Akaka MA (2012) Value Cocreation and Service Systems (Re)Formation: A Service Ecosystems View. Serv Sci 4:207–217. doi: 10.1287/serv.1120.0019

Vargo SL, Akaka MA, Vaughan CM (2017) Conceptualizing Value: A Service-ecosystem View. J Creat Value 3:117–124. doi: 10.1177/2394964317732861

Vargo SL, Lusch RF (2011) It's all B2B...and beyond: Toward a systems perspective of the market. Ind Mark Manag 40:181–187. doi: 10.1016/j.indmarman.2010.06.026

Vargo SL, Lusch RF (2016) Institutions and axioms: an extension and update of service-dominant logic. J Acad Mark Sci 44:5–23. doi: 10.1007/s11747-015-0456-3

Vargo SL, Lusch RF (2004) Evolving to a New Dominant Logic for Marketing. J Mark 68:1–17. doi: 10.1509/jmkg.68.1.1.24036

Vargo SL, Lusch RF (2008) Service-dominant logic: Continuing the evolution. J Acad Mark Sci 36:1–10. doi: 10.1007/s11747-007-0069-6

Vargo SL, Lusch RF (2017) Service-dominant logic 2025. Int J Res Mark 34:46–67. doi: 10.1016/j.ijresmar.2016.11.001

Vargo SL, Maglio PP, Akaka MA (2008) On value and value co-creation: A service systems and service logic perspective. Eur Manag J 26:145–152. doi: 10.1016/j.emj.2008.04.003

Vargo SL, Wieland H, Akaka MA (2015) Innovation through institutionalization: A service ecosystems perspective. Ind Mark Manag 44:63–72. doi: 10.1016/j.indmarman.2014.10.008

Varshney U (2014) Mobile health: Four emerging themes of research. Decis Support Syst 66:20-35

Venkatesh V, Rai A, Sykes TA, Aljafari R (2016) Combating Infant Mortality in Rural India: Evidence from a field study of eHealth Kiosk Implementations. MIS Q 40:353–380

Von Nordenflycht A (2010) What is a professional service firm? Toward a theory and taxonomy of knowledge-intensive firms. Acad Manag Rev 35:155–174. doi: 10.5465/AMR.2010.45577926

Voss C, Perks H, Sousa R, et al (2016) Reflections on context in service research. J Serv Manag 27:30–36. doi: 10.1108/JOSM-04-2015-0115

WHO (2016a) WHO | Maternal mortality. http://www.who.int/mediacentre/factsheets/fs348/en/. Accessed 20 May 2017

WHO (2018) WHO | Maternal health. In: Matern. Heal. http://www.who.int/maternal-health/en/. Accessed 30 Sep 2018

WHO (2007) Everybody's business: strengthening health systems to improve health outcomes: WHO's framework for action. Production 1–56. WHO Press.

WHO (2020) Maternal and newborn health. http://www.euro.who.int/en/health-topics/Life-stages/maternal-and-newborn-health/maternal-and-newborn-health. Accessed 23 Mar 2020

WHO (2015a) WHO | Density of physicians (total number per 1000 population, latest available year). https://www.who.int/gho/health_workforce/physicians_density/en/. Accessed 10 Oct 2019

WHO (1989) Strengthening the performance of community health workers in primary health care. Report of a WHO Study Group. World Health Organ. Tech. Rep. Ser. 780:1–46

WHO (2011) mHealth: New horizons for health through mobile technologies. Observatory 3:66–71. doi: 10.4258/hir.2012.18.3.231

WHO (2015b) WHO | Maternal mortality country profiles. http://www.who.int/gho/maternal_health/countries/en/. Accessed 25 Nov 2017

WHO (2014) Global maternal newborn, child and adolescent health policy indicator database based on key informant surveys in 2009-10, 2011 & 2013-14. http://www.who.int/maternal_child_adolescent/epidemiology/policy-indicators/en/

WHO (1998) World Health Day 1998; safe motherhood. Div Reprod Heal 72:98

WHO (2016b) Maternal mortality in 1990-2015 - Sweden. World Heal Organ 1–5

WHO (2012) Optimizing health worker roles to improve access to key maternal and newborn health interventions through task shifting. World Heal Organ 1–98

WHO (2015c) WHO recommendation on birth preparedness and complication readiness. WHO Reprod Heal Libr 1–8

WHO, PEPFAR, UNAID (2008) Task Shifting Global Recommendations and Guidelines. http://www.who.int/healthsystems/TTR-TaskShifting.pdf. Accessed 20 May 2017

Witell L, Anderson L, Brodie RJ, et al (2015) Exploring dualities of service innovation: implications for service research. J Serv Mark 29:436–441. doi: 10.1108/JSM-01-2015-0051

Witell L, Gebauer H, Jaakkola E, et al (2017) A bricolage perspective on service innovation. J Bus Res 79:290–298. doi: 10.1016/j.jbusres.2017.03.021

Yoo Y, Boland RJ, Lyytinen K, Majchrzak A (2012) Organizing for innovation in the digitized world. Organ Sci 23:1398–1408. doi: 10.1287/orsc.1120.0771

Zafar S, Sikander S, Haq Z, et al (2014) Integrating maternal psychosocial well-being into a child-development intervention: The five-pillars approach. Ann N Y Acad Sci 1308:107–117. doi: 10.1111/nyas.12339

Gothenburg Studies in Informatics

ISSN 1400-741X (print), ISSN 1651-8225 (online)

1. Ulf Sundin. A Logic Programming Approach to Information Modelling and Database Design, May 1990. (Licentiate Thesis).

2. Thanos Magolas and Kalevi Pessi. En studie om informationssystems- arkitekturer (in Swedish), February 1991. (Licentiate Thesis).

3. Peter Nordenstam. Individbaserade relativt öppna informationssystem (in Swedish), February, 1990. (Licentiate Thesis).

4. Bo Dahlbom and Lars Mathiassen. Struggling with quality; The Philosophy of Developing Computer Systems, August 1991. (Revised edition: Computers in Context. The Philosophy and Practice of Systems Design, Oxford: Blackwell, 1993.)

5. Börje Langefors. Essays on infology. Summing up and Planning for the Future, Edited by Bo Dahlbom, August 1993.

6. Bo Dahlbom (ed.). The Infological Equation. Essays in honor of Börje Langefors, March 1995.

7. Bo Dahlbom, Frederik Kämmerer, Fredrik Ljungberg, Jan Stage and Carsten Sørensen (eds.). Designing in Context. Proceedings of the 18th Information Systems Research Seminar in Scandinavia, June 1995.

8. Bo Dahlbom, Fredrik Ljungberg, Urban Nuldén, Kai Simon, Jan Stage and Carsten Sørensen (eds.). The Future. Proceedings of the 19th Information Systems Research Seminar in Scandinavia, June 1996.

9. Agneta Ranerup. Användarmedverkan med representanter (in Swedish), August 1996. (Doctoral Thesis).

10. Ole Hanseth. Information Technology as Infrastructure, November 1996. (Doctoral Thesis).

11. Fredrik Ljungberg. Networking, September 1997. (Doctoral Thesis).

12. Jan Ljungberg. From Workflow to Conversation, October 1997. (Doctoral Thesis).

13. Thanos Magoulas and Kalevi Pessi. Strategisk IT-management (in Swedish), March 1998. (Doctoral Thesis).

14. Fredrik Ljungberg (ed.). Informatics in the Next Millennium. Essays in honor of Bo Dahlbom, June 1999.

15. Urban Nuldén. e-ducation, May 1999. (Doctoral Thesis).

16. Lars Erik Holmquist. Breaking the Screen Barrier, May 2000. (Doctoral Thesis).

17. Nina Lundberg. IT in Healthcare - Artifacts, Infrastructures and Medical Practices, May 2000. (Doctoral Thesis).

18. Henrik Fagrell. Mobile Knowledge, October 2000. (Doctoral Thesis).

19. Staffan Björk. Flip Zooming - The Development of an Information Visualization Technique, October 2000. (Doctoral Thesis).

20. Johan Redström. Designing Everyday Computational Things, May 2001. (Doctoral Thesis).

21. Dick Stenmark. Designing the new Intranet, March 2002. (Doctoral Thesis).

22. Pouya Pourkomeylian. Software Practice Improvement, March 2002. (Doctoral Thesis).

23. Rikard Lindgren. Competence Systems, June 2002. (Doctoral Thesis).

24. Ulrika Lundh Snis. Codifying Knowledge, October 2002. (Doctoral Thesis).

25. Lars Svensson. Communities of Distance Education, December 2002. (Doctoral Thesis).

26. Kai Simon. BPR in the Pharmaceutical Industry, April 2003. (Doctoral Thesis).

27. Per Dahlberg. Local Mobility, May 2003. (Doctoral Thesis).

28. Alexandra Weilenmann. Doing Mobility, June 2003. (Doctoral Thesis).

29. Carina Ihlström. The Evolution of a New(s) Genre, September 2004. (Doctoral Thesis).

30. Antonio Cordella. Information Infrastructures in Action, November 2004. (Doctoral Thesis).

31. Helena Holmström. Community-Based Customer Involvement for Improving Packaged Software Development, November 2004. (Doctoral Thesis).

32. Christian Hardless. Designing Competence Development Systems, March 2005. (Doctoral Thesis).

33. Andreas Nilsson. Sport Informatics – Exploring IT Support for Spectators at Sporting Events, November 2005. (Doctoral Thesis).

34. Johan Lundin. Talking about Work – Designing Information Technology for Learning in Interaction, November 2005. (Doctoral Thesis).

35. Agneta Nilsson. Contextual Implementation of Organizational Networking Systems, August 2006. (Doctoral Thesis).

36. Mathias Klang. Disruptive Technology – Effects of Technology Regulation on Democracy, October 2006. (Doctoral Thesis).

37. Ulrika Josefsson. Coping Online – Patients' Use of the Internet, February 2007. (Doctoral Thesis).

38. Magnus Holmqvist. Developing And Implementing IS/IT in Aftermarket Logistics, June 2007. (Doctoral Thesis).

39. Jonas Landgren. Designing information Technology For Emergency Response, September 2007. (Doctoral Thesis).

40. Magnus Andersson. Heterogeneous IT Innovation. Developing industrial architectural knowledge, October 2007. (Doctoral Thesis).

41. Nicklas Lundblad. Law in a Noise Society, February 2008. (Doctoral Thesis).

42. Maria Åkesson. Digital Innovation in the value networks of newspapers, September 2009. (Doctoral Thesis).

43. Marie Eneman. Developing Effective Child Protection Strategies: Critical Study of Offenders' Use of Information Technology for Sexual Exploitation of Children, December 2010. (Doctoral Thesis).

44. Elisabeth Frisk. Evaluating as Designing, March 2011. (Doctoral Thesis).

45. Ann Svensson. Kunskapsintegrering med informationssystem i professions orienterade praktiker (cover paper in Swedish), May 2012. (Doctoral Thesis).

46. Maria Bolin. Narrativer i förändringsarbete – från projekt till Athenas plan. September 2014. (Doctoral Thesis).

47. Tomas Lindroth. Being Multisituated – Characterizing Laptoping in Networked Situations, April 2015. (Doctoral Thesis).

48. Wanda Presthus. Business Intelligence Utilisation through Bootstrapping and Adaptation, September 2015. (Doctoral Thesis).

49. Jesper Lund. Digital Innovation: Orchestrating Network Activities. September 2015. (Doctoral Thesis).

50. Soumitra Chowdhury. Service Logic in Digitalized Product Platforms – A Study of digital service innovation in the Vehicle Industry. September 2015. (Doctoral Thesis).

51. Asif Akram. Value Network Transformation – Digital Service Innovation in the Vehicle Industry. January 2016. (Doctoral thesis).

52. Fatemeh Saadatmand. Shared Platform Coopetition: The Paradoxical Tension between Stabilized Cooperation and Intensified Competition. November 2016. (Licentiate thesis).

53. Fatemeh Saadatmand. Shared Platform Evolution: An Imbrication Analysis of Coopetition and Architecture. March 2018. (Doctoral Thesis).

54. Fahd Omair Zaffar. The Value of Social Media – What Social Networking Sites afford organizations. June 2018. (Doctoral Thesis).

55. Stefan Nilsson. Designing for technology-mediated collaboration. December 2018. (Doctoral Thesis).

56. Taline Jadaan. The Emergence of Digital Institutions. Oktober 2019. (Doctoral Thesis).

57. Hannes Göbel. Designing Digital Resourcing. Januari 2020. (Doctoral Thesis).

58. Hawa Nyende. Maternal Healthcare in Low Resource Settings: Investigations of IT as a resource. June 2020. (Doctoral Thesis).

The Swedish Research School of Management and Information Technology MIT

The *Swedish Research School of Management and Information Technology* (MIT) is one of 16 national research schools supported by the Swedish Government. MIT is jointly operated by the following institutions: Blekinge Institute of Technology, Chalmers University of Technology, University of Gothenburg, Jönköping International Business School, Karlstad University, Linköping University, Linnaeus University Växjö, Lund University, Mälardalen University College, Stockholm University, Umeå University, Örebro University, and Uppsala University, host to the research school. At the Swedish Research School of Management and Information Technology (MIT), research is conducted, and doctoral education provided, in three fields: management information systems, business administration, and informatics.

DISSERTATIONS FROM THE SWEDISH RESEARCH SCHOOL OF MANAGEMENT AND INFORMATION TECHNOLOGY

Doctoral theses (2003-)

1. **Baraldi, Enrico (2003),** *When Information Technology Faces Resource Interaction: Using IT Tools to Handle Products at IKEA and Edsbyn.* Department of Business Studies, Uppsala University, Doctoral Thesis No. 105.

2. **Wang, Zhiping (2004),** *Capacity-Constrained Production-Inventory Systems: Modelling and Analysis in both a Traditional and an E-Business Context*. IDA-EIS, Linköpings universitet och Tekniska Högskolan i Linköping, Dissertation No. 889

3. **Ekman, Peter (2006),** *Enterprise Systems & Business Relationships: The Utilization of IT in the Business with Customers and Suppliers*. School of Business, Mälardalen University, Doctoral Dissertation No 29.

4. **Lindh, Cecilia (2006),** *Business Relationships and Integration of Information Technology*. School of Business, Mälardalen University, Doctoral Dissertation No 28.

5. **Frimanson, Lars (2006),** *Management Accounting and Business Relationships from a Supplier Perspective.* Department of Business Studies, Uppsala University, Doctoral Thesis No. 119.

6. **Johansson, Niklas (2007),** *Self-Service Recovery*. Information Systems, Faculty of Economic Sciences, Communication and IT, Karlstad University, Dissertation KUS 2006:68.

7. **Sonesson, Olle (2007),** *Tjänsteutveckling med personal medverkan: En studie av banktjänster.* Företagsekonomi, Fakulteten för ekonomi, kommunikation och IT, Karlstads universitet, Doktorsavhandling, Karlstad University Studies 2007:9.

8. **Maaninen-Olsson, Eva (2007),** *Projekt i tid och rum: Kunskapsintegrering mellan projektet och dess historiska och organisatoriska kontext.* Företagsekonomiska institutionen, Uppsala universitet, Doctoral Thesis No. 126.

9. **Keller, Christina (2007),** *Virtual learning environments in higher education: A study of user acceptance.* Linköping Studies in Science and Technology, Dissertation No. 1114.

10. **Abelli, Björn (2007),** *On Stage! Playwriting, Directing and Enacting the Informing Processes*. School of Business, Mälardalen University, Doctoral Dissertation No. 46.

11. **Cöster, Mathias (2007),** *The Digital Transformation of the Swedish Graphic Industry*. Linköping Studies in Science and Technology, Linköping University, Dissertation No. 1126.

12. **Dahlin, Peter (2007),** *Turbulence in Business Networks: A Longitudinal Study of Mergers, Acquisitions and Bankruptcies Involving Swedish IT-companies*. School of Business, Mälardalen University, Doctoral Thesis No. 53.

13. **Myreteg, Gunilla (2007),** *Förändringens vindar: En studie om aktörsgrupper och konsten att välja och införa ett affärssystem*. Företagsekonomiska institutionen, Uppsala universitet, Doctoral Thesis No. 131.

14. **Hrastinski, Stefan (2007),** *Participating in Synchronous Online Education*. School of Economics and Management, Lund University, Lund Studies in Informatics No. 6.

15. **Granebring, Annika (2007),** *Service-Oriented Architecture: An Innovation Process Perspective.* School of Business, Mälardalen University, Doctoral Thesis No. 51.

16. **Lövstål, Eva (2008),** *Management Control Systems in Entrepreneurial Organizations: A Balancing Challenge*. Jönköping International Business School, Jönköping University, JIBS Dissertation Series No. 045.

17. **Hansson, Magnus (2008),** *On Closedowns: Towards a Pattern of Explanation to the Closedown Effect*. Örebro University School of Business, Örebro University, Doctoral Thesis No. 1.

18. **Fridriksson, Helgi-Valur (2008),** *Learning processes in an inter-organizational context: A study of krAft project*. Jönköping International Business School, Jönköping University, JIBS Dissertation Series No. 046.

19. **Selander, Lisen (2008),** Call Me *Call Me for some Overtime: On Organizational Consequences of System Changes.* Institute of Economic Research, Lund Studies in Economics and Management No. 99.

20. **Henningsson, Stefan (2008),** *Managing Information Systems Integration in Corporate Mergers & Acquisitions*. Institute of Economic Research, Lund Studies in Economics and Management No. 101.

21. **Ahlström, Petter (2008),** *Strategier och styrsystem för seniorboende-marknaden*. IEI-EIS, Linköping universitetet och Tekniska Högskolan i Linköping, Doktorsavhandling, Nr. 1188.

22. **Sörhammar, David (2008),** *Consumer-firm business relationship and network: The case of "Store" versus Internet.* Department of Business Studies, Uppsala University, Doctoral Thesis No. 137.

23. **Caesarius, Leon Michael (2008),** *In Search of Known Unknowns: An Empirical Investigation of the Peripety of a Knowledge Management System*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 139.

24. **Cederström, Carl (2009),** *The Other Side of Technology: Lacan and the Desire for the Purity of Non-Being.* Institute of Economic Research, Lund University, Doctoral Thesis, ISBN: 91-85113-37-9.

25. **Fryk, Pontus, (2009),** *Modern Perspectives on the Digital Economy: With Insights from the Health Care Sector*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 145.

26. **Wingkvist, Anna (2009)**, *Understanding Scalability and Sustainability in Mobile Learning: A Systems Development Framework.* School of Mathematics and Systems Engineering, Växjö University, Acta Wexionesia, No. 192, ISBN: 978-91-7636-687-5.

27. **Sällberg, Henrik (2010***), Customer Rewards Programs: Designing Incentives for Repeated Purchase.* Blekinge Institute of Technology, School of Management, Doctoral Dissertation Series No. 2010:01.

28. **Verma, Sanjay (2010),** *New Product Newness and Benefits: A Study of Software Products from the Firms' Perspective*. Mälardalen University Press, Doctoral Thesis.

29. **Iveroth, Einar (2010),** *Leading IT-Enabled Change Inside Ericsson: A Transformation Into a Global Network of Shared Service Centres.* Department of Business Studies, Uppsala University, Doctoral Thesis No. 146.

30. **Nilsson, Erik (2010),** *Strategi, styrning och konkurrenskraft: En longitudinell studie av Saab AB*. IEI-EIS, Linköpings universitet och Tekniska Högskolan i Linköping, Doktorsavhandling, Nr. 1318.

31. **Sjöström, Jonas (2010),** *Designing Information Systems: A pragmatic account*. Department of Informatics and Media, Uppsala University, Doctoral Thesis.

32. **Numminen, Emil (2010),** *On the Economic Return of a Software Investment: Managing Cost, Benefit and Uncertainty*. Blekinge Institute of Technology, School of Management, Doctoral Thesis.

33. **Frisk, Elisabeth (2011),** *Evaluating as Designing: Towards a Balanced IT Investment Approach*. IT University, Göteborg, Doctoral Thesis.

34. **Karlsudd, Peter (2011),** *Support for Learning: Possibilities and Obstacles in Learning Applications*. Mälardalen University, Doctoral Thesis.

35. **Wicander, Gudrun (2011),** *Mobile Supported e-Government Systems: Analysis of the Education Management Information System (EMIS) in Tanzania*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2011:49.

36. **Åkesson, Maria (2011),** *Role Constellations in Value Co-Creation: A Study of Resource Integration in an e-Government Context*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2011:36.

37. **Nfuka, Edephonce N. (2012),** *IT Governance in Tanzanian Public Sector Organisations*. Department of Computer and Systems Sciences, Stockholm University**,** Doctoral Thesis.

38. **Larsson, Anders Olof (2012),** *Doing Things in Relation to Machines: Studies on Online Interactivity.* Department of Informatics and Media, Uppsala University, Doctoral Thesis.

39. **Andersson, Bo (2012),** *Harnessing Handheld Computing: Framework, Toolkit and Design Propositions.* Lund University, Doctoral Thesis**.**

40. **Erixon, Cecilia (2012),** *Information System Providers and Business Relationships: A Study on the Impact of Connections*. Mälardalen University, Doctoral Thesis.

41. **Svensson, Martin (2012)**, *Routes, Routines and Emotions in Decision Making of Emergency Call Takers*. Blekinge Institute of Technology, Doctoral Dissertation Series No. 2012:04.

42. **Svensson, Ann (2012),** *Kunskapsintegrering med informationssystem I professionsorienterade praktiker*. Institutionen för tillämpad IT, Göteborgs universitet, Doktorsavhandling.

43. **Pareigis, Jörg (2012),** *Customer Experiences of Resource Integration: Reframing Servicescapes Using Scripts and Practices*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2012:38.

44. **Röndell, Jimmie (2012),** *From Marketing to, to Marketing with Consumers*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 155.

45. **Lippert, Marcus (2013),** *Communities in the Digital Age: Towards a Theoretical Model of Communities of Practice and Information Technology*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 156.

46. **Netz, Joakim (2013),** *Diffusa spänningar eller spännande tillväxt? Företagsledning i tider av snabb förändring*. Mälardalens högskola, Doktorsavhandling nr 135.

47. **Thorén, Claes (2013),** *Print or Perish? A Study of Inertia in a Regional Newspaper Industry*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2014:10 (Ny uppl.).

    Stockhult, Helén (2013), *Medarbetare i dialog: en studie om viljan att göra mer än det formellt förväntade*. Örebro universitet, Örebro Studies in Business Dissertations, 4.

48. **Mihailescu, Daniela (2013),** *Explaining the Use of Implementation Methodology in Enterprise Systems Implementation Context: A Critical Realist Perspective*. Lund University, Doctoral Thesis.

49. **Ghazawneh, Ahmad (2012),** *Towards a Boundary Resources Theory of Software Platforms*. Jönköping International Business School, Doctoral Thesis.

50. **Shams, Poja (2013),** *What Does it Take to Get your Attention? The Influence of In-Store and Out-of-Store Factors on Visual Attention and Decision Making for Fast-Moving Consumer Goods*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2013:5.

51. **Osowski, Dariusz (2013),** *From Illusiveness to Genuineness: Routines, Trading Zones, Tools and Emotions in Sales Work*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 160.

52. **Höglund, Linda (2013)**, *Discursive Practises in Strategic Entrepreneurship: Discourses and Repertoires in Two Firms*. Örebro University, Doctoral Thesis.

53. **Persson Ridell, Oscar (2013)**, *Who is the Active Consumer? Insight into Contemporary Innovation and Marketing Practices*. Department of Business Studies, Uppsala University, Doctoral Thesis.

54. **Kask, Johan (2013),** *On business relationships as Darwinian systems: An exploration into how Darwinian systems thinking can support business relationship research*. Örebro University, Doctoral Thesis.

55. **Paulsson, Wipawee Victoria (2013)**, *The Complementary Use of IS Technologies to Support Flexibility and Integration Needs in Budgeting*. Lund University, Doctoral Thesis.

56. **Kajtazi, Miranda (2013),** *Assessing Escalation of Commitment as an Antecedent of Noncompliance with Information Security Policy*. Linnaeus University, Doctoral Thesis.

57. **Hasche, Nina (2013),** *Value Co-Creating Processes in International Business Relationships: Three empirical stories of co-operation between Chinese customers and Swedish suppliers*. Örebro University, Doctoral Thesis.

58. **Pierce, Paul (2013),** *Using Alliances to Increase ICT Capabilities*. Lund University, Doctoral Thesis.

59. **Mansour, Osama (2013),** *The Bureaucracy of Social Media: An Empirical Account in Organizations*. Linnaeus University, Doctoral Thesis.

60. **Osmonalieva, Zarina (2013)**, *Factors Determining Exploitation of Innovative Venture Ideas: A study of nascent entrepreneurs in an advisory system*. Mälardalen University, Doctoral Thesis.

61. **Holmberg, Nicklas (2014),** *The Purity of Separation of Concerns: The Service Oriented Business Process - a Design Approach for Business Agility.* Lund University, Doctoral Thesis.

62. **Poth, Susanna (2014),** *Competitive Advantage in the Service Industry. The Importance of Strategic Congruence, Integrated Control and Coherent Organisational Structure: A Longitudinal Case Study of an Insurance Company*. Department of Business Studies, Uppsala University, Doctoral Thesis.

63. **Safari, Aswo (2014),** *Consumer Foreign Online Purchasing: Uncertainty in the Consumer-Retailer Relationship*. Department of Business Studies, Uppsala University, Doctoral Thesis.

64. **Sandberg, Johan (2014)**, *Digital Capability: Investigating Coevolution of IT and Business Strategies*. Umeå University, Doctoral Thesis.

65. **Eklinder Frick, Jens (2014),** *Sowing Seeds for Innovation: The Impact of Social Capital in Regional Strategic Networks*. Mälardalen University, Doctoral Thesis.

66. **Löfberg, Nina (2014)**, *Service Orientation in Manufacturing Firms: Understanding Challenges with Service Business Logic*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2014:30.

67. **Gullberg, Cecilia (2014)**, *Roles of Accounting Information in Managerial Work*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 171.

68. **Bergkvist, Linda (2014)**, *Towards a Framework for Relational-Oriented Management of Information Systems Outsourcing: Key Conditions Connected to Actors, Relationships and Process*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2014:31.

69. **Tavassoli, Sam (2014)**, *Determinants and Effects of Innovation: Context Matters.* Blekinge Institute of Technology, Doctoral Thesis No. 2014:10.

70. **Högström, Claes (2014)**, *Fit In to Stand Out: An Experience Perspective on Value Creation*. Karlstad University, Doctoral Thesis. Karlstad University Studies 2014:44.

71. **Jansson, Tomas (2015),** *Agila projektledningsmetoder och motivation*. Karlstads universitet, Doctoral Thesis. Karlstad University Studies 2015:9.

72. **Ryzhkova, Natalia (2015)**, *Web-Enabled Customer Involvement: A Firms' Perspective.* Blekinge Institute of Technology, Doctoral Thesis.

73. **Sundberg, Klas (2015),** *Strategisk utveckling och ekonomistyrning: Ett livscykelperspektiv*. Företagsekonomiska institutionen, Uppsala universitet, Doctoral Thesis No. 173.

74. **Nylén, Daniel (2015),** *Digital Innovation and Changing Identities: Investigating Organizational Implications of Digitalization*. Umeå University, Doctoral Thesis.

75. **Chowdhury, Soumitra (2015)**, *Service Logic in Digitalized Product Platforms: A Study of Digital Service Innovation in the Vehicle Industry*. Gothenburg University, Doctoral Thesis.

76. **Jogmark, Marina (2015),** *Den regionala transformationsprocessens sociala dimension. Karlskrona 1989-2002*. Blekinge Tekniska Högskola, Doctoral Thesis.

77. **Sundström, Angelina (2015),** *Old Swedish Business in New International Clothes: Case Studies on the Management of Strategic Resources in Foreign-Acquired Swedish R&D Firms*. Mälardalen University, Doctoral Thesis.

78. **Öbrand, Lars (2015),** *Information Infrastructure Risk: Perspectives, Practices & Technologies*. Umeå University, Doctoral Thesis.

79. **Brozović, Danilo (2016),** *Service Provider Flexibility: A Strategic Perspective*. Stockholm University, Doctoral Thesis.

80. **Siegert, Steffi (2016),** *Enacting Boundaries through Social Technologies: A Dance between Work and Private Life*. Stockholm University, Doctoral Thesis.

81. **Linton, Gabriel (2016)**, *Entrepreneurial Orientation: Reflections from a Contingency Perspective*. Örebro University, Doctoral Thesis.

82. **Akram, Asif (2016)**, *Value Network Transformation: Digital Service Innovation in the Vehicle Industry*. Department of Applied Information Technology, Chalmers University of Technology and University of Gothenburg, Doctoral Thesis.

83. Hadjikhani, Annoch (2016), *Executive Expectation in the Internationalization Process of Banks: The Study of Two Swedish Banks Foreign Activities*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 177.

84. El-Mekawy, Mohamed (2016), *From Theory to Practice of Business-IT Alignment: Barriers, an Evaluation Framework and Relationships with Organizational Culture*. DSV, Stockholm University, Doctoral Thesis.

85. Salavati, Sadaf (2016), *Use of Digital Technologies in Education: The Complexity of Teachers' Everyday Practice*. Linnaeus University, Doctoral Thesis.

86. Pashkevich, Natallia (2016), *Information Worker Productivity Enabled by IT System Usage: A Complementary-Based Approach*. Stockholm Business School, Stockholm University, Doctoral Thesis.

87. Stone, Trudy-Ann (2016), *Firms in Global Value Chains.* Blekinge Institute of Technology (BTH), Doctoral Thesis.

88. Saarikko, Ted (2016), *An Inquiry into the Nature and Causes of Digital Platforms.* Umeå University, Doctoral Thesis.

89. Tona, Olgerta (2017), *The Journey of Mobile Business Intelligence: From Vision to Use*. Lund University, Doctoral Thesis.

90. Fredin, Sabrina (2017), *History and Geography Matter: The Cultural Dimension of Entrepreneurship*. Blekinge Institute of Technology, Doctoral Thesis.

91. Giovacchini, Elia (2017), *Weaving the Symbiotic Relationship: A Longitudinal Study of a Firm-Sponsored Open Source Community Relationship Maintenance*. Stockholm Business School, Stockholm University, Doctoral Thesis.

92. Gillmore, Edward (2017), *Four Essays on Subsidiary Evolution: Exploring the Antecedents, Contexts and Outcomes of Mandate Loss*. School of Business, Mälardalen University, Doctoral Thesis.

93. Crawford, Jason (2017), *Regulation's Influence on Risk Management and Management Control Systems in Banks*. Department of Business Studies, Uppsala University, Doctoral Thesis.

94. V on Schantz, Hanna (2017), *Well, that makes sense! Investigating opportunity development in a technology start-up.* Stockholm Business School, Stockholm University, Doctoral Thesis.

95. Wass, Sofie (2017), *The Importance of eHealth Innovations: Lessons about Patient Accessible Information*. Jönköping International Business School, Doctoral Thesis.

96. Imre, Özgün (2018), *Adopting Information Systems: Perspectives from Small Organizations*. Department of Management and Engineering (IEI), Linköping University, Doctoral Thesis.

97. Lövgren, Daniel (2017), *Dancing Together Alone: Inconsistencies and Contradictions of Strategic Communication in Swedish Universities*. Informatics and Media, Uppsala University, Doctoral Thesis.

98. **Charitsis, Vasileios (2018)**, *Self-Tracking, Datafication and the Biopolitical Prosumption of Life.* Karlstad University, Doctoral Thesis.

99. **Lammi, Inti (2018)**, *A Practice Theory in Practice: Analytical Consequences in the Study of Organization and Socio-Technical Change.* Department of Business Studies, Uppsala University, Doctoral Thesis.

100. **Leite, Emilene (2018)**, *Complexity in the 'Extended' Business Network: A study of Business, Social and Political Relationships in Smart City Solutions*. Department of Business Studies, Uppsala University, Doctoral Thesis.

101. **Aasi, Parisa (2018)**, *Information Technology Governance: The Role of Organizational Culture and Structure*. Department of Computer and Systems Sciences, Stockholm University, Doctoral Thesis.

102. **Servadio, Luigi (2018)**, *Customer Rituals: Ethnographic Explorations of Wine Rituals with Families and Friends.* Stockholm Business School, Stockholm University, Doctoral Thesis.

103. **Ahlgren, Kajsa (2018)**, *Travelling Business Models: On Adapting Business Models to New Contexts.* Design Sciences, Faculty of Engineering, Lund University, Doctoral Thesis.

104. **Markowski, Peter (2018)**, *Collaboration Routines: A Study of Interdisciplinary Healthcare*. Stockholm Business School, Stockholm University, Doctoral Thesis.

105. **Zaffar, Fahd Omair (2018)**, *The Value of Social Media: What Social Networking Sites Afford Organizations*. Division of Informatics, Department of Applied Information Technology, University of Gothenburg, Doctoral Thesis.

106. **Stendahl, Emma (2018)**, *Headquarters Involvement in Managing Subsidiaries.* Stockholm Business School, Stockholm University, Doctoral Thesis.

107. **Fischer, Christian (2018)**, *Business Intelligence through a Sociomaterial Lens: The Imbrication of People and Technology in a Sales Process*. Department of Business Studies, Uppsala University, Doctoral Thesis.

108. **Lagin, Madelen (2018)**, *The Price We Pay: The Autonomy of Store Managers in Making Price Decisions*. Department of Business Studies, Örebro University, Doctoral Thesis.

109. **Odar, Susanne (2019)**, *Managementinitiativ, mening och verksamhetsresultat: En retrospektiv studie av en teknikintensiv verksamhet*. Department of Management and Engineering (IEI), Linköping University, Linköping Studies in Science and Technology, Doctoral Thesis.

110. **Radits, Markus (2019)**, *A Business Ecology Perspective on Community-Driven Open Source: The Case of the Free and Open Source Content Management System Joomla*. Department of Management and Engineering (IEI), Linköping University, Linköping Studies in Science and Technology, Doctoral Thesis No. 1937.

111. **Skog, Daniel A. (2019)**, *The Dynamics of Digital Transformation: The Role of Digital Innovation, Ecosystems and Logics in Fundamental Organizational Change*. Umeå University, Doctoral Thesis.

112. Ek, Peter (2019), *Managing Digital Open Innovation with User Communities: A Study of Community Sensing and Product Openness Capabilities in the Video Game Industry*. Department of Business Studies, Uppsala University, Doctoral Thesis No. 199

113. Muhic, Mirella (2019), *Transition to Cloud sourcing – Innovation and competitive advantage*. Design Sciences, Faculty of Engineering, Lund University, Doctoral Thesis.

114. Mankevich, Vasili (2019), *Digital Innovation Management: Investigating Digital Trace Data in Online Communities*. Umeå University, Doctoral Thesis.

115. Vink, Josina (2019), *In/visible - Conceptualizing Service Ecosystem Design*. Karlstad University, Doctoral Thesis.

116. Bäckström, Izabelle (2019), *Mirror, mirror on the wall, who's the innovator after all? An explorative study of a management-initiated employee innovation process*. Department of Design Sciences, Faculty of Engineering, Lund University, Doctoral Thesis No. 116.

117. Bani-Hani, Imad (2020), *Self-Service Business Analytics and the Path to Insights: Integrating Resources for Generating Insights,* Department of Informatics, School of Economics and Management, Lund University.

118. Kashyap, Shruti Rangan (2020), *Monsoon Paper Dragons: Transparency, Accountability, Risk, and Compliance in Banking Regulation and Practice*, Department of Business Studies, Uppsala University, Doctoral Thesis.

119. Havemo, Emelie (2020), *Den visuella bilden av organisationen: Perspektiv på visualitet i accounting*, Linköping Studies in Science and Technology, Doktorsavhandling nr. 2075. Institutionen för ekonomisk och industriell utveckling, Linköpings universitet.

120. Nyende, Hawa (2020), *Maternal Healthcare in Low Resource Settings: Investigations of IT as a resource*, Department of Applied Information Technology, University of Gothenburg, Doctoral Thesis.