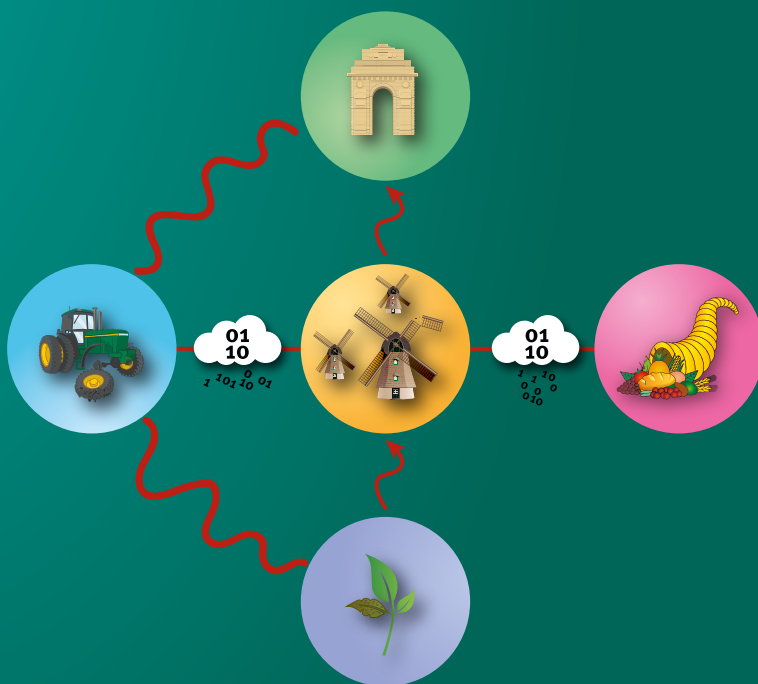


Why is it so challenging to cultivate open government data?

Understanding impediments from an ecosystem perspective



Jonathan Crusoe

Linköping University, Faculty of Arts and Sciences thesis No. 124

Why is it so challenging to cultivate open government data?

Understanding impediments from an ecosystem
perspective

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Linköping 2019

Why is it so challenging to cultivate open government data?
Understanding impediments from an ecosystem perspective

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Printed in Sweden by LiU-Tryck, Linköping, Sweden, 2019

ISBN: 978-91-7685-099-2

ISSN: 1401-4637

Why is it so challenging to cultivate open government data?

Understanding impediments from an ecosystem perspective

By

Jonathan Crusoe

Abstract

Introduction: This compilation licentiate thesis focuses on open government data (OGD). The thesis is based on three papers. OGD is a system that is organized when publishers collect and share data with users, who can unrestrictedly reuse the data. In my research, I have explored why it can be challenging to cultivate OGD. Cultivation is human activities that change, encourage, or guide human organizations towards a higher purpose by changing, introducing, managing, or removing conditions. Here, the higher purpose is OGD to realize believed benefits. Thus, OGD cultivation is an attempt to stimulate actors into organizing as OGD.

Problem and Purpose: OGD is believed to lead to several benefits. However, the worldwide OGD movement has slowed down, and researchers have noted a lack of use. Publishers and users are experiencing a set of different impediments that are challenging to solve. In previous research, there is a need for more knowledge about what can impede the OGD organization, cause non-valuable organizing, or even collapse the organization. At the same time, there is a lack of knowledge about how impediments shape the organization of OGD. This gap can make it hard to solve and overcome the impediments experienced by publishers and users. The sought-after knowledge can bring some understanding of the current situation of OGD. In this research, I have viewed the organization of OGD as an ecosystem. The purpose of this thesis is to draw lessons about why it can be challenging to cultivate OGD ecosystems by understanding OGD impediments from an ecosystem perspective.

Research Design: I set out to explore OGD through qualitative research from 2016 to 2018. My research started with a pilot case study that led to three studies. The studies are each reported in a paper and the papers form the base of this thesis. The first paper aims to stimulate the conceptually oriented discussion about actors' roles in OGD by developing a framework that was tested on a Swedish public agency. The second paper has the purpose of expanding the scope surrounding impediments and was based in a review and systematization of previous research about OGD impediments. The third paper presents an exploration of impediments experienced by publishers, users, and cultivators in the Swedish national OGD ecosystem to identify faults. From the three papers, lessons were drawn in turn and together, that are presented in this thesis.

Findings: Cultivators when cultivating OGD ecosystems are facing towering challenges. The following three main challenges are identified in this thesis: (1) to cultivate a system that can manage stability by itself without constant involvement, (2) to cultivate a system that is capable of evolving towards a "greater good" by itself, and (3) to have an up-to-date precise vocabulary for a self-evolving system that enables inter-subjective understand for coordinating problem-solving.

Contribution: The theoretical contribution of this thesis is that OGD ecosystems can be viewed as a public utility. Moreover, I recommend that researchers approach the organizing of OGD as the cultivation of evolution, rather than the construction of a structure; to consider the stability of the system in growth, value, and participation; and to be cautious with how they label and describe OGD actors. For actors that are cultivating OGD, I recommend that they guide the OGD actors to help them organize; view OGD cultivation as the management of evolution (growth) towards a purpose; and view cultivation as a collaborative effort where they can supply ideas, technologies, practices, and expertise.

FOREWORD

Information Systems Development (ISD) is a research discipline within the Faculty of Arts and Sciences at Linköping University (LiU), Linköping Sweden. ISD is a discipline studying human work with developing and changing different kinds of IT systems in organizational and societal settings. The research discipline includes theories, strategies and policies, models, methods, co-working principles and artefacts related to information systems development. Different development and change situations can be studied as planning, analysis, specification, design, implementation, maintenance, evaluation and redesign of information systems. Focus is also on the interplay with other forms of organizational development, processes of digitalization and innovation. The discipline also includes the study of prerequisites for and results from information systems development, as e.g. institutional settings, studies of usage and consequences of information systems on individual, group, organizational and societal levels.

The ISD research at LiU is conducted in collaboration with private and public organizations. Collaboration also includes national and international research partners in the information systems research field. The research has a clear ambition to give distinct theoretical contributions within the information systems research field and relevant focus areas. Simultaneously, the research aims to contribute with practically needed and useful knowledge.

This work, *Why is it so challenging to cultivate open government data? Understanding impediments from an ecosystem perspective*, is written by Jonathan Crusoe, Linköping University. He presents this work as his licentiate thesis in Information Systems Development, Information Systems Division, Department of Management and Engineering, Linköping University, Sweden.

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Acknowledgment

Research education is not an isolated enterprise; over the years, there have been people that have supported and guided me in many different ways. I would want to acknowledge all of them, but I have to focus my attention; their contributions by themselves could be covered in a thesis. I want to thank my colleagues from my division, my family, my scout family, my research friends, my close friends, and, finally, my co-supervisors and supervisor. I know someone will ask about this and there is no prioritization order in this presentation.

Thank to my colleagues from the division of information systems. **Daniel** for your input on my paradigmatic worldview, but most importantly, the good conversations we have at lunch. **Göran** for allowing me to explore the identity and history of information systems. Your doctoral dissertation will always be one of my most treasured texts. Your humanitas and prudentia is a virtue. **Ida**, for your guidance in research and giving the final name of my thesis. Your prudentia is a virtue. **Johanna** for your guidance in pedagogy and coffee break talks. Your affableness is a virtue. **Madeleine** and **My** for helping me with ticks, travels, book orders, and other administrative tasks. Without you, I would have been stuck and bookless. **Malin**, you have given emotional support, but most importantly of all, you have taught me how to cite and reference texts as an academic. The knowledge I now use every day. **Maria**, you are a good friend and our late nights of cheese and wine are awaited. Your ambitiousness and industriousness are a virtue that I awe. **Siri** for changing my worldview by introducing me to critical realism. **Truls**, you are a good colleague and your stoicism is something to strive for. Overall, thank to my colleagues for bathing me in a positive spirit. You have had a bigger impact on my life outlook than can be expressed in any text or speech.

Thanks to my family for raising me to become who I am. Thanks to my father, **Stellan**, for the sofa to sleep on when visiting Stockholm and support only a father can give. Your fortitude has always inspired me to overcome adverse odds. Thanks to my mother, **Pia**, for taking care of me when I was younger and that you now are caring for my cat. I thank my parents for allowing me to see and experience the world as I grew up. Thanks to my cat, **Sotis**, for taking care of my mother. Just make sure you do not eat all those shrimps she is spoiling you with. Thanks to my brother, **Simon**, for our late game nights when we were younger and making me realize the importance of humility. Thank to my grandparents on my father's side, **Aileen** and **Tord**, for the Christmas food and your love. You still owe me a bucket of bearnaise sauce. Thank to my grandparents on my mother's side, **Lars Gunnar** and **Britt Louise**, I will always treasure the adventure you brought me on when I was younger. Lars Gunnar, you have always been my educational role model. Britt Louse, you took care of me when I was younger and thought me how to do crochet. I am grateful for the family I have grown up with and got to know over the years. The love you have shown is irreplaceable.

I also would like to thank my second family, the scout family. I could write a book about everything you taught me and the love you have given me. Comrade **Bertil** and Leader **Marie**, you have paid train tickets and been a haven. I am always looking forward to the next scout dinner. **Helge**, you have always been like a brother and I will always remember the joy from our late nights of gaming. Our gaming made my studies survivable. Remember to buckle up and bring some dynamite to our next tea party. **Tove**, you have been a role model and a good scout leader. Thanks for allowing me to roleplay with your scouts and giving me the opportunity to practice leadership and guidance. Thanks again to the rest of the scout family, if I were to list all of you, this work would be thanks with a thesis on the side.

Over the years, I have met several Ph.D. students, and some are still hanging around. I would like to thank them. **Antoine** and **Elisabeth** thank you for your comments on my thesis draft, inspiring industriousness, and cultural exchange. **Karin**, you are a good friend and your comments on my thesis draft have been helpful. I love our exploration of open data and we are cooking with gas. **Klervie** and **Fredrik**, our time in LiUPhD has been amazing and I hope you will continue to contribute to others lives just as we have. Many thanks to all other Ph.D. friends, you know who you are.

Thank to my close friends for showing patience and emotional support. **Rasmus**, just like Helge, you have always been there through thick and thin. Our late nights of gaming are invaluable. **Erik, Elias, Linus**, and **Valdemar**, you have given me a fun time, and I hope that we will never time travel together. **Franz**, you are like a brother and always been one of the most supportive of my studies. I know thanks are not enough, but there are no better words for what you have given. Thanks, old friend. Always remember to wear a helmet. **Harald**, thanks for our late nights with wine and politics. Your tolerance is a virtue. **Szymon** and **Destiny**, you are both impossible to get rid of and two of the most fantastic people I have ever met. You have shown support in thick and thin, showered me with gifts, and been there when I needed you. In addition, thank to my other friends!

Finally, many thanks to my mentors and research role models. My co-supervisor **Fredrik**, you have been a good friend and just like my supervisor a person to revere. I might buy you another cookie or watermelon, so be prepared. My co-supervisor **Sofie**, your virtue is *comitas* and with it, you have given encouragement, guidance, and support. Your comments and gravitas have been priceless in my education. My supervisor, **Ulf Melin**, I could have had prepared 84 slides, but decided to be short and concise instead. You have shown support and guidance through thick and thin. I know I am stubborn and all over the place, as such, I am thankful for your patience and stoicism. You have done more than can be expected from any one (e.g., read my texts at short notice). Most importantly of all, you have reawakened what the school stole from me: *my curiosity*. There are no words for the positive changes you have led me through.

Finally, I cannot mention the all of you (because of anonymity), many thanks to the research participants!

Jonathan Crusoe

Linköping, March 2019

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1 Introduction

This work is a *compilation licentiate thesis* that covers three papers about open data. Open data is organized when a publisher collects and shares data with anyone. For example, a weather agency releases weather data for free, and a programmer develops a smartphone application on the data adding potential value for users. The app can then be used by others to get the latest weather reports visualized with extra analysis. For public organizations in the role of publishers, this can reduce paperwork, involve citizens in policy-making, and enable decision-making on fresh data for free from several public organizations without hassle. On the shared data, anyone can create new products and services or improve them. Products and services can help increase the quality of life for citizens or become the latest innovation (Davies, 2010; Ubaldi, 2013). However, while open data has possibilities, at least so far, there is a lack of use and realization of the benefits offered (Safarov et al., 2017). The world-wide open data movement has slowed; no government has made open data the norm of the day-to-day governing, earlier leaders are faltering with little data being published, and open data is often viewed as a side project (Open Data Barometer, 2018). Thus, it seems that it is challenging to cultivate an open data ecosystem that is beneficial. My definition of *cultivation* has developed with my research and refers to human activities that change, encourage, or guide humans organizing towards a higher purpose by changing, introducing, managing, or removing conditions, for example, events, activities, expertise, ideas, and technologies. In short, an *ecosystem perspective* is a holistic approach to view human organizations as a system (see chapter 3). This licentiate thesis explores previous open data research and open data practice to draw lessons about why it is challenging to cultivate an open data ecosystem by viewing impediments from an ecosystem perspective. *Impediments* are circumstances that obstruct or prevent activities (Hinder, 2018). The exploration and the lessons are one-step towards understanding conditions for cultivating an open data ecosystem that can be beneficial.

Open data is a shift from the traditional system where those who interpret and collect data have been the same (Tananbaum, 2008). Traditionally, public organizations can collect data for internal use and publish aggregated data for citizens on websites. This shift means going from data closed inside an organization towards data open for anyone. In the new system, actors (individuals and organizations) collect and share data for others to reuse without restriction (Ayre & Craner, 2017). Actors share their raw data, rather than aggregated data. **The core idea is to maximize the potential value of collected data by broadening the number of people who can interpret the data beyond those who collect the data to minimize unnecessary work and storage.** This change can lead to fewer people collecting the same data, less data is double stored, and people who lack capability will have access to data that is otherwise inaccessible. Technological advances have made open data possible, as they allow for easy copying, distribution, processing, and storage of data.

Moreover, for open data there are two basic roles; the *publisher*, who collects and shares data, and the *user* who reuses data without restriction (Zuiderwijk & Janssen, 2014a). In this thesis, the focus is on open government data (OGD), where the publisher is a governmental or a public organization (Attard et al., 2015), while the user is more inclusive and can, for example, be citizens, businesses, researchers, developers, NGOs, or journalists (Safarov et al., 2017). OGD is enabled and supported by an underlying technical infrastructure (Davis, 2011) and several practices; such as institutions, organizations, laws, ethics, economics, operations, policies, and strategies (Hossain et al., 2016). Together the roles, the infrastructure, and the practices organize into an OGD ecosystem (e.g., Dawes et al., 2016); “*a system of people, practices, values, and technologies in a local environment*” (Nardi & O’Day, 1999, p. 49). One to several OGD ecosystems can be organized in our society.

OGD, the ecosystem perspective, and the different actors will receive further attention in the two following sections. For now, the focus is on the possibilities of OGD to give insight into why people would accept or reject the idea. The possibilities of OGD are often viewed as the possible outcomes of using OGD products, services, or information. Products or services developed on OGD can be more

attractive than the data underneath (Casellas Serra, 2014). For this reason, OGD is a mean to some end (Hartog et al., 2014). OGD is a method to realize some value and data is the raw resource.

1.1 Day and Night of a Data-Driven Future

The possible outcomes of OGD can be perceived from two positions. There are two conventional extremes surrounding the conversation of technological change (Nardi & O'Day, 1999); technophilia and dystopia. Both sides perceive technological change to be inevitable. The technophile uncritically accepts new technology, while forgetting technologies' evolving social meaning and deep integration in social life. The dystopian condemns new technologies and recommend us to walk away from them (or at least be cautious). They believe we may lose our social communities and life to such things. Illustrating the two extremes can help us understand why people accept or reject OGD as the technophile and dystopian have different believes about the outcomes of OGD.

The better life in a smarter nation

The technophile would argue that OGD will lead us into a prosperous future. OGD can benefit society, the publishers, and the users. For society, OGD can bring democratic accountability, equal access to data, economic growth, the creation of a new data-driven sector, stimulation of innovation, competitiveness, knowledge development, and collective problem-solving (Janssen, Charalabidis, & Zuiderwijk, 2012; Kucera & Chlapek, 2014; Schrier, 2014). The publishers can gain increased transparency that can lead to higher trust, more public visibility, higher public engagement, optimization of administrative processes, improved government data management and performance, a channel to automatically inform the public, easy cross-department data sharing, and increased data quality (Janssen, Charalabidis, & Zuiderwijk, 2012; Hartog et al., 2014; Kucera & Chlapek, 2014; Schrier, 2014). The users of OGD can be able to improve or develop products, services, or processes, empower themselves, gain insight into the public sector, have access to information that can support decisions, avoid spending resources on collecting data already collected by others, combine data from several sources, and in the end be allowed new business opportunities (Janssen, Charalabidis, & Zuiderwijk, 2012; Schrier, 2014; Safarov et al., 2017). In more practical terms, in the EU, it is believed that OGD can help save 629 million hours for traffic travelers, reduce road fatalities by 5.5%, create 25.000 jobs (to a total of 100.000 in 2020), 1.7 billion euro in cost savings for governments, help to make better decisions, save 7.000 lives due to quicker response to emergencies, and lower power consumption by 16% (Carrara et al., 2015). In addition, when we are in need, OGD can also help us find the closest toilet (Bichard & Knight, 2012). In sum, the technophile believes that OGD will lead to a better society, a stronger economy, and a smarter nation. OGD has the potential to change the lives of the citizens and our future.

The data oligarchy and the masses

While the technophile argues for the possibilities and benefits, the dystopian stays more critical. The dystopian raises several concerns and like the technophile supports them. The dystopian is concerned about the data, the users, the publishing, and the consequences. The data might have more problems than we first perceive. Kitchin (2014) tells us that OGD is often expressed as politically benign, as if there were no political influences on data creation, when the opposite is likely the case. The data might also lack utility and have no usability, which would make OGD costly. Zuiderwijk and Janssen (2014b) have identified through interviews that data can be biased and have poor quality.

The potential users and probable beneficiaries are clouded. Gurstien (2011) argues that while OGD will be accessible to everyone, not everyone owns the technology or have the knowledge and skills to use the data; something that may cause a "data divide." Hellberg and Hedström (2015) emphasize that citizens may not actually care about using OGD even if they have the technology and skills. Kitchin (2014) adds that OGD may be benefiting businesses more than citizens. Businesses gain access to free data that they may profit from and, at the same time, remove the public sector from the market and weaken other producers of such data.

Publishing OGD is more than just releasing data for benefits. Kitchin (2014) tells us that OGD can be unsustainable as it is not free to implement and maintain. Hossain et al. (2016) have requested more research on the economic side of OGD, or as they put it “show me the money” (p. 33). Zuiderwijk et al. (2018) surveyed 156 OGD initiatives and found that while 63% aimed to create openness and 55% aimed to increase in transparency. The initiatives mostly delivered operational and technical benefits, with economics being second, and societal benefits last. OGD may have no or few social benefits.

OGD has the risk to come with more than benefits. Zuiderwijk and Janssen (2014b) have observed in interviews that users may misinterpret data, misuse data, and violate others’ privacy. Barry and Bannister (2014) report a risk of media running with more negative stories about the government or public organizations, something that can increase mistrust between the government and the citizens. Whitmore (2014) claims that it is possible to predict if a country is going to war by using its budget data. Continuing in the authors’ thinking, OGD may open for new ways of spying on public organizations and nations. While public organizations, nations, and citizens can be at risk, communities can also experience consequences. Serwadda et al. (2018) worry that OGD could reopen the gates for “parachute-research”; scientists swooping in, taking samples, and leaving without sharing or contributing. Researchers using OGD are likely to use and interpret data from communities to which they have no connections. At the same time, OGD can cause people and business to avoid certain areas (e.g., because of bad crime statistics). For poor communities, this may mean an inability to develop, as investors are scared away (Kitchin, 2014). As a result, OGD comes with possible consequences and the dystopian would argue that OGD is not for the citizen and can cause a governmental hollowing driven by big businesses that study the citizens over the data divide. Thus, leading to a data oligarchy.

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In conclusion, the technophile and dystopian stand on respective extreme positions. The technophile foretells an improved society, a stronger economy, and a smarter nation, while the dystopian presages big businesses hollowing out the government and actors studying citizens over a data divide. The predicted benefits are desirable, while the journey there could be hard or even impossible to traverse. This journey may even end at another destination than planned (for better and worse). In the following sections, I first present the knowledge needs identified in research and practice, then the research question with objectives, the audience and contribution, delimitations, and ending with a presentation of the thesis outline.

1.2 Where More Knowledge is Needed

Previous OGD research has explored OGD from an ecosystem perspective and impediments experienced by different actors. An ecosystem perspective is a holistic approach to understand humans organizing into a system of organizations and their relations and contains several ideas about the system (see chapter 3). The ecosystem perspective was popularized in 2011 when Pollock (2011) argued for the necessity of feedback from the user to the publisher. This perspective has been used to understand OGD in different countries. For example, it was used to identify how infrastructure can support different specialized user communities in the UK (Davies, 2011).

The ecosystem perspective has also been used to identify the essential elements (processes) of an OGD ecosystem (Lee, 2014; Zuiderwijk et al., 2014c; Dawes et al., 2016). Four essential elements are supply (publishing of OGD), demand, the use of OGD, and feedback; by studying them we can determine functions, impacts, requirements, and importance of different roles (Immonen et al., 2014; Dawes et al., 2016; Van Schalkwyk et al., 2016). Studying roles from an ecosystem perspective allows us to understand their interdependence and ongoing evolution. The perspective leads to insights into how to achieve growth of and health for an OGD ecosystem (Harrison et al., 2012; Heimstädt et al., 2014a). At the same time, the ecosystem can help us understand how actors can organize by action to form an OGD ecosystem.

The ecosystem perspective can also be used to evaluate and compare OGD in and between countries (e.g., Dawes et al., 2016; Styrim et al., 2017; Welle Donker & Van Loenen, 2017). In previous research, the ecosystem perspective has been used to understand (1) elements for an OGD ecosystem, (2) OGD roles, and (3) evaluate and compare OGD ecosystems.

While the ecosystem perspective is popular in OGD research, the current models of OGD ecosystems have not included impediments. Rather, OGD impediments are framed as issues to be solved (e.g. Lee, 2014), while I argue that impediments are an essential part of an ecosystem, as they have the possibility to shape the OGD ecosystem through needed solutions and the problems they cause but can also be inherent expressions of the system's properties. Some studies have touched on impediments impacting ecosystems; the dispersed and heterogeneous nature of the data, the lack of feedback into the policy process, and no clear leadership outside organizations (Attard et al., 2015; Reggi & Dawes, 2016; Welle Donker & van Loenen, 2017). However, these studies have not been integrated into our understanding of ecosystems to capture how impediments can shape and impact the system, and in turn, how impediments can be solved or countered by cultivating the system. As a result, **(a) we need more knowledge on what can impede growth, cause growth in a non-valuable direction, or even collapse an OGD ecosystem.** Impediments, wrong turns, or collapse of an ecosystem can lead to dystopian outcomes for OGD, while resolving them have the possibility of technophilic outcomes.

When actors act in different OGD roles, they are involved in activities and can encounter OGD impediments. *OGD impediments* are circumstances that obstruct or prevent OGD activities, such as publishing, using, or the flow of data from publisher to user (Beno et al., 2017; Safarov et al., 2017; Hinder, 2018). In addition, impediments can be unintended consequences, such as breaking the law, privacy infringement, abuse, or fraud, as they can obstruct or prevent future OGD activities (Kucera & Chlapek, 2014; Barry & Bannister, 2014). OGD impediments have been researched for both publishers and users by different researchers. OGD impediments experienced by publishers can be laws, costs, unknown data locations, and technical capacity (Barry & Bannister, 2014; Conradie & Choenni, 2012; Conradie & Choenni, 2014). For users, impediments can be an inability to find the data, parlance, data quality, and paywalls (Zuiderwijk et al., 2012; Martin et al., 2013; Hjalmarsson et al., 2015). In previous research, impediments are often researched locally.

Local cultivation can be used to seed, model, develop, manage, change, build, or create conditions to solve impediments (Bloom & Dees, 2008; Pollock, 2011; Mars, Brostein, & Lusch, 2012; Harrison et al., 2012; Lee, 2014). For this problem-solving, cultivators are using the evolutionary property of ecosystems. Evolution for an ecosystem happens as new ideas, technology, activities, and expertise are introduced or elements are adapting (Nardi & O'Day, 1999). Formation of ecosystems happens over time as they grow out from an existing context (Heimstädt et al., 2014a). At the same time, changes to conditions can propagate the system (Nardi & O'Day, 1999). The evolution and propagation are two new dimensions to impediments and the local focus. As a result, solutions to impediments face a few challenges; (1) solutions may have no or only local effects, (2) solutions may improve the local situation, but cause impediments for others, (3) solutions may cause existing solutions to fail or together cause new impediments, (4) when the solution is finished the original impediment may no longer exist, and (5) solutions can work and fail as the ecosystem evolves. If impediments are studied from a local perspective and solutions are only introduced for such circumstances, cultivation may become the impediment of the ecosystem. Thus, we understand how impediments are experienced by actors, but **(b) there is a lack of knowledge on how OGD impediments shape an OGD ecosystem.**

Our current understanding of OGD contains a knowledge gap about the interaction between OGD ecosystems and OGD impediments. The lack of understanding risks resulting in solutions that contribute to problems rather than solving them. The knowledge gap can complicate problem resolutions and may make OGD initiatives less effective as intended impacts are not achieved. Thus, the gap complicates the cultivation of OGD.

1.3 Research Question and Research Objectives

This thesis seeks to understand OGD impediments from an ecosystem perspective. This is done to increase the understanding of why it can be challenging to cultivate an OGD ecosystem. Therefore, **the purpose of this thesis is to draw lessons about challenges in cultivating an OGD ecosystem**. The lessons were drawn by studying an OGD ecosystem and OGD impediments. To answer this purpose, I generated a research question, which was further developed into three research objectives. The purpose is based on the two knowledge gaps: (1) we need more knowledge on what can impede growth, cause growth in a non-valuable direction, or even collapse an OGD ecosystem, and (2) there is a lack of knowledge on how OGD impediments shape an OGD ecosystem. Thus, I argue that it is hard to understand why cultivation may have no effect or why the growth of an ecosystem stutters. My thesis attempts to answer the following research question:

What can we learn about challenges in the cultivation of an OGD ecosystem by studying impediments from an ecosystem perspective?

To answer the research question, further knowledge is needed about OGD ecosystems and OGD impediments. First, to understand OGD ecosystems there is a need to understand the roles (e.g. a user and a publisher). The first objective is thus:

(1) To understand OGD ecosystem actor roles by developing and using an analytical framework

As seen in the introduction, there are studies about OGD impediments for publishers and users in previous research. However, I have not identified any comprehensive study of what is already known about impediments. Therefore, the second objective is:

(2) To identify what is known about OGD impediments by reviewing previous OGD research

Once roles and impediments are understood, there is a need to study them together in practice. This can be achieved by studying Swedish practice from an ecosystem perspective to understand OGD roles and OGD impediments. Studying impediments in a practical context allows the creation of an OGD ecosystem model, which considers OGD impediments. The third objective is thus:

(3) To explore OGD roles and OGD impediments in Sweden from an ecosystem perspective

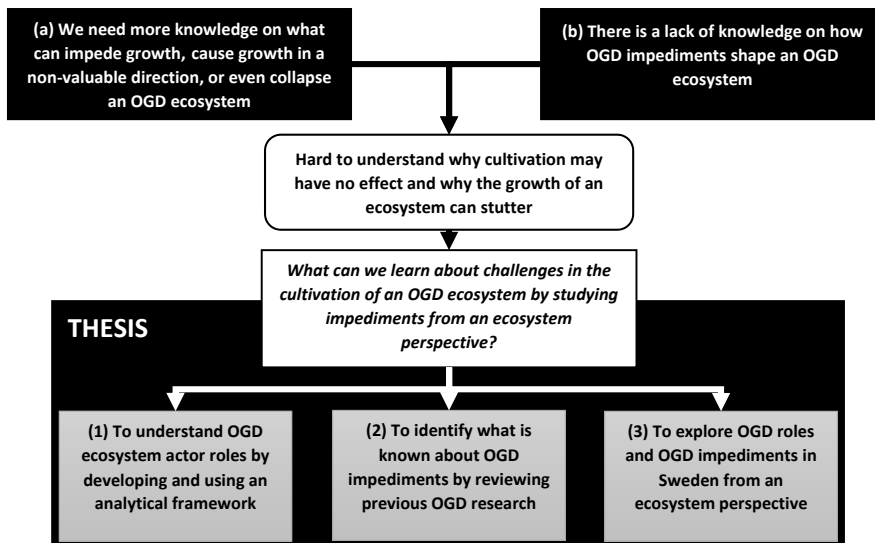


Figure 1: knowledge gaps, need, research question, and research objectives

Figure 1 starts by presenting two knowledge gaps in OGD research. From the two situations, a problem was identified, which then leads to a research question. The research question was then divided into three research objectives. Each of the objectives was addressed with one study. The objectives help to understand the roles of an OGD ecosystem, the current knowledge about OGD impediments, and their interaction in practice. By studying OGD impediments in previous research and practice separately, I can discuss how the ecosystem perspective contributes to the studies and compare the contributions. At the same time, I can contribute with lessons about challenges in cultivating an OGD ecosystem.

1.4 Audience and Expected Contribution

The contribution of this thesis is aimed towards researchers and practitioners that either study or use the OGD ecosystem perspective. This also includes the study or use of OGD ecosystem cultivation. The contribution is lessons about challenges in the cultivation of an OGD ecosystem. A *lesson* is an experience that teaches you how to behave better in a similar situation in the future (Lesson, 2019). The resulting lessons can be considered when either cultivating, working in, or researching OGD ecosystems.

From a knowledge perspective, I argue that lessons learned are a form of guiding knowledge (Goldkuhl, 1998), as it gives advice based on experience. The experiences come from analyzing and reflecting on the achievement of the three objectives and their comparison. Following Goldkuhl (1998), the research question and research objectives can be analyzed for knowledge need and knowledge character. To learn about the challenges in cultivation by studying impediments from an ecosystem perspective, I need to understand the OGD ecosystem, OGD impediments, and their interaction. In addition, the knowledge need is to understand the conditions that make cultivation challenging. Therefore, the lessons will be concerned with conditions that can be thought about when cultivating in the future. The resulting knowledge is guiding because it can support future cultivation, but it does not explain how to cultivate. The knowledge is of “just remember to think about this”-type. Table 1 presents the research objectives with knowledge needs, their knowledge character, and possible results. Each objective was answered with one study.

Table 1: Objectives, knowledge needs, knowledge character, and possible results

Research Objective	Knowledge need	Knowledge character	Possible Results
(1) To understand OGD ecosystem actor roles by developing and using an analytical framework	Understand similarities and differences between roles, as these properties can play a role in the commonality and uniqueness of OGD impediments and OGD ecosystem formation.	Categorical, classificational, and characterizing knowledge about OGD roles from an ecosystem perspective.	Different publishers and users. OGD roles missed in previous research. Roles impact on an OGD ecosystem.
(2) To identify what is known about OGD impediments by reviewing previous OGD research	Compile current knowledge of OGD impediments into the OGD ecosystem perspective, as without it I have an incomplete picture.	Categorical, classificational, and characterizing knowledge about OGD impediments from an ecosystem perspective, with a step towards explaining knowledge.	Different impediments and where they are encountered by whom. How impediments are obstructing or preventing OGD activities. Further need for knowledge development.
(3) To explore OGD roles and OGD impediments in Sweden from an ecosystem perspective	Create an OGD ecosystem model that includes OGD impediments from empirical data, as this has not been done before. The result can then be compared with the above.	Categorical, classificational, characterizing, and explaining knowledge; OGD ecosystem model with impediments.	Elements and impediments of a specific ecosystem. The interaction of the ecosystem and the impediments.

1.5 Delimitations

For my research there were some delimitations. I decided to focus on the interaction between OGD ecosystems and OGD impediments. Another approach would have been to study how conditions inside an OGD ecosystem can impact the ecosystem's growth to learn more about what cultivators can change. I decided to focus on the conditions surrounding potential solutions (the impediments experienced by actors) and not the solutions themselves. However, I sought to understand the phenomena cultivators are trying to cultivate to understand their challenges.

Moreover, the purpose of my research was to draw lessons about challenges in cultivating an OGD ecosystem, which I decided to do by studying impediments from an ecosystem perspective. Alternatively, I could have had studied the activities of cultivators and their impediments from an ecosystem perspective to focus on their experience. I used the ecosystem perspective but could have used the life cycle perspective (e.g., Attard et al., 2015) or actor-network theory (e.g., Higman & Pinfield, 2015). I believe the ecosystem perspective better describes the dynamics of an OGD system.

1.6 Thesis Outline

The following literary work is a compilation licentiate thesis covering three papers. For me, a compilation thesis is based on papers published by the author and the text binds the papers into a whole. In this binding, the author presents a summary of the papers and makes the whole go beyond the parts. This thesis consists of eight chapters, including the introduction. The thesis starts with the introduction, previous research, and an explanation of the OGD ecosystem perspective. Then the paradigmatic worldview is given, then the research design and last the summaries of the papers are presented. The thesis ends with a discussion and a conclusion. The chapters are further described below.

In the **second chapter**, information systems are defined, the OGD definition is further developed, then the relationship between OGD and information systems is discussed, and finally, previous research on OGD impediments is presented.

The **third chapter** presents and describes the OGD ecosystem perspective used in this thesis. This chapter starts by presenting some previous research using the ecosystem perspective, and then continues to present and describe the OGD ecosystem perspective.

The **fourth chapter** presents my paradigmatic worldview for the period of my research, which has influenced my studies. This chapter includes my basic beliefs about reality, humans, social units, knowledge, practice, value, and ethics in research, and ends with presenting how the paradigmatic worldview has impacted my research.

The **fifth chapter** starts with presenting the research process for the thesis with three studies, then, in turn, describes the process deeper for each study, then presenting how the lessons learned were derived from the three studies and previous research. Each study resulted in one paper.

The **sixth chapter** presents a summary of the findings from the three papers and ends with an overall analysis.

The **seventh chapter** discusses lessons that can be learned from the studies. This discussion starts with the lessons from each study followed by lessons drawn from the combination of the findings, a reconceptualization of OGD, and ends with a presentation of challenges in cultivation.

The **eighth concluding chapter** contains a presentation of three identified challenges that can be experienced when cultivating OGD ecosystems, theoretical contribution and implications, practical recommendations for cultivators, my reflection, and future research.

Finally, **Appendix 1** contains the three papers this thesis is based on.

2 Previous Research

In the following chapter, I shortly present the history of the information system (IS) field and related perspectives to position my OGD research, as I am an IS researcher focusing on OGD. The definition of open government data (OGD) is then given to allow insight into its complexity and assumptions behind the concept, and then describe OGD from an IS perspective to anchor OGD inside my research field. The chapter ends with an overview of what is currently known about OGD impediments.

2.1 Information System's history and perspectives

My research on OGD can be put into a larger context of the IS discipline that I am part of. The IS field has a history with several perspectives. To understand IS perspectives; we need to go back to the origin of the field. In 1951, LEO, the first computer in business was operational (Davis, 2006; Hirschheim & Klein, 2011; Hirschheim & Klein, 2012). This development soon resulted in a demand for research on computers in organizations. However, computer science researchers were reluctant to apply knowledge and address problems in the business and organizational context. Their technical view collided with the social nature of business (Fitzgerald & Adam, 2000). Around the same time, Leavitt and Whistler were the first to articulate one of the central concerns of the IS field (ibid.). A new (at the time) technology called information technology (IT) was prognosed to affect the work of middle management and top management. IT includes techniques for processing large amounts of information rapidly, support decision-making with statistical and mathematical methods, and might stimulate higher-order thinking (Leavitt & Whistler, 1958). Soon, several perspectives were created to manage the capabilities of IT in organizations, such as infological systems, reporting and control systems, and behavioral systems (Langefors, 1966; Dickson, 1968; Blumenthal, 1969; Hirschheim & Klein, 2011). The IT in organization focus soon grew to include other areas, such individuals' perspectives, organizational approaches, coordination and planning of political decision processes, and healthcare (Mason & Mitroff, 1973; Lucas, 1973; Kunz & Rittel, 1970; Wennberg & Gittelsohn, 1973). At the start, IS perspectives were focusing on using the capabilities of IT in organization but have since then broaden to be concerned with IT in relation to society, organizations, groups, and individuals. For example, the rise of IS in government gave IS a new phenomenon to study that grew to a new sub-discipline, e-government (Grönlund & Horan, 2005). "... e-government is [broadly] defined as the use of ICT in and by governments and public administrations over the period since the adoption by governments of the Internet and the World-Wide-Web in the 1990s." (Bannister & Connolly, 2012, p. 211). The field overlaps with the emerging research focusing on OGD (Attard et al., 2015), as such both research areas sometimes have common interest (e.g., governmental IT-systems). The interest for OGD in the field of e-government is big, as seen in Government Information Quarterly, EGOV-CeDEM-ePart, Scandinavian Workshop on E-Government, Information Polity, International Conference on Theory and Practice of Electronic Governance, and EJournal of EDemocracy and Open Government. Thus, this thesis is part of the IS field and the e-government field. Something seen in the references of this thesis, where OGD research have been published and discussed.

The historical development surrounding IS has resulted in several perspectives. IS can be concerned with the use of information by individuals or groups in organizations, particularly through IT (Falkenberg et al., 1998). IS can also encompass social units (markets, organizations, groups, and individuals), IT-artifacts, their relations, and IS development (Sidorova et al., 2008) or be regarded as five environments, three processes, and an information subsystem (Ives, Hamilton, & Davis, 1980). At the same time, IS can be perceived as an open system that transforms data, requests information, and organizational resources into information inside an organization (Nolan & Wetherbe, 1980) or an IT-artifact and its immediate nomological net (Benbasat & Zmud, 2003). In addition, IS can also be viewed as three related practices with a holistic view on IT (Goldkuhl, 2008). Finally, IS can be viewed as existing to serve, help, or support people taking purposeful action (Checkland & Holwell, 1998). In this thesis, I have decided to use the latter perspective on IS. This perspective helps to highlight the difference between core businesses and IS, but also focuses on systems, their relationship, and their IT base. Other

perspectives tend to focus on the IT-artifact or the development process inside one organizational context. The problem is that OGD, as a field of interest within IS, spans several organizations and involves equally many IT-artifacts and the social component is important. This scope places importance on actors and infrastructure interoperability. Alternatively, I could have had used Nolan and Wetherbe's (1980) perspective, as they focus on systems, but their perspective focuses on a system with inputs and outputs with an external feedback mechanism. Their perspective is too narrow. In the next section, I first present open government data (OGD) and then in the section after view the OGD phenomena from an IS perspective. The later section will further describe the perspective of Checkland and Holwell.

2.2 An Introduction to Open Government Data

Open Government Data (OGD) refers to several things, such as a philosophy, a noun, two roles in a relationship, and a vision. The movement behind OGD is cousin to the open source (OS) movement and close-family with the open government (OG) movement and open data (OD) movement. In common, the movements seek free access to a resource (e.g., information or software). OGD and OS has another commonality and that is the collaboration to develop and improve a central resource (data or software) (Perens, 1999; Pollock, 2011). However, for OGD, users need to give feedback to publishers so they may improve their data management or publishing, while for OS, the users (developers) can directly change or improve the resource. As a result, OGD do not provide the same source access as OS. The OGD movement and the OG movement both seek to gain free access to information from public organizations (Harrison et al., 2012; Wirtz & Birkmeyer, 2015). On the other hand, OG is a technological and institutional strategy, which transforms government information from a citizen's perspective. Citizens can protect, reuse, collaborate, or interact with governmental information. OG seeks to empower the citizens by allowing them to scrutinize public officials' decisions and actions and allow them to propose alternative actions and solutions (Sandoval-Almazan & Gil-Garcia, 2016). OG seeks transparency and accountability, which OGD can provide. However, OGD is believed to provide more than transparency (e.g., cost savings and economic growth). Moreover, OGD is a subset of the open data (OD) movement. *"The open data movement aims to make data freely available to everyone, without limiting restrictions from copyright, patents, or other mechanisms of control. Like its cousin open source, no single organization is behind the movement — rather, it's more a philosophy shared by disparate individuals and groups."* (Ayers, 2007, p. 95). In comparison, OD wants everyone to share any data, while OGD specializes on the sharing of data from public organizations. At the core of the OGD movement, *Open Government Data (OGD)* is perceived to be interoperable data, which is collected by and shared over the Internet by public organizations to be used by anyone without restrictions (Attard et al., 2015; Open Data Handbook, 2015; Hossain et al., 2016). As a result, OGD is a philosophy making assumptions about how parts of society should function, the purpose of such function, and (sort of) how people should behave, as such it is a normative model (see Figure 2).

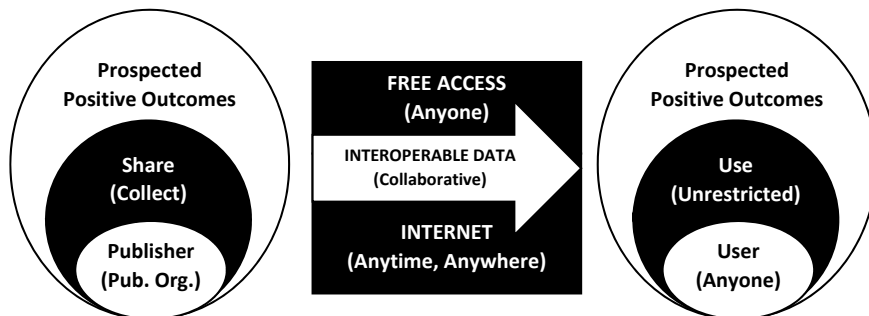


Figure 2: The normative model of OGD with the assumptions of the philosophy visible. Illustrated by me.

For the normative OGD model to succeed there are three important pillars. To understand the origins of the pillars, I need to note that the OGD perspective grounds itself in the use and not in the publishing. The **interoperable data** must have properties that allow for use, modification, and redistribution, while the relationship between publisher and user must allow use by anyone, at anytime, anywhere for any purpose (Tauber, 2007; Open Data Charter, 2015; Open Knowledge, 2015). For the data to have these properties, it must be delivered in a non-proprietary machine-readable format, with content that is complete, comprehensive, primary, timely, and comparable. Data must be formed to allow for the widest range of uses (Tauber, 2007; Open Data Charter, 2015; Open Knowledge, 2015). To allow anyone, at anytime, and anywhere to freely access the data, it is shared over the **Internet** in a digital format without payment and registration (Tauber, 2007; Open Data Handbook, 2015; Open Knowledge, 2015). At the same time, to allow for **free access**, the data cannot be under any copyright, patent, trademark, or regulation (Tauber, 2007; Open Data Charter, 2015; Open Knowledge, 2015). Together, the described pillars are believed to emerge into interoperable data (Open Data Handbook, 2015) from both a technical and social level. The movement assumes that interoperable data can be used for positive outcomes. However, the pillars can only be fulfilled by the publishers, while the user is the only one who can realize the prospected outcomes. As such, OGD is a collaborative enterprise in practice.

Putting OGD into practice results in a social and technical system that can be described in several ways. Many descriptions attempt to capture how data is produced by a publisher who shares the data to some other party for use in a context. OGD can be described as a life cycle (e.g., Attard et al., 2015; Charalabidis et al., 2018), a process (e.g. Janssen & Zuiderwijk, 2012; Zuiderwijk et al., 2012), an ecosystem (e.g. Dawes et al., 2016), a model (e.g. Kalampokis et al., 2011b), and a schema (Kalampokis et al., 2011a). In this thesis, I have used the ecosystem perspective, which is described in the next chapter. There is a difference between the normative model, the OGD description, and OGD practice. In my research, I used the normative model as a definition, while I studied OGD in practice through the ecosystem perspective to understand what I see. Therefore, there are discrepancies between the normative model and the empirical data in my thesis. One such instance is how the model tell us nothing about an OGD portal, while such has been identified in practice (see paper three).

To summarize, OGD is a philosophy with a movement, a type of data in a relationship, and a normative model with a practical system as counterpart. As a philosophy, OGD is concerned with unrestricted access of public data for anyone. As data in a relationship, OGD is surrounded with assumptions for what is needed for it to function to reach a certain purpose. Finally, for the last, OGD is the introduction of a normative model into society (see Figure 2), which changes it from a previously closed state to a new open state. This change can be viewed as a transformation of an information system.

2.3 Open Government Data as Information Systems

Information systems are systems organized to serve, help, or support people taking purposeful action in organizations where the IS is based on IT. IT is a collection of both practices, techniques, and devices concerned with collecting, storing, processing, and distributing data or information. IS exists in relation to organizations. An organization is a social collectivity concerned with some collective action with norms and values where people talk and act as if the collective entity is a real being (Checkland & Holwell, 1998, p. 9, p. 80, p. 109). OGD is a transformation of the IS for several actors and the combination of several IS into one as I explain below.

Without OGD, the publishers and the users are organizations with systems of purposeful action (PAS) severed, helped, or supported by information systems (IS). This description follows the traditional perspective of data collection and interpretation inside one organization (cf. Tananbaum, 2008). This configuration allows tailoring between the PAS and IS. However, OGD opens parts of the IT of the publisher for anyone to access. This opening causes an expansion of the IS beyond the organization's boundaries and the system may need to serve, help, or support several unknown PAS. However, the expansion is not a full expansion of the IS, rather it becomes another outlet for the data. New external

users can access the data but have low influence over the IS, as it is internal and tailored to the usage of the publisher. However, the publisher cannot control how the data is used. To solve this issue of influence, the normative model sets up assumptions about how to achieve interoperable data. As a result, OGD attempts to create a social and technical system where the publisher and user do not have to be in the same organization. The publisher can open their IT to external users, thus, the user does not need to collect, store, and distribute the data or information. Users, who otherwise lack resources and capabilities, can now acquire data for their PAS. In the end, OGD can lead to less double storage of data and less people needing to collect the same data. However, as publishers and users organize for OGD, they can experience impediments.

2.4 The Properties of OGD Impediments

The topic of impediments in OGD research is not unknown. From 2011 to 2017, 31 articles studying impediments were identified with a peak of 14 articles in 2012 (see paper two). Impediments in OGD has been studied from several perspectives, such as process, use and publish, cognitive, and agenda (Conradie, & Choenni, 2014; Martin, 2014; Beno et al., 2017; Wirtz et al., 2016). An *impediment* is a circumstance that obstructs or prevents any activity or development (Hinder, 2018). Impediments for publishers can be lack of resources, fear of misinformation, legislation, and low technical capacity (Barry, & Bannister, 2014). On the other hand, users can experience unpublished data, essential data missing, data not interoperable, and lack of skills and capabilities to use the data as impediments (Zuiderwijk et al., 2012). OGD impediments have properties that can make them hard to manage. OGD is often perceived as a chain of activities (starting with data creation and ending with use). In the chain, different actors can participate in one or several activities (Zuiderwijk et al., 2012). Activities in one phase can create impediments in a later activity for someone else (Zuiderwijk, & Janssen, 2014a). Impediments can also lead to further impediments at other locations (Huang et al., 2017). This cause-and-effect also means that a solution in a later activity can be an impediment in an earlier activity. At the same time, actors can unknowingly create impediments for each other as they try to resolve issues. Impediments can be viewed as a network (cause-and-effect relationships) in a cycle and part of a strategic decision in a broader context (see paper two). For the actors, impediments can also vary in severity (Beno et al., 2017), thus, making it hard to diagnose OGD, as an impediment for one might not be an impediment for the other. Furthermore, as identified in paper three, impediments can have several and different sources which can be direct or indirect. Impediments can also share sources with each other. A source can be something, but also the lack of something. For example, bad data quality can be caused by both errors in data creation or limitations of the data storage. As a result, impediments can be very complex to manage and understand. Table 2 presents some common impediments with possible sources and impact. The relationships were interpreted by me through informal logic, personal experience, and previous research (Maxwell, 2012; Weston, 2018), as previous research alone is not always clear about them.

Table 2: Some common impediments in OGD with possible sources and possible impact

Possible Source(s)	Impediments (Circumstances)	Possible effects on OGD activities
Lack of resources, legislation, and fear of consequences (Barry & Bannister, 2014).	Data is not published (Zuiderwijk et al., 2012).	Data cannot be discovered, thus, not used.
Data was not created to be combined with other datasets.	Data lacks essential information (Zuiderwijk et al., 2012).	Data cannot be combined, thus, not used with other data. Can lower the value of the outcome.
Metadata is not created with user input.	Metadata cannot be found or cannot be understood (Zuiderwijk et al., 2012)	Obstructs evaluation of data, thus, make analytical investigation difficult (Saxena, & Muhammad, 2018).

Free fields in IT-systems, errors in data creation, or the work tradition (Paper three)	Data is not structured (Yang, Lo, & Shiang, 2015) or data has a layout made for printing (Brugger et al., 2016). The lack of essential information can enhance this.	Users need to dedicate more resources to cleaning and normalization of the data (Magalhaes, & Roseira, 2016). Low data quality can make data unusable, as it cannot be analyzed (Whitmore, 2014; Weerakkody et al., 2017).
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3 The OGD Ecosystem Perspective

In the following chapter, I first give some background to the ecosystem perspective and OGD ecosystem perspective. Then, I present my model of an OGD ecosystem. The model consists of important actors, processes, social environment, and infrastructure and is based in previous research.

3.1 Introduction to the Ecosystem Perspective

A *perspective* is a way to view reality and contains assumptions, perceptions about its character, history, valuation, and expectations. Analyzing perspectives are important, as it allow us to understand our biases and assumptions (Goldkuhl, 1998). My ecosystem perspective is based on theory and was used in the research process (cf. Eisenhardt, 1989; Walsham, 1995). The ecosystem perspective was first articulated in 1935 for ecology (Tansley, 1935; Real & Brown, 1991; Pickett & Cadenasso, 2002) and has since experienced diverse conceptual developments and been used in many fields (Mars et al., 2012). The ecosystem perspective is not the only perspective that can be used to understand organizations and their relations. Organizations can, for example, be studied as machines, organisms, brains, cultures, and political systems (cf. Morgan, 1997). Organizational relationships can, for example, be understood as transactions, social exchanges, and resource dependencies (North & North, 1992; Pfeffer & Salancik, 1978; Högberg, 1999). However, in current OGD research, the ecosystem perspective has received increased attention to understand both organizations and their relations (e.g., Dawes et al., 2016; Najafabadi et al., 2017; Styron et al., 2017; Welle Donker & van Loenen, 2017).

The ecosystem perspective

The ecosystem perspective is a form of “holistic thinking” or system thinking, that has been used for various purposes with different meanings with strong divergence. It is defined in relation to its “ecological situation” (Jax, 2002; Jax, 2006; Jax, 2007), the phenomenon under study. In the field of information systems, this perspective has been applied on several phenomenon, such as enterprise information systems, digital strategies, green information systems, smart cities, mobile platforms, software platforms with apps, and smart tourism (Basole & Karla, 2011; Ceccagnoli et al., 2012; Cranefield et al., 2015; Gretzel et al., 2015; Tan et al., 2015; Tiwana, 2015; Brandt et al., 2016; El Kadiri et al., 2016; Romero & Vernadat, 2016; Sasaki, 2018). Similarly, in OGD research, the ecosystem perspective has been used, but the use is fragmented with a narrow focus (Zuiderwijk et al., 2014c) and lacks a definition for its ecological situation. One example is the unclear difference between component and element (e.g., Dawes et al., 2016). I, therefore, present my own ecosystem perspective for OGD based on previous research. The use of the perspective is presented in the research design sections 5.2, 5.3, and 5.4.

In 1935, Sir Author Tansley articulated the first definition of the ecosystem as a biotic community or assemblage and its associated physical environment in a specific place (Tansley, 1935; Real & Brown, 1991; Pickett & Cadenasso, 2002). Since then, the concept has been used for anything from ecology to business to organization to innovation to education to healthcare (Mars et al., 2012). The use has come with conceptual evolution. At the same time, ecosystems can also be viewed as machines, organisms, and algorithms (Cronon, 1995; Pickett & Cadenasso, 2002). The meaning of and the definition of ecosystem vary amongst research disciplines and field under study. This difference can make it hard to communicate findings and obfuscate the research process. To avoid miscommunication and ease understanding, I need to take a step back. The perspective of a phenomenon and the object of a phenomenon are different (Goldkuhl, 1998). Perspectives are a way to look at nature or deal with it at a certain level of observation, while objects refer to a phenomenon realized in space and time (Jax, 2007).

In my thesis and research, the ecosystem perspective was, for example, used to generate a model of an ecosystem that I observed with empirical data. The perspective is part of my methodology and, in the end, the assumptions of the perspective is integrated into the knowledge product. The knowledge product is an attempt to describe an object and is not a perfect copy. To define an ecosystem perspective, I use

two dimensions; meaning and model (Pickett & Cadenasso, 2002). Meaning refers to the technical abstract definition of an ecosystem, which can vary for different (ecological) situations. Model describes the specifications needed to address real situations (Golley, 1993; Pickett & Cadenasso, 2002). For perspective analysis (see Goldkuhl, 1998), meaning is concerned with what the object is and how the object is, and model is trying to describe the components of an object and their function and context. Together, the two dimensions form a perspective, as they contain assumptions, perceptions about the object's character, history, valuation, and expectations. In the following subsections, I first define the OGD ecosystem and then present my model of an OGD ecosystem. This is an approach to visualize my analytical perspective (Goldkuhl, 1998) and I have created the definition and model by using previous research as puzzle bits.

3.2 What is an OGD Ecosystem?

The ecosystem definition consists of a *descriptive* definition that supplies conditions under which an object can be attributed the concept. The conditions ensure that the perspective with assumptions are applied to the right object. The description is supplemented with *factual* information to further describe the object. For example, the description of a dog might be a picture of a generic dog to define the creature, while the factual information would be that of its behavior and life style. In addition, the ecosystem definition has a general definition and specific definition. The latter can be thought as the definition for an "ecological situation" (Jax, 2007); an example is "innovation ecosystem." The specific definition in this research is based on the organizational ecosystem, which is different from the biological ecosystem (see Mars et al., 2012).

Organizational ecosystems

Organizational ecosystems are describing human organizational structures, networks, and systems (Mars et al., 2012). This perspective is used to see the larger complex social system (e.g. organizations, public spaces, communities, regions, nations, and the world) by studying how the system is formed by people, practices, values, and technologies. The system is organized from human actions supported by technology (Nardi & O'Day, 1999). In the system, actors are brought together by some "higher purpose" and they interact to voluntary exchange information and other resources as they pursue personal goals and agendas. Actors also have a common logic or worldview, for example, about the products use. This commonness can sometimes be competing (Mars et al., 2012).

Factually, both the organizational ecosystems and biological ecosystems are emergent phenomena, experience slow and almost invisible degeneration, and the same ecosystem can collapse under different conditions (Mars et al., 2012). The organizational ecosystem is dependent on certain conditions to emerge and thrive. These conditions can differ between ecosystems; what is good for one system, can collapse the other (Mars et al., 2012).

Over time, ecosystems keep changing as new ideas, technology, activities, and expertise are introduced and propagate the system (Nardi & O'Day, 1999). Actors are constantly evolving to adapt to each other's changes, but never reaching a perfect fit. As a result, the formation of an ecosystem happens over time as it grows out of an existing context (Nardi & O'Day, 1999; Davies, 2010; Harrison et al., 2012; Heimstädt et al., 2014b).

Overall, organizational ecosystems are assumed to evolve towards the "greater good," but in an organic way with some missteps. If an organizational ecosystem does not evolve in the right direction, the ecosystem can experience pressure from actors and the social environment, such as political movements (Mars et al., 2012). Because of the adaptive and evolutionary properties, I believe that ecosystems can be cultivated by seeding, modelling, developing, or managing conditions (Bloom & Dees, 2008; Harrison et al., 2012). Importantly, the ability to cultivate organizational ecosystems means they emerge both from the bottom-up and top-down. Cultivation can create conditions whose effects extend far beyond the immediate ecosystem, as humans can replicate and adapt innovations (Mars et al., 2012).

There is also factual information about the actors in the organizational ecosystem. Actors are existing in a system of interdependency because they can only function or have purpose through others (Nardi & O'Day, 1999; Poikola et al., 2010; Harrison et al., 2012; Heimstädt et al., 2014b). Thus, they need each other to achieve the “higher purpose.” Actors are often diverse with several roles (Nardi & O'Day, 1999). However, not every actor is performing optimally from their own view point (Mars et al., 2012), as such there is always room for improvement. Actors in the organizational ecosystem can be specialists or generalists or keystones. Specialists create unique or uncommon resources or information, while generalists create general or common resources or information (Mars et al., 2012). Keystones are actors who the ecosystem must have to survive and are central to the ecosystem's existence, as they allow parts of the system to function. Each keystone fulfils some important role and may contain knowledge inaccessible to outsiders. Knowledge can also be inaccessible about technologies because they have locality in a surrounding habitation (Nardi & O'Day, 1999; Harrison et al., 2012; Heimstädt et al., 2014b; van Schalkwyk, 2014). Actors can also be “nested” with each other. *Nested* refers to the number of supplementary sources actors have to some information or some resource. Nestedness is important for a stable and functioning ecosystem. In addition, actors are planning, forecasting, designing, and coordinating (e.g. institutions), competing, and have contingency plans (Mars et al., 2012).

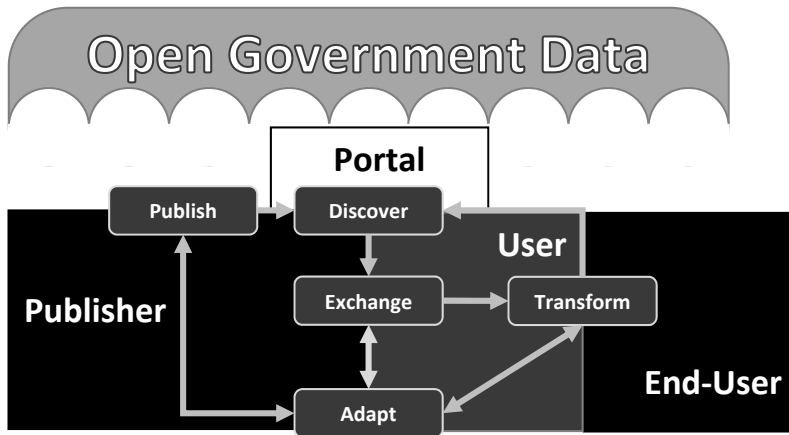
OGD Ecosystems

Actors organize as an OGD ecosystem to achieve interoperable data flow from public organizations to users for reuse. Here, actors are both supporting and supported by the flow. The activities are assumed to be supported by the Internet (see section 2.2). Actors are hoping the reuse will lead to several benefits. The technophile argues that OGD can lead to a better society, a stronger economy, and a smarter nation. In opposition, the dystopian argues that OGD is not for the citizen and can cause a government hollowing driven by big business, where businesses' studies the citizens over the data divide (see section 1.1). OGD can, therefore, be viewed as an organizational ecosystem, as actors are working towards a common higher purpose, share a common (and competing) worldview, and are interacting with each other.

In addition to the factual information provided above, an OGD ecosystem; (1) is assumed to contain local ecosystems encompassed by general ecosystems that are interdependent on the institutional level, (2) is coevolving in a cycle, similar to the carbon cycle, rather than evolving, (3) is interacting and communicating with other ecosystems, as such coevolving with them, and (4) needs to address several issues to grow and stay healthy. The ecosystem needs to address issues concerning privacy governance, operational changes, and usage (Davies, 2010; Poikola et al., 2010; Pollock, 2011; Harrison et al., 2012; Ubaldi, 2013; Heimstädt et al., 2014b; Lee, 2014; Zuiderwijk et al., 2014c).

3.3 My OGD Ecosystem Model

In the following section, I present my OGD ecosystem model based on previous research. Figure 3 presents an overview of the OGD ecosystem model. OGD ecosystems are formed from actors' interactions in processes. The actors' activities are regulated and influenced by the social environment and supported or served by infrastructure (Nardi & O'Day, 1999; Jax, 2007; Mars et al., 2012).



Cultivators

Figure 3: The OGD Ecosystem Model. The umbrella is the normative OGD model. The rounded boxes are processes. Background boxes represent the involvement of different actors. Illustrated by me.

Actors (individuals and organizations) are participating in different activities in processes. Actors are grouped into roles by typical participation and agenda. The typical roles for an OGD ecosystem are publishers, OGD portals, users, end-users, and cultivators. *Publishers* collect and share data with the *users*, who reuse the data without restrictions (Zuiderwijk & Janssen, 2014a; Heimstädt et al., 2014a). On *OGD portals*, publishers publish datasets, or metadata for users to find (Kalampokis et al., 2011; Attard et al., 2015). A portal is both an IT-artifact and maintained by someone; it is thus seen as an infrastructure and a role. Users can in turn provide services or products to *end-users* or other users (Heimstädt et al., 2014a; Lindman et al., 2016). *Cultivators* are actors that try to build or cultivate conditions in the ecosystem (Bloom & Dees, 2008; Pollock, 2011; Harrison et al., 2012; Lee, 2014). In my thesis, publishers are municipalities and public agencies, while users can, for example, be citizens, businesses, researchers, developers, NGOs, or journalists (Safarov et al., 2017). OGD portals and cultivators can be anyone.

While actors participate in several **processes**, the ecosystem perspective is concerned with processes that are important for the organization of the ecosystem. These processes are referred as *elements* in my thesis. Three typical OGD elements are publishing data, using data, and feedback (Pollock, 2011; Attard et al., 2015; Dawes et al., 2016; Hossain et al., 2016; Ayre & Craner, 2017). Publishing data is started by the publishers and allow the users to acquire OGD. Using data can be initiated when the users have acquired data and integrates it into services and products. In feedback, both the publishers and the users are participating as the feedback go from user-to-publisher. Feedback allows the publishers to increase quality of their OGD. This improvement can ease use, thus, resulting in an increase in benefits. Publishing data and using data are both elements dominated by a single role but can only function together. Interdependence between elements is normal, for example, publishing is dependent on data use for value, while the user is dependent on the publisher for data. However, these processes are high-level representations and can be broken down into:

Publish is the process where the publisher opens their data. For publishing, the actor needs to create, collect, or receive data, audit their data inventory, select data, harmonize data, and make the data accessible (Lee, 2014; Zuiderwijk et al., 2014a; Attard et al., 2015).

Discover is the process where users are finding data published by publishers. The process is divided into the sub-processes registering, presenting, and finding. The publisher registers metadata on an OGD portal and the OGD portal presents the metadata to the user (Kalampokis et al., 2011; Attard et al., 2015). The user searches the OGD portal to find the data (Lee, 2014; Zuiderwijk et al., 2014b).

Exchange is the process where data is exchanged from publisher-to-user. The publisher provides the infrastructure to allow the user to scrutinize and acquire the data (Lee, 2014; Zuiderwijk et al., 2014b; Attard et al., 2015). Scrutinizing involves visualization of, reading documentation about, and understanding quality of the data to decide if it is useful (ibid.). Acquiring refers to the method used to access the data, preferably automatable, such as API (Lee, 2014). The exchange element is setting up the publisher to be passively providing infrastructure, while the user is actively using the infrastructure.

Discover and *exchange* can differ depending on how responsibilities are divided between publishers and OGD portals (Kalampokis et al., 2011), thus, placing the elements in an interdependent state. In addition, both elements have the challenge to adapt to transforming because transforming can take multiple forms and yield different results with different applications, such as reports, prepared data, visualizations, and mobile applications (Davies, 2010; Lindman et al., 2016).

The user *transforms* acquired data by integrating the data into products and services to be used by an end-user. The transforming element is a broad set of elements with similar purpose, such as cleaning data, creating tables, visualizing maps, writing blog posts, developing mobile apps, and informing decisions (Davies, 2010; Lindman et al., 2016). For using OGD to inform decision, there might be no difference between the user and the end-user because both can look directly at the data. For example, an administrator might download a dataset in EXCEL to extract some facts to support a decision.

Adapt is a process where the actors of the organizational ecosystem are coevolving. For example, a user can provide feedback to a publisher on how to improve the data and the infrastructure.

The actors are influenced or regulated by the **social environment**, which consist of values, norms, and institutions (Mars et al., 2012). In OGD, transparency of government and the common ownership of government data are assumed to be good. These assumptions seem to come from the open government movement and the open data movement. At the same time, OGD is under the attempt on imposing several norms, such as mentioned in section 2.2. For example, OGD assumes from the start that the publisher is a public organization and the user is anyone. The exchange and reuse cannot be excluding or restricted. Moreover, actors' activities are supported or served by **infrastructure**, such as data portals that help connect publishers and users (Nardi & O'Day, 1999; Poikola et al., 2010; Zuiderwijk et al., 2014c).

In my thesis, the above OGD ecosystem model is used in the discussion and has been a foundation for how I have perceived and thought about the practical OGD ecosystem. I created the model by using previous research as puzzle pieces. In the next chapter, I present my paradigmatic worldview, where one part is my ecosystem perspective.

4 My Paradigmatic Worldview

The following chapter is describing and arguing for my paradigmatic worldview. I first present the elements of my worldview and then visit the basic beliefs of each in turn. At the end, I present the impact of my paradigmatic worldview on my research. My worldview has over time shifted between positivist, interpretivist, and critical realist. Today, when writing this thesis, I view it to be a mix of interpretivist and critical realist. This chapter touches on the surface of what is known about existing paradigms and human psychology. Here, I use paradigmatic worldview to mean a researcher's worldview.

4.1 Elements of a Worldview

All research is based on underlying assumptions about what constitutes valid research and appropriateness of research methods (Myers, 2013). The assumptions define the nature of the “world”, the individual’s place, and the range of possible relationships to the world and its parts (Guba & Lincoln, 1994). The underlying assumptions are part of the individual’s worldview but limiting down to an instance; we have a paradigm (Guba & Lincoln, 1994). In the following text, worldview and paradigm are used synonymously (cf. Creswell & Creswell, 2017), in both cases the use refers to a researcher’s worldview – a paradigmatic worldview.

A worldview is a general philosophical orientation about the world and the nature of research that a researcher brings to a study (Creswell & Creswell, 2017) and refers to a system of beliefs and assumptions about the development and nature of knowledge (Saunders & Lewis, 2012). To put it plainly, a worldview is the set of basic beliefs about fundamental aspects of reality that ground and influence all one's perceiving, thinking, knowing, and doing (Funk, 2001). These beliefs need to be made visible to conduct and/or evaluate research (Myers, 2013). Worldviews are at the center of the individual’s knowledge and influence how we reason about the world (Funk, 2001).

In previous research, four common paradigmatic worldviews are critical realism, interpretivism, positivism, and transformism. Critical realism tries to explain reality through underlying structures that shape observable events (Saunders & Lewis, 2012; Bhaskar, 2013). Interpretivism views knowledge as a social construction and emphasises its context. There is a focus on differences in human roles and how meaning is assigned to phenomena (Orlikowski & Baroudi, 1991; Fitzgerald & Howcroft, 1998; Saunders & Lewis, 2012; Saunders & Lewis, 2012; Myers, 2013; Creswell & Creswell, 2017). Positivism assumes an objective reality that can be captured in law-like generalizations through highly structured methods (Orlikowski & Baroudi, 1991; Fitzgerald & Howcroft, 1998; Saunders & Lewis, 2012; Myers, 2013; Creswell & Creswell, 2017). Transformism consists of several camps with similar basic beliefs, such as critical theory and postmodernism. Their beliefs emphasize the role of language, power relations, and conflicts. This worldview goes beyond describing reality and wants to change it based on political assumptions (Orlikowski & Baroudi, 1991; Saunders & Lewis, 2012; Myers, 2013; Creswell & Creswell, 2017).

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In my research, the objective was to study humans working with OGD. For this purpose, I used an ecosystem perspective that led me to a certain set of core beliefs about reality. The ecosystem perspective had the function of an analytical perspective in my research. The perspective and other research perspectives (e.g. case study methodology, content analysis, and typology development) were also used as part of my research (Eisenhardt, 1989; Walsham, 1995). The ecosystem perspective focuses on a system formed through ever-changing interdependent human interaction and activity where technology exists to support (cf. Nardi & O'Day, 1999). The perspective, therefore, influenced my worldview. In addition, my qualitative research context had an influence.

By previous research a worldview can be divided into nine elements (Guba & Lincoln, 1994; Funk, 2001; Flick, 2012). Not all elements are relevant for a paradigmatic worldview (e.g. teleological and

theological). I have selected six elements that I think are important for my research and I describe my basic beliefs for each below. The six elements are:

- (1) Ontology is beliefs about the form and nature of **reality**. The what and how things really are (Guba & Lincoln, 1994; Fitzgerald & Howcroft, 1998; Funk, 2001; Saunders & Lewis, 2012). For example, the realist and anti-realist both have beliefs about reality (cf. Liston, 2019).
- (2) Anthropology is beliefs about the nature and purpose of **humans** (Funk, 2001). This element should not be mixed up with the research and field of anthropology.
- (3) Sociology is concerned with beliefs about the form, nature, function, and development of **social units**. Researching is a human enterprise, for example, we publish in journals and use a special language. Like anthropology, this element should not be mixed up with the research and field of sociology.
- (4) Epistemology is beliefs about **knowledge**. The what and how for knowledge and its sources and relations (Guba & Lincoln, 1994; Fitzgerald & Howcroft, 1998; Funk, 2001; Saunders & Lewis, 2012; Myers, 2013).
- (5) Methodology is beliefs about how we should **practice** to find what can be known and create knowledge from it (Guba & Lincoln, 1994; Fitzgerald & Howcroft, 1998).
- (6) Axiology is beliefs about **value and ethics** in research (Fitzgerald & Howcroft, 1998; Saunders & Lewis, 2012; Myers, 2013).

The elements as they are defined has a relationship to each other. I view reality to be the base of everything, and humans emerge from it. Together humans organize into social units and “carry” knowledge, values, and ethics separated from reality but can be grounded in the other elements. However, through practice humans interact with reality, themselves, and the “social units.” Depending on the paradigmatic worldview, the relationships between the elements and meaning can vary. The following discussion is about my beliefs in each element and be ordered by the list above.

4.2 My View on Reality

Beliefs about the form and nature of reality belong to the ontological element of a worldview (Funk, 2001; Saunders & Lewis, 2012). Some authors view ontology as the perception of reality (e.g. Guba & Lincoln, 1994), others believe it does not exist (Liston, 2019), but I view it as what and how things are. Reality consists of several phenomena, e.g., quantum physics, atoms, and energies. Animals and humans emerge from reality as atoms form DNA, which are the core of cells, cells that can form animals and humans (Atkins, 2004). The worldviews in previous research have different approaches to reality. The critical realist believes reality consists of experiences, events, and mechanisms (Bhasker, 2013). The interpretivist believes reality is a social product produced in a context and cannot be understood without the context, and can only be interpreted (Orlikowski & Baroudi, 1991). On the other hand, the positivist sees reality as consisting of an objective physical and social world that is independent of humans to be discovered (Orlikowski & Baroudi, 1991; Creswell & Creswell, 2017). The transformatist believes in the social reality as produced and reproduced by humans, but also with objective properties that tend to dominate the human experience (Orlikowski & Baroudi, 1991).

The paradigms can broadly be divided into the separatist (Positivist and Critical Realist) and unionist (Interpretivist and Transformatist). The separatist paradigms view reality as independent of humans. The critical realist views reality to consist of events and mechanisms to be discovered, while the positivist believes reality to be real uni-directional cause-effect relationships that needs to be discovered. However, the positivist views the social world (sociological) independent of humans. I believe similar to the unionist paradigms that the social world emerges from humans. The unionist paradigms view the world as being constructed by humans and, therefore, view reality as interdependent with them. I see that the unionists cannot explain the behaviors of the physical reality, such as why books have substance or why dead matter emerge into life. I think that the positivist mixes sociology into ontology, while the unionist mixes sociology and ontology into anthropology. On the other hand, the critical realist can

explain reality with events and mechanisms, but the experiences are an anthropological element. Experiences can be a bridge between the anthropological and ontological. I, therefore, have a critical realist view of reality.

4.3 My View on Humans

Basic beliefs about human nature and purpose are referred as anthropology (Funk, 2001). The worldviews in previous research have different beliefs about humans. The critical realist believes there is a human nature with high degree of behavioral plasticity, where humans are open systems capable of communication, creativity, and resistance (Gorski, 2013). The interpretivist believes humans are social actors, sense-makers, interpreters, and subjective perceivers (Orlikowski & Baroudi, 1991; Saunders & Lewis, 2012; Myers, 2013). The positivist believes human action is intentional and (boundedly) rational (Orlikowski & Baroudi, 1991). The transformatist believes humans to be political, historical, and limited with unfulfilled potential (Orlikowski & Baroudi, 1991; Myers, 2013).

The positivist worldview does not account for history and "...implies people are not active makers of their physical and social reality" (Orlikowski & Baroudi, 1991, p. 12). While the interpretivist and transformative paradigm implies humans are steered by an invisible discourse and reality is just human language (Gorski, 2013). They view humans as locations of socialization, not as "flesh and blood" (Archer et al., 2013). Essentially, both sides neglect important elements of being human. While the critical realist focuses on explaining how underlying mechanisms shape observable events (Saunders & Lewis, 2012), they admit to the plural experience of humans while defending a reality independent of humans (Mingers et al., 2013). In this view, "... [humans] are more than their biology but less than their socialization" (Archer et al., 2013, p. 193).

Humans exist in what is, and they experience it, they can think about what should be, and then try to act to shrink the gap (Peterson, 2003). Acting can be performed either together or alone. Humans thanks to their biology possess intuitive understandings of physics, biology, engineering, psychology, space, numbers, probability, economics, information, knowledge, logic, language, and ethics (Pinker, 2003, p. 220; Haidt, 2012). Intuitive means organized in advance of experiences, for example, humans are born to be righteous, but they need to learn what to be righteous about (Haidt, 2012). The understanding of psychology and language help humans socialize, while the understanding of engineering gives them the ability to generate and use recipe knowledge (e.g. Berger & Luckmann, 1967). The intuitive understanding is not perfect, for example, before the empirical methodology helped us to separate subject and object in description; "... [the] pre-experimental man observed "morality" in his behavior and inferred [...] the existence of a source for that morality in the structure of the "universe" itself." (Peterson, 2003, p. 103). Another example is how pre-experimental humans saw women birth children and caves "birth" ores and concluded they are related through femininity (ibid.). While the intuitive understanding contains flaws, it is important to note that humans evolved to capture and survive reality (Pinker, 2003). Therefore, flaws cannot easily be dismissed or solved as they can fill important purposes in social life (ibid.; Haidt, 2012).

For human socialization, I move from a critical realist worldview to something similar to an interpretivist worldview. The move is a result of my education and experiences. Humans seek to understand the world in which they live and work (Creswell & Creswell, 2017). Humans are socialized and educated into different domains with specialized knowledge that form their understanding of reality (Berger & Luckmann, 1967). Humans together construct meaning and value about real and social phenomena (Berger & Luckmann, 1967; Peterson, 2003). Human meaning is anchored in the context and history and is only accessible through social constructions. As a result, it is not universal (Fitzgerald & Howcroft, 1998; Orlikowski & Baroudi, 1991; Myers, 2013). The meaning can be both subjective and intersubjective (Berger & Luckmann, 1967). However, biology is still important for human behavior as it, for example, can make them angry at events without being able to explain why (see Haidt, 2012).

4.4 My View on Social Units

Sociology is concerned with beliefs about the form, nature, function, and development of social units. This element is not defined by earlier texts, rather it is an element that I see in them and around my own work. For example, the writing of a paper or thesis for others to read is part of sociology. The sociological element in this thesis is the ecosystem perspective presented in chapter 3. Ecosystems are sociological objects. In my instance, they are human organizational systems. Humans are trying to organize as a system to achieve some higher purpose.

4.5 My View on Knowledge

Basic beliefs about what knowledge is and what knowing is are referred as epistemology. Epistemology is also concerned with how “valid” knowledge can be obtained (Guba & Lincoln, 1998; Funk, 2001; Saunders & Lewis, 2012; Myers, 2013), as such it is related to methodology and axiology. Knowledge is a human product dependent both on the production methods, people making it, and previous knowledge. Some believe knowledge to be a local social product impossible to understand without its context and its creation can be a social event (Hirschheim, 1985; Orlikowski & Baroudi, 1991; Fleck, 2012; Bhaskar, 2013). Knowledge can be classified in several ways (see Goldkuhl, 1998). Knowledge as a phenomenon is a collection of experiences, thoughts, and intuitions based on thought styles, which restrict and order the understanding. Knowledge is neither subjective nor collective. Knowledge as anchored in external objects (e.g., texts, words, and body language) can be used as a tool to bypass the reinvention of the wheels (Fleck, 2012). However, an external object can never perfectly represent the internal knowledge of an individual.

Knowledge can be about different phenomena, such as ontological (e.g., stones), epistemological (e.g., theories), and axiological (e.g., good or bad behavior). Knowledge can also be of different kinds; interpretivist knowledge is a contextual generalization and critical realist knowledge is describing the mechanisms shaping an event, while positivist knowledge is laws (Bhaskar, 2013; Myers, 2013). As a result, knowledge consists of an adaption to the phenomenon under study, a transformation method (e.g., generalizability), and a social product. In my research, I have used analytical generalization to transform experiences about humans and social units into knowledge (Walsham, 1993; Yin, 2018). This approach was introduced into my research by the surrounding PhD environment and selected practice.

4.6 My View on Practice

To transform the experiences of reality, humans, and social units into knowledge a research process driven by the researchers (me) is needed. Beliefs about methods (involving both data collection and data analysis) are gathered under methodology (Guba & Lincoln, 1994). In comparison with epistemology, methodology is concerned with the production rather than the knowledge product. Research methods can broadly be divided into quantitative and qualitative (Myers, 2013). Quantitative methods are often associated with positivism as the methods were developed to study natural phenomena and tries to measure phenomena through numbers. Qualitative methods are more associated with social sciences as they were developed to study social and cultural phenomena with a focus on text (ibid). My research is studying humans trying to organize as a system, which means qualitative methods are preferable.

Studied phenomena exists independently from the knowledge created (Fleck, 2012; Mingers et al, 2013), as such there are several ways to uncover the veil. Interpretivism advocates accessing reality from a native view of phenomena by field study and social constructions (Orlikowski & Baroudi, 1991; Myers, 2013), while critical realism advocates for mixed-method research dependent of what is studied (Mingers et al., 2013). This difference comes from that, interpretivism is subjectivist, while critical realism accepts different kinds of knowledge objects (Fitzgerald & Howcroft, 1998; Mingers et al., 2013). In addition, interpretivism attempt to avoid imposing externally defined categories on a phenomenon (Orlikowski & Baroudi, 1991). Both worldviews allow for triangulation of phenomena (Myers, 2013). Positivism studies reality by placing parts of it in closed systems, something criticized by Bhasker (2013) as what can work in the closed system may not work outside of it because of

interference. In my research, I have used interpretivist methods to access and understand the sociological phenomenon of study, as the phenomenon is existing in an open system. The interpretivist methods were also introduced to me through my Ph.D. study context as tools of the trade.

4.7 My View on Value and Ethics

Basics beliefs about value and ethics are called axiology. Axiology in the broadest is concerned with the nature of value, what is good and bad, and what is right and wrong (Funk, 2001). In this thesis, axiology is narrowed down to basic beliefs about value and ethics in research (Saunders & Lewis, 2012, p. 107). The above basic beliefs lead to an acceptance of interpretivist values, such as the assumption that valuable knowledge comes from human interaction and research using qualitative methods. It is easy to place rigor and relevance against each other (Fitzgerald, & Howcroft, 1998; Myers, 2013, p. 12). Rigor is associated with positivism and perceived to be more scientific in nature with a focus on theoretical contribution. Relevance, on the other hand, is associated with “consulting” and immediate practical contributions. However, I think both rigor and relevance are important in research and should be used as qualitative rigorous methods can make theoretical and practical contribution. Research as a process is not transformative (such as turning wood into doors, where the wood is consumed); rather it is an original investigation contributing to knowledge and understanding of a particular phenomenon without consumption of the phenomenon (Myers, 2013). Therefore, research can study phenomena and from it generate both practical and theoretical contribution. Important, is trying to make the contribution believable (Saunders & Lewis, 2012, p. 131).

While researching to produce believable contributions, it is important to follow ethical principles. The field of ethics is involved with systematizing, defending, and recommending concepts of right and wrong behavior (Fieser & Dowden, 2011). Research ethics is a focus area in ethics applied on planning, conducting, and reporting for research (McNabb, 2002; Myers, 2013). In my research, I have worked to follow ethical principles from Myers (2013), and two codes of conducts (Guchteneire, 2006; AIS Research Conduct Committee, 2014).

Rather than recounting all of the ethical principles, I give a few examples on how I have followed them. I informed the research participants about my research. The information included where I’m from, what I research, what I’m interested in, and what the data will be used for. This was often performed at first contact with the participant to ensure transparency and understanding of what my research meant. This was commonly performed in relation to an interview invitation. At the same time, I have tried to contribute with knowledge sought after by both practice and academia by following the problem developments in both domains. The knowledge I create was distributed to academia through articles and presentation, while for practice I used presentations, networking, and popular science articles. After interviews, previous research was shared with the participants as thanks for their contribution. Moreover, I used research methods that would have low impact on the life of the participants, such as email interviews and phone interviews with time constraints rather than closed system experiments. The participants were informed of their anonymity in the contributions. To ensure the contributions were precise they were member checked or presented to the interviewees. This approach meant analysis stayed close to their expert knowledge and experience.

4.8 My Worldview’s Impact on My Research

In the following section, I present a summary of my basic beliefs, their impact on my research, and my role in the research. Table 3 presents the paradigmatic elements with my basic beliefs about them and the beliefs impact on my research. In the research, I have not been an objective outsider looking in, rather I have been part of the knowledge development. I used a theoretical perspective to understand the sociological phenomena, as such it was part of my data collection and analysis (Eisenhardt, 1989; Walsham, 1995). Over time, my knowledge of the phenomena has developed, and I have been able to more clearly see and understand OGD (cf. Fleck, 2012). One example from the empirical material are the concepts of standards, specifications, and formats. At first, I perceived them to be very different, but

over time, I learned that they can be used to refer to the format of the data (e.g., XML, CSV, and PDF) or the internal structure of the data. However, by listening to practitioners, I learned they are a call for order by the “speaker.” At the same time, I have interacted with several humans in the field and exchanged experiences and knowledge about OGD. The humans have been both academics and practitioners in the Swedish context. I, therefore, have had some impact on the OGD ecosystem and the ecosystem influenced me. From an ecosystem perspective, I may have contributed to its evolution.

Table 3: Paradigmatic elements with basic beliefs and their impact on my research

Paradigmatic Element	Basic Beliefs	Impact
<i>Reality</i>	Reality consists of events and mechanisms.	People interviewed use and describe events and mechanisms with their own contextual language. People are separated by time and distance, and experience events and mechanisms differently. As such, I had to interview people from different locations in Sweden.
<i>Humans</i>	Humans are more than biology, but less than socialization. They can experience reality and social units, which do not fully capture them.	I used data verification and studied several other subjects outside of OGD to gain a deeper understanding. One example of data verification, is how I created a code report per participant in paper three and sent them for member check to avoid misunderstanding and allow for extra input.
<i>Social units</i>	Humans can organize as systems to achieve higher purposes.	I studied humans and how they attempt to organize into a system. The phenomena under study was beyond one person to be observable from one location. I had to interview several participants and study different documents to achieve triangulation of the system.
<i>Knowledge</i>	From collected data, analytical generalization can be made.	I analyzed the data for patterns that could be generalized, but also attempted to create or contribute to theories. Previous research was used as a lens to better understand the phenomena under study.
<i>Practice</i>	Data can be collected through qualitative interpretivist methods to capture human experiences.	I interviewed and observed humans involved in and knowledgeable about the phenomena under study. I also searched for relevant documents and websites. In addition, I followed the development of OGD in Sweden as my knowledge developed.
<i>Value and ethics</i>	Interpretivist values. Rigor and relevance are important.	I viewed myself as involved with the OGD practice. Rigor motivated me to conduct thorough research. Relevance motivated me to sharing the research with practice through presentations, discussions, and popular science articles. For ethics see above.

5 Research Design

This chapter presents the overall research design for this thesis followed by the research design for each study. Each study is presented with the authors and their roles, followed by an overview for the study, (if needed) case studied, the process or data collection and data analysis, and ends with how the ecosystem perspective was used. Then, how lessons were drawn from the studies is presented. Finally, the limitations of the country context and research are presented.

5.1 The Research Process

My research was conducted as qualitative research (Myers, 2013) and is reported as a *compilation licentiate thesis*. The research started after my master thesis (Crusoe, 2016) and continued to late 2018. The master thesis is in information systems, from the IT and management study programme at LiU, and is referred to in this text but is not part of this thesis compilation. The master thesis introduced me to OGD. Figure 4 presents the research progression with the following studies and the resulting papers. The compilation thesis covers the three papers. Each paper was the product of one study. The first paper (Crusoe & Melin, 2017) focuses on OGD roles and the OGD ecosystem, the second paper (Crusoe & Melin, 2018) focuses on previous research on OGD impediments, and the third paper (Crusoe, 2019) explores the Swedish OGD ecosystem.

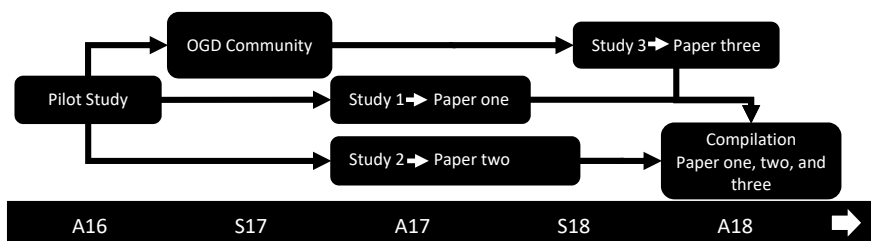


Figure 4: The thesis research process over time (A = autumn, S = spring).

The research started with a pilot study to develop an understanding of the phenomena. The study focused on OGD roles, impediments, ecosystems, lifecycles, and incentives. In programmatic terms, it can be said the study tried to be “an application to conquer the world.” The case studied was the Swedish National Archive, a public agency, as they had published data and was about to start a governmental mission to promote publishing. The pilot study resulted in a paper presented at Scandinavian Workshop on E-Government (SWEG) 2017 and a presentation for the agency. The paper is not part of this compilation thesis. SWEG was selected on the recommendation of my supervisor and has since then been revisited every year, as it gives good feedback through peer review and comments from the presentation, insight into what is happening in the Scandinavian e-government community, and is a crucial creative forum with other researchers. While the master thesis introduced me to the Swedish OGD community, the pilot study immersed me into the Swedish OGD community as I participated in Swedish OGD forums and lectures. Later the pilot study developed into study 1 and led to study 2. Study 1 continued the typological development of OGD roles, while study 2 was a systematic literature review to systematize previous research on OGD impediments. The results of study 2 were first presented at SWEG 2018 and after refinement presented at EGOV-CeDEM-ePart 2018. The conference was selected by recommendation from my supervisor, as it synchronized well with my research progression and key OGD researchers would be there. Then, study 3 started and was an inductive explorative case study of the Swedish OGD ecosystem. In the study, four municipalities, six public agencies, eight users, and two cultivators participated. The result was presented to the participants through a popular science article, and the paper has been submitted to a well-known e-government journal with several OGD articles published. The popular science article has also been included in a report from the new agency for digital government to the ministry of finance. The results from study 2 were also shared with the interviewees

of study 3. The three studies are part of this thesis. In addition, in the thesis, through a discussion, lessons were drawn from my experience and the studies in turn and together.

Before starting the presentation of the research design for the studies, I want to note that for the period when following the Swedish OGD community, participant observation was used to collect data. The method was also used for study 1. *Participant observations* are data collection methods used to study everyday life to observe differences between words and actions (Kawulich, 2005). The method's advantages are its access to everyday life, rich details, and unscheduled events (Kawulich, 2005). The method's disadvantages are that it is time-consuming, interpretative of people's actions rather than words, and selective of details (Kawulich, 2005). In addition, memos were written for the three studies. *Memos* are documents used to capture what you are doing and allow you to reflect on it, a place to dump what is on your mind (Saldana, 2015).

5.2 Study 1 – Typological Development of OGD Roles

Authors: Jonathan Crusoe (Methodology, Data collection, Analysis, and Theory) and Ulf Melin (Methodology, Data collection, Guidance, and Analysis)

Study overview. The first study had the aim to stimulate the conceptually oriented discussion about actors' roles in the OGD ecosystem in both research and practice. This aim was based on unclear conceptualizations of the OGD roles in previous research. The purpose of the study was to elaborate on OGD roles conceptually using previous studies and a pilot case study of the Swedish National Archives. The pilot case study was rooted in Myers' (2013) qualitative case study. *Qualitative Case Study* is a methodology used to study a specific contemporary real-life situation to draw general conclusions (Myers, 2013). The methodology's advantages are its use of triangulation in data collection, can use previous research as a guide, philosophical neutrality, face validity, ability to test a theory in real life, and it allows researchers to come close to the action (Myers, 2013). The methodology's disadvantages are that it can be difficult to gain access, cases can be afraid of time consumption and negative results, researchers have no control over the situation, hard for novice to focus on important issues, is very time-consuming for the researcher, and do not normally involve participant observations and fieldwork (Myers, 2013).

The case of the Swedish National Archives (SNA) is a public agency organized in 12 locations and has about 500 employees. The study focused on its headquarters in Stockholm. The agency was founded in 1618 with the core mission to handle information and archiving. At the time of the study, the agency has been a publisher for about two years and published six datasets with the metadata registered on the Swedish OGD portal. In 2015, the government assigned the public agency to investigate candidates for the responsibility of the national OGD portal and responsibility to stimulate public agencies to publish. Later in the mid-summer of 2016, SNA was appointed the national mission, which started in early 2017 and ended earlier in mid-2018 (the early ending is added in this thesis). The mission focused on public agencies, and SNA had (1) the responsibility to stimulate other public agencies' OGD development, (2) collect information about potentially publishable datasets, (3) maintain and develop the national OGD portal, (4) maintain the OGD guide website, and lastly, (5) support individuals in finding data in the state and provide contact information. At the same time, the public agency collaborated with another public agency that had earlier experience with OGD publishing. At the time of the study, SNA was taking the first steps by preparing the mission as a project and hiring a project leader. Therefore, documents, processes, and other things in or for the mission were still under development through meetings and discussions. As a result, the public agency was preparing to participate in several new OGD roles beyond the first.

Process. The study was conducted iteratively with one loop for typological development and another for empirical coding. Both loops influenced each other. The typological development used *intensional classification method* (Marradi, 1990), which helps to group similar objects into classes by properties. In the study, some advantages and disadvantages of this method was experienced. The method's

advantages are its structured approach to creating typologies, rather than population, and customizability because it provides logic and rules over boundaries and cores. The method's disadvantages are its openness for error of inclusion and exclusion, and risk of biased selection. The typological development started with searching for literature and previous studies to act as an initial guide. The initial findings drove the questioning that developed the basis for the division in the typology. The typology was then populated with previous research, which drove the questioning further. The empirical coding loop started with data collection through meetings, memo writing, and interviews from the Swedish National Archives. In total, five employees were interviewed (see Table 4).

Table 4: Interviewees from the Swedish National Archives

#	Role(s)	Interview Method
1	An analyst and investigator	Face-to-face semi-structured
2	An IT-manager for system development	Face-to-face semi-structured
3	An investigator	Face-to-face semi-structured
4	A business developer and investigator	Face-to-face semi-structured
5	The head of a department	Face-to-face semi-structured

Semi-structured interviews are interviews guided by an interview guide that allows for the formulation of new questions as the interview is progressing. The interview method is important for qualitative research (Myers, 2013). The method's advantages are that it starts with a set of prepared questions that can be expanded and allows for the gathering of rich data from people in various roles and situations (Myers, 2013). The method's disadvantages are that interviews are artificial, there can be a lack of trust and time, gatekeepers may block access, risk of elite bias, Hawthorne effect, constructs knowledge in the process, language can be ambiguous, and interviews can go wrong (Myers & Newman, 2007).

Moreover, the collected data was initially coded and analyzed. *Initial coding* (also known as open coding) breaks data into discrete parts (codes) and is open-ended to follow the directions of the data (Saldana, 2015). The advantages of coding are its ability to analyze, create a theory, and manage varied and diverse data (Schreier, 2012). The disadvantages of the method are its time-consumption, risk of overwhelming the researcher, and can be limited to the generation of lower level theories (Myers, 2013). The codes were inserted into the typology and, therefore, became part of the population and in turn, drove more questioning. At the same time, the known population and questioning influenced the data collection and coding. Progression in either typological development or empirical coding led to developments in the other. In the paper, the final insertion of the codes into the typology is presented.

Ecosystem perspective. In the study, the ecosystem perspective was used to understand roles and their interaction, where the ecosystem was the system in which all roles were organized. The typological development started with the assumption of an ecosystem as the first level of the typology and gradually approached the actors and their activities, as such it drove the questioning. The three typology levels represented are the membership of the ecosystem, the participation in elements, and the OGD roles.

5.3 Study 2 - Systematize Research on OGD Impediments

Authors: Jonathan Crusoe (Data collection, Analysis, and Methodology) and Ulf Melin (Guidance and Analysis)

Study overview. The second study had the purpose of expanding the scope surrounding OGD impediments. This expansion was performed by taking a step back to view other actors and activities surrounding the publishers and OGD publishing. The problem was that previous research tended to study specific parts or specific phases of a larger system or process. This focus allows for specialized solutions that can cause impediments at other locations of the ecosystem. This study was thus conducted as a systematic literature review where the identified articles were coded to make illustrations and a systematization of the identified impediments. Systematization (2019) is the act of organizing something as a system. In the study, some advantages and disadvantages of this method were experienced. This

method's advantages are that it allows for creative freedom to solve a problem, reuse of previous research, and select other methods for such purpose. However, the method's disadvantages are that it did not follow any standard method and is open for selection bias.

Data Collection. Data was collected through a systematic literature review. A *systematic literature review* is a data collection method for collecting literature about a topic to bring the reader up-to-date (Cronin et al., 2008). The method's advantages are its ability to provide information about a topic from a wide range of sources that can then be compared and combined and limit bias in identifying and selecting sources (Greenhalgh, 1997; Kitchenham, 2004). The method's disadvantages are that it is time-consuming (Kitchenham, 2004) and erroneous selection of keyword can lead to missed opportunities (as experienced). In the study, the systematic literature review started with defining keywords, then selection of databases, search using the keywords, filtering, and summarization of results, and analyzation of the findings. The systematic literature review used simple keywords created by combining "open data" with "barrier," "risk," "challenge," or "impediment" to search Google Scholar. For each keyword, the first 50 results were studied for all years, the year of 2016, and the year of 2017. In total, this resulted in 600 articles. From the 600 articles, relevant articles were summarized with article id, authors, title, year, publishing origin, topic, and important conclusions. When systematic literature reviews were identified, the purpose of the study and information about the method were included in the summary. Later when analyzing the relevant articles and interesting references were discovered, snowballing was used by including interesting reference from them (Wohlin, 2014). At the end with snowballing, 34 articles were identified.

Analysis. The final set of articles was coded into three illustrations to present them as data and coded to systematize the OGD impediments. The coding process was based on Saldaña (2015). The presentation of the data involved a distinct coding effort to analyze historical development, impediment types, and study focuses. The sketches of the illustrations were discussed and analyzed in a generative dialogue by the researchers, and final changes were made. The systematization of OGD impediments started with identifying an OGD process, then the articles were categorize coded into the process, and possible linkages between impediments were identified. Finally, categories were refined by reflecting on their meaning. The *categorize coding* was based on Saldña's (2015) coding techniques; inductive codes were inserted into deductively created categories (the process). The insertion allowed changes to both. The method comes with the same advantages and disadvantages as initial coding. In addition, a few extra were experienced in application. The experienced advantages were that the method allowed for creativity, reflection on the data, and stayed close to the data. The disadvantages with this method were that the created categories might not fit with the inductive codes, the risk of bias from previous research or practice, and difficulty to decide if the code or category needed to be changed.

Ecosystem perspective. For this study, the ecosystem perspective was used to take the step back and view the often studied OGD impediments and OGD process as part of an OGD ecosystem. This use allowed for expanding the process, impediments, and identifying possible linkages between the impediments.

5.4 Study 3 – Exploration of the Swedish National OGD Ecosystem

Author: Jonathan Crusoe

Study overview. The purpose of the third study was to explore what impediments publishers, users, and cultivators can experience. From their experiences, ecosystem faults were identified. This study was performed as an explorative case study and started by mapping the Swedish national OGD ecosystem. An *exploratory case study* is the same as the qualitative case study described above, however, it is used to discover the phenomena in the contemporary real-life situation (Myers, 2013). In the mapping, several interesting actors, documents, presentation, recorded presentations, and websites were identified. Almost all actors were contacted for interviews and several participated. The end number of participants by data collection method can be seen in Table 5. The interviews were analyzed for activities and

impediments, and from the knowledge, faults were identified. The result at this stage was sent to the interviewees as a popular science article for feedback and comments from the interviewees. Finally, the knowledge was supplemented with codes from several important documents.

The case of the Swedish national OGD ecosystem. Sweden is governed by a parliamentary government and has a population of 10 million. The country is divided into counties with municipalities. In total, there are 21 counties and 290 municipalities. In support, there are 460 public agencies. Public organizations have high autonomy from the government. Overall, the country has good digital maturity, made several investments into OGD, and a long history with transparency. In fact, the country has launched almost 200 digitalization initiatives (not all OGD), was in the top three between 2015 and 2018 in the digital economy and social index (DESI), and in the year of 1766 the government passed the principle of public access to official records with the freedom of the press act into the constitution. The Swedish national OGD ecosystem consists of some OGD portals, several cultivators, publishers, and users, data labs, hackathons, and other events. At the time of this paper, the national OGD portal had 1647 dataset registered. However, while the country has an active OGD ecosystem, their OGD maturity is lagging.

Data collection. In the study, both empirical data and previous research were used. Empirical data came from interviews, documents, recorded presentations, presentations, and websites. Previous research was identified through searching Scopus, Google Scholar, and Linköping University Library and some articles were from study 1 and study 2. Interview data was used as the primary source, while documents, websites, and presentations were secondary and used to supplement. In total four municipalities, seven public agencies, eight users, and one department were interviewed (see Table 5). All semi-structured interviews were supported by an interview guide, which aimed to explore the interviewee's experience with OGD, impediments and challenges, public context and participation, and solutions. All interviews were transcribed and prepared for analysis by making a data memo for each. At the end of the research, seven important documents supplemented the findings, as they were studies of the impediments experienced in the Swedish OGD ecosystem on a national and local level. Moreover, new methods for this study were the use of voice interviews and e-mail interviews. *Voice (Telephone) interviews* are an alternative to face-to-face interviews (Novick, 2008). I include Skype in the voice category because the software had the same function as a telephone. The method's advantages are that it is cost effective, gives increased access to geographically disparate interviewees, requires less space, provides increased interviewer safety, easy to take notes unobtrusively, interviewees can remain on "their turf," permit more anonymity and privacy, decreased social pressure, and increase rapport (Novic, 2008). The method's disadvantages are the lack of coverage for some participants, the absence of visual cues, and the potential for the interviewee to get distracted by activities in their environment (Novic, 2008). *E-mail interviews* are conducted over email where questions are asked few at a time over several days (McCoyd & Kerson, 2006). The method's advantages are that it enables extensive and longitudinal communication, allows convenient text responses, leads to less social pressure, and geographical differences in experience are revealed (McCoyd & Kerson, 2006). The method's disadvantages are that there is no direct observation of emotions and technical problems can be experienced (McCoyd & Kerson, 2006). At the same time, it can be hard to guarantee who the interviewee is.

Table 5: Data collection by actor and data collection method (From paper three).

	Municipalities	Public Agencies	Users	Department
Voice interviews	2	1	1 (2016)	1
E-mail interviews	2	6	3 (1 unfinished)	-
Face-to-face interviews	-	-	4 (2016)	-
Total	4	7	8	1

Analysis. For the analysis, inductive content analysis was used to code the data memos. *Content analysis* is used to build a model to describe a phenomenon in a conceptual form. In inductive content analysis, the codes are derived from the data (Elo & Kyngäs, 2008). The method is well-suited to analyze multifaceted, sensitive phenomenon. The method's advantages are that it can handle large volumes of textual data and different textual sources and deal with corroborating evidence (Elo & Kyngäs, 2008). The method's disadvantages are that it is based on ambiguous or extensive research questions and open for excessive interpretation (Elo & Kyngäs, 2008). The study's content analysis consisted of three stages; (1) data were grouped by actor (individual or organization) within a data memo and coded into a code report. The coding started with identifying meaning units; then these were transformed into condensed meaning units, which later was grouped into codes. Codes were in the code report divided between activities and impediments. The writing of the code report involved going back to the data memo for validation for each code. One code report gave specific insight into one actor's experience with OGD. This stage resulted in 20 code reports and 14 code reports were sent to interviewees for member check (control for misunderstanding and add missing information). (2) The 20 code reports were grouped by users, municipality, public agency, and cultivator. The groups were then, one code report at a time, coded into a larger codebook. The process involved abstracting code report codes, verifying new codes against data memos, redefining codes as new information was introduced, and categorization. This stage resulted in four codebooks with categories of codes (experiences) common and unique for the actor groups. (3) Summary report of the actors was written and was analyzed with the codebooks, code reports, and analytical memos. At this stage, the research analyzed for patterns in the codes based on the research questions. The pattern analysis was based on Saldaña (2015) and the end result is similar to a logical model (Yin, 2017). Finally, seven important documents were analyzed and included in the research. Documents were analyzed with content analysis guided by document analysis. *Document analysis* is the study of important documents, presentations, and documents. For example, reports and policy documents (Bowen, 2009). The method's advantages are that it is efficient, available, cost-effective, unaffected by research, stable, exact, and provides good coverage (Bowen, 2009). The method's disadvantages are the risk of insufficient detail, low retrievability, and bias from the authors (Bowen, 2009).

Ecosystem perspective. The ecosystem perspective was used as an analytical lens to create an ecosystem model, but also help to identify participants. The perspective was used to analyze the empirical data for a system with sub-systems in which actors participated and acted. Then the model and empirical data were studied to identify ecosystem faults by first analyzing the sub-ecosystems and then the ecosystem as a whole.

5.5 Learning from My Studies

The drawing of lessons from the three papers followed a lightweight method. A *lesson* is an experience that teaches you how to behave better in a similar situation in the future (Lesson, 2019). To share my understanding and describe my experiences in relation to others, metaphors were used because they can help with understanding, managing, and grasping the complex and paradoxical character of organizations and provide a framework for action. Metaphors are a way of seeing and a way of thinking about organizations; as such, I see them as similar to a perspective. At the same time, metaphors highlight certain interpretations and force others to the background while helping people transform their understanding of the nature of the phenomenon (Morgan, 1997). From a knowledge perspective, I argue that lessons are a form of guiding knowledge (Goldkuhl, 1998), as it gives advice based on experience. The resulting lessons can be considered in the future when either cultivating, working in, or researching OGD ecosystems. Lessons were generated by reflecting on each of the papers in turn and then together. Concepts presented in this thesis were used to support the crystallization of my experiences into lessons and a basis for metaphors. The reflection was guided by a few questions with few structures to allow for creativity, exploration, and openness. The questions were:

What have I learned about...

- *impediments in OGD?*
- *the OGD ecosystem?*
- *why can it be challenging to cultivate OGD?*
- *the ecosystem perspective?*

From the reflection, a list of lessons was written. A few interesting lessons were selected for discussion. The interesting lessons were discussed with concepts or through metaphors to convey them and ended with an idiom to capture the experience. Before drawing lessons from the three studies together, the previous metaphors and lessons were used in reconceptualizing the OGD ecosystem metaphor. The interesting lessons were then grouped by relatedness and then lessons were drawn about cultivation challenges. Challenges were identified from studying the grouped lessons.

5.6 Limitations

In my research, there are a few limitations. Several of them are related to circumstances that I had no ability to change. First, the Swedish OGD maturity made it hard to find study participants. Few mature publishers and users had institutionalized OGD. At the same time, there was no national network for publishers and users, meaning I had to navigate fragmented communities. There was one national forum consisting mostly of enthusiasts, which seemed to have ended in 2017. Publishers were easier to find than users, as there was a national OGD portal. Second, both I and the research participants had limited resources. I did not have resources to contact and study every actor in the ecosystem, and the participants had daily matters to attend to. This limitation affected users more than publishers because the users were often using OGD outside of work. Third and finally, there were changes in the government for the OGD focus, the OGD leadership, and the OGD roles. For example, SNA had the mission to promote publishing that was then moved over to a new agency. The new agency got the responsibility to promote OGD publishing. Before another agency had the mission to stimulate and promote publish and use. My research was conducted under this changing period (2016-2018). Also, the responsibility for OGD in the government was moved between two departments. As a result, there is still more actors in the Swedish OGD ecosystem to be studied, and the Swedish maturity is both a curse and a blessing; few possible research participants, but those that existed had experienced and encountered several impediments. The shifts in government meant limited experience for actors in certain OGD roles. Based on the ecosystem perspective, I also would argue that this creates a constant shift in the values and norms surrounding OGD (changes in the normative OGD model (see section 2.2)).

Beyond the Swedish context, the used research methods have some limitations. The literature reviews in the three studies were used to collect important literature and were often limited to the latest and the perceived to be relevant texts, as such key literature may still be out there. For the systematic literature review, broad keywords were used that included research outside the sub-field of OGD but were still relevant to the research. The keywords were singular instead of plural, which meant that some articles can have been missed. The framework from study 1 and the systematization from study 2 need further testing in practice. The framework was developed and tested on a limited case, while the systematization was based on previous research. For data collection, study 1 and study 3 focused on a few interviewees. In study 1, the interviewees were recommended by the organization, as they had experience in OGD or were going to work with it. The difference in experiences leads to different perspectives and mindsets, which may have created biases in the research. In study 3, the first contact mail was also written in such a way it could recruit OGD enthusiasts, which can have created a bias in the data. Some interviewees were knowledgeable in OGD but lacked expertise in other fields. On the other hand, the research participants in study 1 and study 3 were knowledgeable on the OGD topic, and some were involved in the Swedish OGD community. As such, some impediments received more attention than others did. For analysis, the ecosystem perspective was used in all studies to guide the process. The perspective makes several assumptions about reality which are baked into the final product. As a result, the final knowledge

may contain biases and assumptions. Study 1, study 2, and study 3 were using previous research and are in line with previous findings. However, there is still a need for further research and validation.

6 The Three Papers

The following chapter presents summaries of the three papers included in this compilation licentiate thesis and concludes with an overall analysis. The first paper provides a conceptual development of OGD roles. The second paper presents the results from a literature review of OGD impediments. The third paper presents an explorative case study of the Swedish OGD ecosystem. Appendix 1 holds the three papers.

6.1 Paper One – Exploring Actor’s Roles within an Open Data Ecosystem

Research Objective & Purpose: This paper is motivated by the encounter of ambiguous and inconsistent and unclear terminology used for OGD roles in previous research. For example, public organizations can be labeled publisher, provider, and contributor interchangeably. This use risks jumbling roles, creating miscommunication, and impeding the development of a common understanding for researchers and practitioners. Therefore, the purpose of this study was to understand OGD roles; what they are, how they shape the ecosystem, and how they are similar or different in comparison to each other.

Method: The purpose of this paper was achieved by creating an analytical framework, populating it from previous research, and apply it to a case. The study used an iterative and reflexive approach, where the framework was continually developed to understand roles further. For this research, pilot case study methodology, intensional classification method, and initial coding were used.

Use of the ecosystem perspective: In this paper, the ecosystem perspective was used with the OGD process to drive the questioning, which developed the typology. Previous research on OGD was then used to populate the typology. The data collection and data analysis were influenced by the typology and in a transitive manner, previous research and the ecosystem perspective. The perspective was, therefore, used as the frame for the typology and the context for the population.

Findings: It was found that roles have a type of membership in the ecosystem, such as voluntary, encouraged, and assigned. Within the ecosystem, a role fills some function through participation and can focus on different areas. For example, publishers publish data, while users use the data. However, this function can be acted in several (very different) ways, and roles can have different activities, interactions, and goals. For instance, both the data center and data portal are OGD portals, however, the first is a container for data, while the second is a catalogue of metadata. The roles shape the ecosystem. The data center both contains data and metadata and, thus, the user never needs to visit the contributor (publisher), while the catalogue only has metadata and for the user to acquire the data, they must visit the publisher. Moreover, the case organization perceived itself to be a role not consistent with previously mentioned terminology. They perceived themselves to be a publisher, however, they were also an archivist. Unlike previous terminology (where the publisher publishes live data), they published retired data. The case organization also participated in several parts of the ecosystem in an attempt to fulfill different functions. At the same time, the organization also acted in different roles. Therefore, an actor can be part of an ecosystem at several and very different locations and participate as different roles.

Contribution: The outcome of the study was an elaboration on roles conceptually and a tentative analytical framework. The framework consists of a populated typology, which can be used for comparative analysis. The terminology in previous research does not capture the richness of practice, and further conceptual development is needed. The actors thank to their uniqueness “create” roles that then shape the ecosystem. To understand an OGD ecosystem, the actors with their roles need to be studied.

6.2 Paper Two – Investigating Open Government Data Barriers

Research Objective & Purpose: In OGD research about impediments, the focus is often on publishing and using data. The research has identified several complexities and applied at least the same number of conceptual labels and perspectives. This focus allows the implementation of specialized solutions for unique and challenging problems, where the solutions can cause impediments and problems at other locations. Solutions for one actor can become new impediments and problems for others. Therefore, there is a need to investigate and systematize OGD impediments research to understand and outline an expanded scope of the phenomenon. The resulting knowledge can serve as inspiration for future OGD research and OGD practice. This knowledge can provide insights into the challenges and complexities encountered when and beyond publishing and using OGD.

Method: In this study, previous research was identified through a systematic literature review and then coded. The codes were systematized with the help of the previous research mentioned above. The review identified 600 articles from which 34 articles were selected for analysis. The identified articles were analyzed for historical development, impediment types, research focuses, impediments, and their location. This method produces three illustrations to present the articles as a set and one systematization.

Use of the ecosystem perspective: The ecosystem perspective was used to expand the scope surrounding the OGD process. This application allowed identifying impediments outside the process in the “surrounding” system.

Findings: The findings consist of two parts. In the first part, the historical development, impediment types, and research focuses are presented to give insights into current OGD research, but also to be transparent with the findings. In the historical development there is a peak of impediment research in 2014 with a drop off and stabilization afterwards. Common impediment types were technical, legal, and data in nature while process impediments were the least experienced. Previous research has also tended to focus on publishing, usage, and systems over legal, privacy, and society matters. In the second part, the systematization is presented with 64 identified impediments divided into five distinct processes; suitability, decision to release, publishing the data, using the data, and evaluation. The publisher is involved in suitability and publishing the data while able to support the use. The user is involved in the use of data. Both the publisher and user are to some degree involved in the decision to release and the evaluation with other actors, such as cultivators. Moreover, the impediments are both social and technical where they can start inside the publisher and stretch out into the context. For example, the publisher’s core activities can cause low data quality that is an impediment for users. On the other hand, low supply and demand can make it hard for the publisher to decide what to publish. The impediments can, therefore, also stretch from outside to inside the publisher’s organization.

Contribution: The outcome of this study is a move away from impediments as easy to manage and reduce towards viewing impediments as a network in a cycle and part of a strategic decision in a broader context. Publishers and users need to recognize impediments as existing in a cycle and think about them when making strategic decisions. The study identified a knowledge gap between use and evaluation, where the government cannot solve impediments, only mitigate them (e.g., inability to combine data). Furthermore, knowledge is needed about economics and assumptions in relation to OGD impediments and another gap is the responsibilities of and division of labor between the publisher and the user.

6.3 Paper Three – A National Ecosystem of Faults and Frustration

Research Objective & Purpose: It is believed that OGD can lead to several benefits, such as reduced paper work for public organizations and new innovations. At the same time, the possibilities of OGD can be challenging to realize because of impediments. Impediments are complex and difficult, as a solution for one actor can be an impediment for someone else. Currently, OGD is experiencing low use, and previous research has focused on the impediment experienced by publishers and users. More knowledge is needed about impediments from a national perspective. Impediments have received light

attention in Sweden. Sweden is interesting, as it has a long history with transparency, good digital maturity, and executed several cultivation attempts, yet lagging in several international OGD measurements. The focus in previous research risks leading to solutions that can cause impediments for others. The purpose of this study was to explore what impediments actors in the Swedish national OGD ecosystem can experience. From this knowledge, ecosystem faults were identified. Previous research has touched on the topic, such as heterogeneous nature of data and lack of leadership outside organizations. Faults can be a cause of the Swedish lag and the low use of OGD.

Method: The study was conducted as an explorative case study. This study started with mapping the Swedish OGD ecosystem leading to 20 interviews (10 publishers, eight users, and two cultivators) and the identification of seven important documents. The data was analyzed with content analysis to identify activities and impediments. The activities and impediments were then grouped into sub-ecosystems, and they were analyzed for faults in the ecosystem. The findings were then supplemented with the codes from the seven documents.

Use of the ecosystem perspective: The ecosystem perspective was used to analyze the systems in which different actors participated and acted. The perspective was used both as an analytical perspective and to create a model from empirical data. Previous research was studied to identify current understanding of OGD impediment, OGD benefits, and OGD ecosystems. Benefits were studied to understand why actors want to overcome impediments to organize into an OGD ecosystem. To ensure an OGD ecosystem was studied a definition of OGD was synthesized from previous research and practical standards. The definition focused on the properties of the shared data.

Findings: The study found that the Swedish national OGD ecosystem consists of the publisher, the data market, the user, and the cultivation sub-ecosystems. The faults emerge from impediments experienced in the different sub-ecosystems and are immature data exchange and few good examples. The immature data exchange seems to be caused by an unwillingness to institutionalize OGD as the motivation to overcome impediments (from traditions, core business, IT-systems, security, secrecy, and law) is low. Also, the immature feedback element cannot spread and implement needed solutions.

Contribution: The study contributed with a conceptual development of impediments and faults. Impediments can share and have different and several sources. The sources can be something or the lack of something and be direct or indirect. The properties of impediments make identifying and implementing solutions on a larger scale challenging. Faults emerge when actors in an ecosystem experience similar impediments that the actors and the system lack the ability and capability to solve.

6.4 Overall Analysis of the Papers

The purpose of this compilation thesis is to understand why it is challenging to cultivate an OGD ecosystem. As such, the above included papers give insights into;

- (1) The OGD roles that cultivators want to influence or create conditions for.
- (2) Previous research on impediments experienced by the key roles; publisher and user. The impediments cultivators need to overcome (directly or indirectly) to create an OGD ecosystem.
- (3) How impediments are experienced in practice, but also why they are challenging to solve on a system level.

The overall analysis of the papers can be captured with a metaphore. Starting from the problem of the first paper, the current labels used to describe publishers and users are black boxes in a diffuse larger system. The box is roughly stating the function, but it focuses more on the participation, for example, the **publisher** publishes data for the **user** to reuse. This relationship does not explain the actual (real) how of the organizing. Depending on the activities and the interaction of roles the configuration of the ecosystem can vary drastically (Kalampokis et al., 2011). As a result, we have a blueprint sketch, but

not the blueprint of the system. A similar sketch has been used by researchers and practitioners to “capture” the OGD ecosystem (see paper three). Combining the black box roles with the impediments from the systematization (see paper two) we gain a new black box.

Looking into the new black box, we see a publisher sit with two smaller black boxes; one for suitability and one for publishing. On the two boxes, the user sits with a black box of use impediments. The box we look inside is the decision to release and the evaluation processes from study 2. This box is held together by the user and publisher, but also by actors pushing from the outside. However, there is a problem. The user cannot use the data format from the publisher. We look a bit at the problem but cannot find a solution. A friend working in another box has just found a solution and shares it with us. So, we lean in and correct the issue; thus, the user is happy. Suddenly, 100 more publishers and 100 more users climb inside, and the users are now unhappy with the data format, so, we lean in and fix the issue, it just takes more time. Now, we include the differences in roles (see paper one) and a cacophony of happy and angry voices bellows. So, we lean in again to fix the issue. However, as we apply the solution, some users get happy, others get mad, and for some publishers, the solution works, for others nothing happens, and a third group does not even accept the solution (see paper three). Standing there we may ask: *“what went wrong? It all worked so well before...”* In the following chapter, the discussion will focus on what I have learned about challenges in cultivating OGD by studying impediments from an ecosystem perspective. In the above vivid description, the “us” and “we” are cultivators and the large black box is the ecosystem with the publishers and users.

7 Discussion

In the following chapter, I first present the lessons learned from each paper respectively, then make a reconceptualization of an OGD ecosystem as a base for the following presentation, and, finally, present lessons drawn from the combination of the papers. The discussion is based on the concepts presented in previous chapters and I draw lessons from my research and experience. For each paper, I first present the situation, then discuss my experience, and then give recommendations that may benefit OGD practitioners, OGD researchers, and OGD cultivators.

7.1 Drawing Lessons about OGD Roles

In the first paper, I attempted to understand how actors organize into an OGD ecosystem. To do this I developed a framework to manage and capture the roles of the actors. In this section, I first discuss what I have learned about the OGD ecosystem, then impediments, challenges in cultivation, and lessons about the ecosystem perspective. Finally, I present the lessons drawn from the first paper.

The OGD Ecosystems as ideas and practices interacting or patters of activities

In the first paper and from the perspective of this thesis, I identified that an OGD ecosystem is formed by actors' attempts to realize the normative OGD model (see section 2.2). Several heterogeneous actors are trying to organize into a system that is believed to result in different benefits for the involved. Depending on how actors participate, the ecosystem is formed in different ways. At the same time, the actors exist in a local context and the ecosystem grows out of it (Nardi & O'Day, 1999; Davies, 2010; Harrison et al., 2012; Heimstädt et al., 2014b). Here, the normative model and practice interact to form a new system, which can be captured in an ecosystem model. The new system can influence the development of the models, that, in turn, influence practice if introduced again. However, drawing on experience from the three papers, we can end up in a situation where publishers in practice release data and ask for monetary resources, while the normative model assumes it to be free. This situation is often viewed as an impediment conceptualized as a paywall for users. The public organization may need the payment to survive, while the users need the data to be free, as they do not have the money to buy it. At the same time, the normative model focuses on the relationship between the publisher and the user, and as such does not prescribe anything about the need to be able to find the data or a need for continued improvements by feedback. Those issues are solved in the ecosystem by an OGD portal and by an adapt element. An adapt element seems to exist to bring practice closer towards a functioning system (see section 3.3). As such, we will encounter discrepancies between the normative model, the ecosystem model, and practice. It will be up to the practitioner, researcher, and cultivator to decide on the meaning and value of these differences. If there is a continual divergence between models and practice, we can end up in a situation where they no longer represent each other (that can be temporary or permanent). As such, practitioners, researchers, and cultivators may benefit from adapting the models or practice over time.

In the first paper, I view a role as a typical pattern of activities, interactions, and goals. I broadly say, if the actor does this, interact with these people, and have these goals, the actor then has this role. At the same time, I have studied actors that perceived themselves to be a certain role, in this case, SNA as a producer. Several different patterns can fill the same function in the OGD ecosystem (e.g., producers can be achieved in many ways). I argue that an actor can achieve the same goal through different activities and the same activity can be used to achieve different goals. At the same time, interactions can be viewed as activities with different actors. As a result, I can view interactions and goals as part of activities. I can then say that a role refers to a certain pattern of activities by some actor(s). On the other hand, if I would focus on interactions, internal differences of actors would be invisible, as such I would view every public organization as a publisher, while they could be an archivist or contributor. This perspective is very close to the relational focus of the normative model (see section 2.2). If I would focus on goals instead, I would instead have actors switching roles rapidly without changing their activities, as such not changing the ecosystem. Alternatively, I would have activities changing the shape

of the ecosystem, while the goals are the same. This perspective would follow the technophilic and the dystopian perspectives (see section 1.1). I argue that such an approach would lay the ground for political, power, ethical, and rhetorical discussions and research, rather than a holistic approach. Moreover, how actors organize as a system for OGD is important for the formation of an OGD ecosystem. Just as identified with the variations in the OGD portal and OGD center role (Kalampokis et al., 2011). At the same time, the normative OGD model encourages a focus on the interaction between the publisher and the user since the most assumptions are placed there, such as free access, interoperable data, and the Internet. The ecosystem model is more suitable, but still places the most elements on the interaction between the roles, such as discover, exchange, and adapt. On the other hand, focusing on the goals of the actors encourages studying the outcome of the system. As a result, there can be a potential distance, as the models and perspectives are a move away from the practical implications of the actors. This distance can be a challenge in terms of weighing practice versus norms and ideas. In the future, practitioners, researchers, and cultivators may benefit from working with understanding actors' activities that comes to form the ecosystem and how these impact actors. Without understanding the activities, it can be challenging to evaluate the discrepancies mentioned above and understand the real OGD ecosystem and the impediments.

OGD Impediments as belonging to roles

The first paper did not focus on impediments related to OGD; however, the above discussion has given us some input about them. There is an important nuance between different roles and to understand them we need to study their activities. However, the first paper started with presenting the inconsistencies, ambiguousness, and obscurity surrounding OGD roles in previous research (e.g., Zuiderwijk et al., 2012; Lee et al., 2016). I see that it is common to understand actors by their participation from a normative model perspective, rather than ecosystem perspective. The normative model gives us the publishers as an actor collecting and sharing interoperable data over the Internet (see section 2.2), while identified in the studied practice, the actor can occupy the contributor, the provider, or the archivist roles. Actors in the three roles can share data over the Internet and experience impediments with data quality and legal issues. On the surface, they are very similar; however, the sources and solutions can vary greatly. A contributor is collecting data and uploading it to a data center. The data center can have limited processing or storage capabilities, as such causing low data quality. The contributor may be unable to change the data center. I believe this can result in a system where it is easier to standardize data, as changes in the data center would "force" changes for the contributors. A provider is collecting and sharing data directly, as such they have the ability to improve their data management (especially, data collection) to increase data quality. However, I argue that it becomes harder to improve the OGD ecosystem because the sharing now is decentralized and fragmented. On the other hand, an archivist receives their data from other public organizations and cannot improve the data collection. On the sharing side of the actor, the archivist looks like a provider or contributor, as such, can only be identified if the activities of the actors are studied. A critical eye could note that by studying the archivist's data, we could gain the insight for what role they participate in. For example, if a public organization is sharing historical data (such as information about or pictures of artefacts or paintings) they could be an archivist. I agree that we can study the data to gain insight into the roles the actor occupy, but I also disagree since it is very different to have access to the original data sources (e.g., the artefacts) and only the data about them (e.g., pictures of artefacts). What can be done is to study the actor's metadata to learn about their data management and data collection processes. *Metadata* is information describing datasets, such information can be about who produced the data and conditions for use (Ubaldi, 2013). Metadata should always be published with OGD to allow for deeper understanding of the dataset. Thus, activities are central to understanding roles and can be identified through different approaches. Moreover, the legal issue can impact the contributor, the provider, and the archivist equally, as sensitive and personal data cannot be published and has to be resolved outside the actors in the legal framework or by them by cleaning the data. In previous research, there seems to be a tendency to abstract from these roles to their participation as publisher (e.g., Dawes et al., 2016). As a result, when we abstract

from the provider to the publisher and say that the publisher is experiencing some impediment, we are communicating that all instances of this role are experiencing these impediments. In some cases, this is true, in others it is not. The risk is that we through abstraction can decouple the impediments from their activities and sources. This decoupling can result in jumbling the intersubjective understanding of the issue. In a metaphorical sense, we have a playful dog and an angry wolf, which we abstract to the species *Canis*¹. Then we continue to talk about *Canis* as playful, while others only perceive the angry wolf. The reverse can also be true, and we might try to pacify the playful dog because we believe it to be an angry wolf. I argue that to develop further knowledge about impediments we need to anchor them in activities. In the future, practitioners, researchers, and cultivators may benefit from developing a more precise language surrounding roles to allow for collective and collaborative problem-solving.

Challenges in Cultivation as abstract roles

As described above, viewing OGD as consisting of the publisher and the user roles from the normative model perspectives, do creates some challenges. The normative OGD model makes several assumptions about the publishers and users and limits their abilities to organize an ecosystem. Similar to a metaphor, this restriction is neither good nor bad since it can enable an intersubjective understanding to support action, but also highlight certain factors while forcing others to the background (Morgan, 1997). However, observations of impediments and roles in practice are abstracted to fit with the normative model, important information can thereby be lost. As a result, the cultivator has two piles with a correlation between them, one pile is the roles and the other is the impediments. Some impediments can be common amongst all the roles and can be clearer and easier to solve. Grouping all the public organizations into the publisher can make it challenging to create policies or solutions that can handle the variations. The same goes for the participation of the users. To resolve this, the normative OGD model directs the publisher towards certain solutions and with this assumes the “golden” user, but also that the data will fit with those assumptions. In this case, the data needs to be machine readable and provided over the Internet (in my experience, favorably through an API), the golden user is likely a developer or programmer. As a result, the normative OGD model gives little room for variations in the data and for the publisher and the user. For the cultivator, the challenge can be to understand the problems publishers and users are experiencing and to create policies and solutions that can be spread out to the right actors. The normative model does not fit with the complexities of practice, as such leaving little room for the cultivator. In the future, practitioners, researchers, and cultivators may benefit from developing the normative OGD model to include a broader range of publishers and users.

The ecosystem perspective as stability in role interactions

By using the ecosystem perspective in the first paper, I was able to go beyond the normative model (see section 2.2) and understand the complexity of practices. I found that the concepts of nestedness, specialists, and generalists were fruitful for drawing lessons from paper one (see section 3.2; Mars et al., 2012). The concepts are concerned with the interaction between the OGD roles.

For an organizational ecosystem to be stable and functioning, the actors need to have nestedness (supplementary sources to information; Mars et al., 2012). If one source fails, the actor can switch to other sources to survive the shortage. For example, publishers can collect the same data from different sources and users can acquire the same data from different publishers. However, in the first paper, there is an absence of nestedness. Going back to the introduction, I described that OGD seeks “...to maximize the potential value of collected data by broadening the number of people who can interpret the data beyond those who collect the data to minimize unnecessary work and storage.” (This thesis, p. 11). This idea contradicts nestedness and means the organizational ecosystem perspective cannot be fully applied

¹ *Canis* was defined in Linnaeus taxonomy in 1758 (Wilson & Reeder, 2005) and is a classification of species (Atkins, 2004). *Canis* is a genus that includes eight species, where two are *canis lupus* (wolf) and *canis familiaris* (domestic dog) (Mech, 1974).

to the OGD ecosystem. OGD can be seen an extension of the publisher's information system to allow users, who otherwise would lack capability and resources, to access the data (see section 2.3). As a result, nestedness can be used in other organizational ecosystems to create stability, but in the OGD ecosystems, nestedness is abandoned. Other ways of stabilizing the ecosystem may need to be identified. In the future, practitioners, researchers, and cultivators may benefit from thinking about how to compensate for the loss of supplementary sources as a stabilizing force in the system.

Some stability can be achieved with the relationship between generalist and specialist roles. The roles are important for stability in an organizational ecosystem, as they form a nested structure where specialists tend to interact with generalists (Mars et al., 2012). This relationship is associated with the nestedness concept described above. For OGD, I argue that the roles can be applied, but would have to shift expression from supplementary sources to the interoperability of the data. Generalists would produce data that generally can be combined with other data. The data would be common in the sense that citizens are using it in their everyday lives, such as weather reports and train schedules. This could allow users to transform the data into something more specialized. At the same time, I argue that data is a specialist product since it is created for a certain purpose. Data is not politically benign and can contain biases (Kitchin, 2014; Zuiderwijk & Janssen, 2014b). Data is only a small selection of all data available (Checkland & Holwell, 1998). I see a possibility to use data sought by the masses as one source of stability for an OGD ecosystem. When working with publishing and producing data, practitioners, researchers, and cultivators may benefit from considering the ability to combine data with other data and the common value of the data. *Common value* refers to how many citizens are already finding value in having access to the data. It can be possible to create stability from demand, rather than supply.

The lessons learned

In the following section, I have summarized the lessons learned from the discussion above based on the first paper. In the future, practitioners, researchers, and cultivators may benefit from:

- adapting the ecosystem model, the normative OGD model, or practice to each other over time,
- working with understanding actors' activities and how they form the ecosystem and impact other actors,
- developing a more precise language to describe roles and their impediments,
- developing the normative OGD model to include a broader range of publishers and users,
- thinking about how to compensate for the loss of supplementary sources as a stabilizing force in the OGD ecosystem,
- considering the ability to combine data with other data and the common value of the data.

The first paper started with the identification of ambiguous, inconsistent, and unclear terminology used for OGD roles in previous research. The result was a tentative analytical framework and population. Comparing the result towards the normative OGD model (see section 2.2), the ecosystem model (see section 3.3), my population of roles (see paper one), and lessons learned; I see that there are hidden assumptions (e.g., machine-processable data indicates a certain type of use). Publishers are assumed to collect and share data, which indicate control over the data source or data collection or sole producer of the data. From my experience with publishers, some data is generated in dependence of other actors, such as educational statistics (The Swedish Board of Student Finance (CSN)) or police call outs (The Swedish Police). While in the case of the first paper, some OGD from the Swedish National Archives was collected by other actors to then be handed over to the public agency for storage and sharing. In this instance, two public agencies become one "complete" publisher. At the same time, users are assumed to require machine-readable data that is shared over the Internet (e.g., Attard et al., 2015). This

assumption places certain demands on the data and the infrastructure. Infrastructure is known to influence the form of an OGD ecosystem (Kalampokis et al., 2011). I argue that this can over time favor data literate users and could cause the data divide presaged by the dystopian (see section 1.1; Gurstien, 2011). However, it may be too early in the story to tell. Moreover, the ongoing evolution seems to have caused a divergence between the normative model and the population of an OGD ecosystem. One likely challenge for cultivation is that practice can out run the normative model and the language used cannot capture the ongoing evolution of ideas and experiences inside the ecosystem. Central to this is the evolving organization by activities and understanding of data and development of infrastructure. At the same time, it can be hard to discern if the divergence is permanent or temporary and what causes it. The resulting overall lesson for this section can be stated as an idiom:

God and the Devil are hidden in the activities, the data, and the infrastructure.

7.2 Drawing Lessons about OGD Impediments

In the second paper, I sought to understand what is already known about OGD impediments in previous research and systematize this knowledge. In this section, I first discuss what I have learned about OGD impediments, then OGD ecosystem, challenges in cultivation, and lessons drawn about the ecosystem perspective. Finally, I present the lessons drawn from the second paper.

OGD impediments as a cyclical process

To realize the normative OGD model (see section 2.2), actors need to organize as a system, which can be modeled as an ecosystem. On a general level, the organization of a system is realized through actors' activities and the exchange of resources and information between them (Mars et al., 2012). Impediments are experienced by the actors when their activities are obstructed or prevented. Thus, impediments obstruct the organization and, as a result, the formation of the OGD ecosystem. Impediments can also obstruct the attempts to develop, manage, or change the system, such as when users cannot leave feedback to the publishers to improve the quality of a dataset. These behaviors form the baseline for a much more complex behavior.

To illustrate the complexity, I will first outline the OGD process. The process starts with data collected in an organization, that is then shared for others to reuse, and finally there is evaluation and a decision (see paper two). I now assume an everyday improvement loop for the process (e.g., Pollock, 2011), following the processes presented in section 3.3. The improvement loop can be initiated when data is collected inside a publisher's organization and is then shared through their IT to some external users. Some users are experiencing quality issues since some essential information is missing in the data (see section 2.4; e.g., Zuiderwijk et al., 2012). The users contact the publisher and leave feedback. The publisher then decides to improve the data quality by making a few adjustments in the organization and the publishing process. The improved data is then shared to the users. Here, we can identify five distinct processes: data's suitability as OGD, OGD publishing, OGD use, OGD evaluation, and OGD decision (see paper two). Now let us follow the OGD process to explore how the improvement of the data can be impeded. The data's suitability as OGD is based inside the publisher organization and is related to core tasks, collection processes, storage systems, and internal use. Improving the quality of the data can mean changes to any of these, which may be undesirable or challenging to change. For example, the publisher may be unable to change the IT-system (storage) because of IT-contracts or unable to sustainably provide the data (see paper three). On the other hand, the publishing may be challenging to change due to a lack of skills to maintain security, information to improve the metadata, or a lack of knowledge of what data formats to use. Publishing impediments can be related to service, publishing and opening the data, and administration. Once the improved data is published and usable, other users than those who

left feedback might find the data unusable or changes can risk breaking their solutions. The distressed users might be unable to leave feedback or publishers might be unable to use the feedback, as it is too fragmented since users do not know what to look for. Finally, the publisher needs to decide on what feedback to use and what users' needs to meet and coordinate the improvements with other publishers of similar data. Here, if changes are enacted without reflection, it is possible to end up in a state of constant change (see section 3.2; Nardi & O'Day, 1999) with one "bad" solution replacing another as different groups of users are never satisfied. As a result, OGD is much more than the normative OGD model (see section 2.2). Some impediments only exist because of a conflict between practice and the normative model, such as the paywall impediment. The normative model states that OGD should be free, while publishers may need to sell the data to survive. Now imagine that the described impediments can vary per dataset and actor, thus, we have part of the overall analysis described in section 6.4. The problem is that impediments can be similar on the surface but can have different sources underneath. Therefore, several impediments can cause very similar problems. In the future, practitioners, researchers, and cultivators may benefit from identifying the sources of common impediments and their impact. This can help in problem-solving and prioritize what impediments need to be resolved first.

OGD ecosystems as elements

The identified impediments are well anchored in the OGD ecosystem model (see section 3.3). Both publishers and users can experience impediments during the discover, exchange, and adapt elements. While publishers can encounter impediments in the publish element and the user can experience impediments in the transform element. The decision network and evaluation network have been merged into the adapt element, as such they involve more than the sole publisher and sole user. This merge can mean a publisher or a user is impeded from adapting by impediments outside of their relationship and assumed to work together in adaption. For example, laws can prevent publication. However, the ecosystem model has pushed the suitability process for publishers to the background. Comparing this dislocation with the normative OGD model (see section 2.2), I see that suitability is contradictory to the free access for anyone. For data to be suitable as OGD, it needs to be sustainable to publish. OGD is not free to implement and maintain (Kitchin, 2014). A critical eye could note that public organizations are funded by taxes and should, therefore, be able to provide the data for free. However, from my experience with public organizations, they seem to seek to invest resources to get the most "bang-for-the-buck" to achieve their objectives (see paper three). I can see how they view OGD to be a gamble between dystopian night and technophilic day, as there is no guarantee that data will be used to create benefits (See section 1.1; e.g., Janssen et al., 2012; Zuiderwijk & Janssen, 2014b). Before investing in solutions for impediments, practitioners and cultivators may benefit from investigating if the outcome will be sustainable.

Challenges in cultivation as biomes in an ecosystem

The overall analysis (see section 6.4) described the ecosystem with impediments and roles as a cacophony, which is something that can be seen when only studying impediments (see paper two). I will return to a metaphorical presentation for pedagogical reasons, to make more sense of OGD as a system. The OGD process with its five distinct processes can be viewed as three different biomes. Two that are preexisting and one that needs to be constructed. The publisher biome is preexisting and has its own local ecosystem where the actors, the social environment, and the infrastructure are organized for several very different higher purposes. Each of the higher purposes has one to several systems of purposeful action (PAS) which is served by an IS (see section 2.3 and 3.2; Checkland & Holwell, 1998; Mars et al., 2012). The IT-systems are likely organized to support the PAS. The biome is surrounded with high cliffs with a fertile lake (data) in the middle and there are some roads and paths leading to the world outside, on some of the paths there are giant gates. Every day, the population of the biome works towards different higher purposes and makes exchanges with actors from other biomes. Outside in the deep living jungle, we find similar, but different, biomes of possible users. The users are plants, some are doing quite well with bountiful harvests, while others are providing meagre fruits and their stalks are

brittle. The end-users are living a fine life on the crops as there are alternatives. Some cultivators (see section 3.3) are studying the wildlife and note worryingly that the ecosystem is dry and could do better. If they could encourage some of the publishers to dig ditches through the mountains and provide some water to the plants more users and end-users could live a better life. However, if the ditches are not done right the lake may dry up or the jungle might be flooded. The water must also be nourishing and fresh (not poisonous) to the users and end-users and cannot drain the publisher's biome. The mountains are also different (some are mud and others are granite) and the publishers' biomes can vary drastically in both size and inhabitants. This vivid description gives us a quick way to understand that OGD is more than connecting an output with an input. Each of the biomes will come with their own particular impediments and connecting them will open for new unique and challenging impediments. Some impediments will be common among the biomes, like what format to use or lack of communication channels. In this mess, the cultivator needs to coordinate publishers and users to ensure that dug ditches do what they are intended to do without emptying the lake and nobody is siphoning the water. An otherwise simple solution suddenly becomes a lot more complex. In the future, researchers, practitioners, and cultivators may benefit from thinking about how impediments are addressed in the ecosystem, as it might be easier to change the shape of the ditch than reorganize an entire biome.

The ecosystem perspective as a bridge between the worlds of publisher and user

Impediments are expressed when actors are trying to grow and organize a new ecosystem from several other base ecosystems with their own higher purposes and worldviews (Nardi & O'Day, 1999; Davies, 2010; Harrison et al., 2012; Marts et al., 2012; Heimstädt et al., 2014b). The new ecosystem becomes a "bridge" between the base ecosystems. Ecosystems can experience slow degeneration and collapse under different conditions since what is good for the first, might be bad for the second (see section 3.2). This difference puts us in a particular situation since the normative OGD model (see section 2.2) and the ecosystem model (see section 3.3) are pushing for very specific conditions to be achieved. How the conditions can be achieved is open for interpretation, but it is possible that those conditions will be bad for some ecosystems. Conditions can be cultivated by humans replicating and adapting solutions from other ecosystems (Nardi & O'Day, 1999; Mars et al., 2012). OGD actors can by studying other OGD ecosystems identify working conditions and then attempt to introduce them to their ecosystem. One such example, I would argue, is the OGD portal that exists in several ecosystems. The introduction can lead to growth, but also, collapse of the new ecosystem or, as in the case of OGD, cause the collapse of one of the base ecosystems. I see that possible signs of negative conditions are strong resistance from the ecosystem (e.g., actors do not accept the solution), common impediments that attrit the population (e.g., actors are leaving the ecosystem), or have low impact. In the second paper, it is challenging to identify if impediments are negative conditions. For example, removing the paywall could make OGD unsustainable for publishers and, as such, be a negative condition. This change risks collapsing one small part of the ecosystem and, thus, can have no or low impact, but as users are dependent on the publishers they are also at risk. Depending on the number of users the impact would differ. At the same time, removing the paywall may lead to more businesses and increased tax revenue for the government. Thus, making OGD sustainable on a national level. What is important for the removal of the paywall is that the loss of income needs to be compensated by use at other locations. However, the collapse of a municipal ecosystem could have consequences beyond the OGD ecosystem. As a result, we are in a situation where stability is needed and randomly introducing or removing conditions can cause ecosystem degradation or collapse even if they are working in other ecosystems. In the future, practitioners, researchers, and cultivators benefit from studying the positive conditions to understand why they are working before introducing them. The knowledge can be used to identify if the same circumstance exists in their ecosystem, something that would help avoid degradation and collapse.

Identifying impediments in an ecosystem is not an easy task. Ecosystems are in constant flux and impediments can propagate (see section 2.4 and 3.2; Nardi & O'Day, 1999; Zuiderwijk, & Janssen, 2014a), as such it can be challenging to discern between an impediment and just a temporary obstruction.

Impediments are, at the same time, experienced in the activities of the actors in their own ecosystems and can be unique and individual. However, the idea of a constant change might be farfetched for an OGD ecosystem. In my experience, I have seen changes in the ecosystems, such as new users, new features on the national OGD portal, and new publishers pushing data. But when I look at the impediments in paper two and the normative OGD model (see section 2.2), I see several calls for the reversed – actors are seeking stability (e.g., standards for data formats). The normative model calls for machine-readable combinable data that can be accessed anywhere at any time (Tauber, 2007; Open Data Charter, 2015; Open Knowledge, 2015), thus, placing certain stability criteria in place. The impediments can be a lack of guarantee for maintenance of OGD, wrong formats, or the diversity of the user base (see paper two). As a result, there is a line between what is considered constantly changeable and constantly stable. The widest range of uses must be enabled by the data as well as the infrastructure (see section 2.2; Attard et al., 2015; Open Data Handbook, 2015; Hossain et al., 2016), this is a core assumption of OGD. In the future, practitioners, researchers, and cultivators may benefit from viewing data and infrastructure as a stable foundation needed for a diverse OGD ecosystem.

The lessons learned

In the following section, I have summarized the lessons learned from the discussion above based on the second paper. In the future, practitioners, researchers, and cultivators may benefit from:

- identifying the sources of common impediments and their impact,
- investigating if solutions for impediments will be sustainable,
- thinking about how impediments are addressed in the OGD ecosystem,
- studying the positive conditions to understand why they are working before introducing them,
- viewing data and infrastructure as a stable foundation needed for a diverse OGD ecosystem.

The second paper started with the need to systematize OGD impediments in previous research. The result was an OGD process integrated into an OGD ecosystem with impediments. The above discussion has two themes (impediments and solutions) and two core idea (stability and sustainability). The growth of an ecosystem, for example, by introducing solutions to impediments, needs to work towards growing a system that is stable and sustainable for all actors involved even if the system is not perfect for everyone. The concluding lesson for this section can be given as an idiom:

Like planting a rainforest in the desert.

7.3 Drawing Lessons about OGD Ecosystems

In the third paper, I presented the exploration of experienced impediments in Swedish OGD practice from an ecosystem perspective. I sought to understand how impediments impact the ecosystem and emerge into faults. In this section, I first discuss what I have learned about OGD impediments, then OGD ecosystem, challenges in cultivation, and lessons about the ecosystem perspective. Finally, I present the lessons from the third paper.

OGD Impediments as a ball of yarn

OGD ecosystems are like a tangled ball of yarn a cat has played with. Several similar strings (ecosystem elements) are tangled and knotted together around a very loosely defined core. In paper two, I noted that there was a tendency for research to study very specific parts of a single string or just one of the knots (e.g., adoption impediments and cognitive impediments (Janssen et al., 2012; Wirtz et al., 2016)). This approach, I argue, does not fully capture the impediments' impact or severity. With paper three, I studied the Swedish OGD ecosystem to understand how impediments emerge into faults. Faults are essentially several different impediments that together causes a common problem in the ecosystem. A fault can be

produced in different ways and takes a variety of expressions but has the same impact (e.g., the dispersed and heterogeneous nature of data (Attard et al., 2015)). In a metaphorical sense, a knot can be knotted in several ways but will always be a lump. To identify a fault, cultivators need to speak with several actors (e.g., publishers, users, and cultivators) in different domain specific ecosystems (e.g., traffic, education, and environment). Some faults can be specific for the domain, while others being national. When a knot involves one string it can be viewed as an individual issue, while when a knot involves several strings it becomes a collective issue. One such knot in Sweden is the Swedish Constitution that favors documents. Another is the country's long history focused on IT-system functionality. A knot can also be entangled in several other knots, such as when the low data quality is caused by the focus on documents and IT-functionality (see paper three). In the future, practitioners, researchers, and cultivators may benefit from studying ecosystem faults to understand why an ecosystem is experiencing slow growth, degeneration, or collapse. Studying faults can allow actors to understand the impact of impediments and identify points of collaboration, rather than trying to tussle with the whole ball of yarn by themselves.

OGD Ecosystem as growth

In paper three, I explored the Swedish national ecosystem. I saw publishers, users, and cultivators organizing into a national OGD ecosystem, but also saw some of them being an ecosystem or be part of one. For example, a municipality can be an ecosystem (organization) and be part of a geographical ecosystem (city). A user, on the other hand, could be part of several ecosystems (e.g. Hack for Sweden or their everyday job). To ease the discussion, I have divided the ecosystems into *base ecosystems* (publishers' organizations and users' everyday), *role ecosystems* (public organizations in the role of publishers and actors in the role of users), the *OGD ecosystem* (encompassing all the other ecosystems, but also has the data market), and the *cultivation ecosystems* (e.g., hackathons and data labs that encourage data use). While the roles are visible in the ecosystem model, the above described ecosystems are not visible in the ecosystem model (see section 3.3). The role ecosystems grow out of the base ecosystems and then together grow into the OGD ecosystem (e.g., Harrison et al., 2012), as such the later ecosystem is a "bridge between the worlds of publishers and users." In my experience, the cultivation ecosystem is the odd one in the group because it can be concerned with the whole ecosystem, but also related to very specific parts of it or not be associated at all. For example, one of the public agencies interviewed for paper three attempted to cultivate data use but was not focusing on use of OGD. Moreover, the base ecosystems need to grow into their respective role ecosystems. The growth is a complex process because there is already from the start a certain pattern of activities, data, and infrastructure that might need changing. I argue that this growth happens towards their interpretation of the normative OGD model (see section 2.2). The growth can be obstructed by an inability to publish any data or use any data. At the same time, the user ecosystem is dependent on the publisher ecosystems providing very specific conditions to support them. For example, one user strongly stated that if publishers did not follow his definition of OGD it was unusable (paraphrasing; Crusoe, 2016). I see the interaction between the base ecosystems and role ecosystems as essential for the growth of the OGD ecosystem and they can by themselves or together cause impediments (see Figure 5).

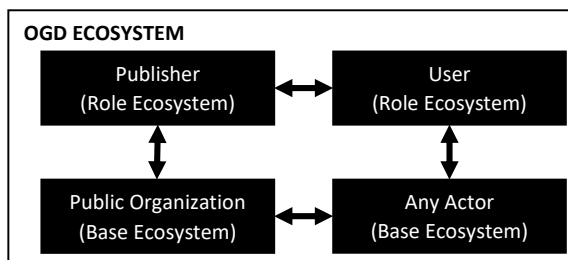


Figure 5: Interaction between ecosystems to form an OGD ecosystem. Illustrated by me.

Based on paper three, my experiences with OGD, and previous research (see chapter 0; Bloom & Dees, 2008; Davies, 2010; Poikola et al., 2010; Pollock, 2011; Harrison et al., 2012; Mars et al., 2012; Ubaldi, 2013; Heimstädt et al., 2014b; Lee, 2014; Zuiderwijk et al., 2014c), I believe that an OGD ecosystem has a very specific growth pattern: (1) creation of a cultivation ecosystem that can spread the idea of the normative OGD model to actors, (2) a public organization grows into a publisher by sharing their data, (3) an actor grows into a user when they do something with the data, and (4) the actors are experiencing some benefits. This growth pattern has assumed a simple one-to-one relationship and is local in nature. In paper three, a similar growth pattern was seen for a public organization. The public organization decided to publish their data when they noted that several actors were scraping data from their website. Web scraping (2019) is when a computer program visits a website to extract and copy its data into a structured format. To make this decision, it must have had been introduced to ideas similar to OGD. Once it published the data, users could use the data, and the actors benefited from the exchange. As OGD ecosystems grow, they can merge with other OGD ecosystems². A merge can cause the system to experience “growth pains.” Cultivators can then need to cultivate new solutions. For example, for the problem of finding OGD, an OGD portal can be introduced. The Swedish OGD ecosystems are experiencing faults that impede the growth. The OGD idea is not always accepted or spread, publishers do not always publish data, users cannot always create good examples, and the faults are challenging to resolve. In the future, practitioners, researchers, and cultivators may benefit from approaching OGD ecosystems as growing out of several contexts to form bridges of data between them.

Challenges in Cultivation as merging diverse growth

In paper three, I identified that publishers and users can both be cultivators. Cultivators often acted on a local level; only the two dedicated cultivators in the paper acted on a national level. The cultivators are facing several challenges with the OGD ecosystem since it consists of several very different ecosystems that needs to grow into one ecosystem. The growth is guided by the normative OGD model (see section 2.2), but there is no national element for supporting the cultivation and growth of the OGD ecosystem. In my experience, the cultivators, publishers, and users are working on a local level to develop the ecosystem that creates several sprouts of very different kinds. The history and context of the locations shape the outcome of the cultivation. One publisher attempted to arrange a hackathon, but the idea was rejected by the local community, as they thought it wasn't something for them. Thus, the publisher had to take a different approach. I identified that the Swedish cultivators focused on the local development, rather than national development of the data exchange. There were OGD forums and communities, but they were fragmented and in my experience with a dedicated group of participants. The cultivators' local focus, I argue is likely driven by the high autonomy of the public organizations, lack of national channels and resources, and the vast size of the potential Swedish OGD ecosystem. Sweden has about 700 potential publishers and almost ten million potential users or end-users. In the future, cultivators may benefit from collaborating to ensure that they cultivate OGD ecosystems that can merge.

Impediments can have several different sources and cause similar problems as was identified in paper three. For example, there is more than one reason why a public organization does not publish data. The normative OGD model (see section 2.2) builds on the assumption that data should be provided over the Internet. I see that this causes the concept to be linked with IT and programming. The demand for machine-readable data further adds to this. Also, the normative model assumes that government data should be accessible to anyone. This openness can easily be interpreted as transparency. Sweden has a good digital maturity and long history with transparency as an important public value (Nordin, 2015; European Commission, 2018). I can understand if public organization would perceive themselves to already have a variation of OGD and find the idea unnecessary. However, as I noted in paper three, Sweden's digitalization and transparency are different from OGD. In the future, practitioners,

² The concept of merging OGD ecosystems has not been identified in previous OGD research.

researchers, and cultivators may benefit from being careful with informing actors about OGD by distinguishing it from any similar phenomena.

The OGD ecosystem perspective as an organizational ecosystem perspective

In the third paper, the ecosystem perspective was used to identify important actors and a model in practice. When studying OGD in Sweden, I saw actors being brought together by the possibilities presented by OGD. Publishers, users, and cultivators saw possible benefits with organizing into an OGD ecosystem; for example, economic benefits and social benefits. To realize the benefits, the actors are interdependent as one must share for the other to use. In Sweden, there is a problem with the interdependence, the publishers are sharing data, but few users can create the sought-after benefits. The users are facing challenges when trying to use the data, as the data exchange is immature.

Another interpretation can be provided by the organizational ecosystem perspective (see section 3.2). This perspective assumes that actors are exchanging information or resources voluntarily while they are brought together by some “higher purpose.” They can have contingency plans if catastrophe would strike (Mars et al., 2012). Reinterpreting the findings of paper 3 from Mars’ perspective, I see that the interdependency between the Swedish publishers and users is at the first onlook voluntary; the publishers can publish data if they want to and the user can select what data to use. However, once the relationship is established, the interdependency grows stronger. This strengthening was not per se seen in Sweden, since I believe actors can also seek to avoid a strong unsafe interdependence.

Following the normative OGD model (see section 2.2), I see that once data is published it needs to be kept published to avoid unintended consequences. At the same time, publishers must allow anyone to acquire the data to unrestrictedly use it (Tauber, 2007; Open Data Charter, 2015; Open Knowledge, 2015). As a result, once the data is published, publishers cannot decide who to give the data to or restrict the use, thus, the exchange is no longer voluntary for them. It is a situation of all-or-nothing. Publishers can manage what data users have access to by selection and cleaning it (e.g., what data to publish and clean out sensitive information), which risks lowering the value of the data. On the other hand, for the users, as the idea of OGD is to minimize the number of publishers of the same data (see chapter 1), the users can become dependent on the sharing of the publishers. If a user’s business model is built around OGD and the data is retracted, it will be challenging to have a contingency plan that allows for continual provisioning of their service or product. However, it is possible that users have other revenue streams. This situation can make users very dependent on publishers for survival. In addition, the all-or-nothing assumption underlying the normative OGD model causes a considerable risk for users. If one user is misusing the OGD, it can cause a retraction of data for everyone else. In paper three, I identified one publisher retracting their data because of financing (do not know if it affected any users) and some users did experience a distance between them and the publishers.

In sum, publishers participate in an all-or-nothing relationship hence users can experience challenges in producing a contingency plan for a relationship that can be terminated by others. What I want to say is that one of the important, yet forgotten, stability factors in the OGD ecosystem is the ability to have working contingency plans and the ability to opt-in or opt-out of specific exchanges (Mars et al., 2012). In the future, practitioners, researchers, and cultivators may benefit from thinking about how to create safety for OGD actors. It is possible that we end up in a scenario where data is published, several users start using it, and it must be retracted due to the misuse by one person.

The lessons learned

In the following section, I have summarized the lessons learned from the discussion above based on the third paper. In the future, practitioners, researchers, and cultivators may benefit from:

- studying ecosystem faults to understand why an ecosystem is experiencing slow growth, degeneration, or collapse,

- approaching OGD ecosystems as growing out of several contexts to form bridges of data between them,
- collaborating to ensure that they cultivate OGD ecosystems that can merge,
- being careful with informing actors about OGD by distinguishing it from any similar phenomena,
- thinking about how to create safety for OGD actors.

The third paper started with a need to understand impediments from an ecosystem perspective. For this purpose, I explored the Swedish OGD ecosystem to identify experienced impediments and then emerging faults. The result was an ecosystem model and an impediment model. I saw how an OGD ecosystem grew from several base ecosystems, where a new ecosystem formed a bridge constructed from infrastructure to carry data from one side to the other. Starting with the publisher on one side and ending with the user on the other side. Both actors isolated by the gap to be bridged. I can say that the actors construct a bridge from opposite sides of a metaphorical river to hopefully meet in the middle. These projects can encounter both impediments and faults, which risks either the collapse of the bridge or that the two arcs never meet. The overall lesson for this section can be presented as an idiom:

Building a bridge from the opposite sides of a river must still meet in the middle.

7.4 Reconceptualizing an OGD Ecosystem as a Public Utility

In the previous discussion, I have conceptualized an OGD ecosystem in several different ways, such as patterns of activities, biomes, and as a bridge between two worlds. However, before continuing, I want to do a final pull to bring the metaphors from the three discussions to one to be carried on my shoulders.

OGD is similar to public utilities. Public utilities are organizations and institutions that build and maintain national critical infrastructure while providing essential services (McNabb, 2016). In more detail, a public utility is a network structure that have an extensive distribution system of strong physical linkages between components. The system creates goods or services at one location and then distribute them over the network to several end-users. The infrastructure is often partly owned by the government and, typically, there is a substantial sunk cost since the infrastructure is extensive (Geddes, 1998; McNabb, 2016). One public utility that is similar to OGD is the water supply network.

Data flows from publishers to users through the Internet, like how water streamed from the ancient mountains to Rome through aqueducts. In ancient Rome, water was collected from springs to flow through aqueducts to basins then to reservoirs. Sometimes water was mixed from several sources in a basin. From reservoirs, water pipes were used to deliver the water to, for example, public baths and fountains (Bono & Boni, 1995). OGD and the Roman aqueducts are similar, as both focus on distributing some resources from one location to several locations that can be used for several different purposes, based on an extensive architecture involving several actors, and has key locations in the architecture with flows between them. The difference between OGD and the ancient aqueduct system is that OGD is digital, the resources to be distributed comes in greater variety (e.g., weather reports, crime statistics, and budget sheets). Aqueducts are also replaced by activities and infrastructure, and the infrastructure is built both by private and public actors compared to the physical water of the aqueducts built by the city of Rome. In addition, OGD has the OGD portal to help users identify reservoirs where they can acquire data. Figure 6 presents a conceptualization of an OGD ecosystem as a public utility ecosystem based on the ecosystem model (see section 3.3) and the above discussion. As a result, OGD is an example of a possible public utility. Calls to make data into a public utility has been made (e.g., Scherer, 2016; Nahrstedt et al., 2017), but I have not identified any previous research on OGD as a public utility.

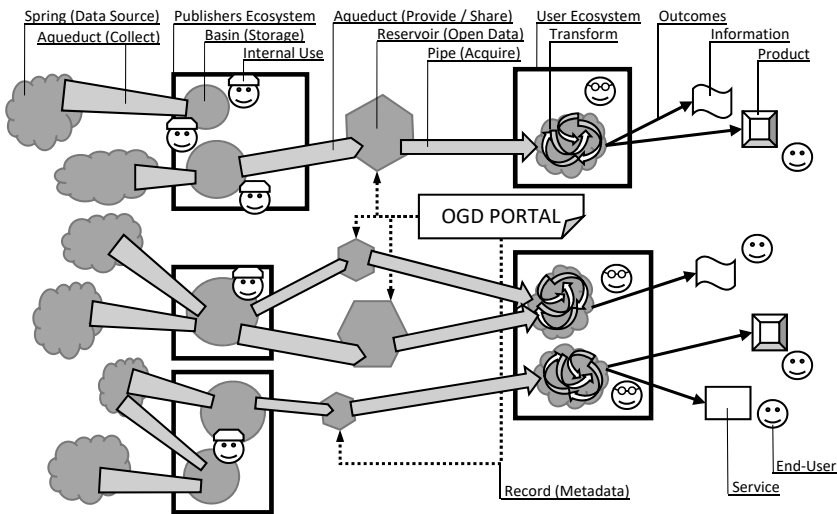


Figure 6: Conceptualization of an OGD Ecosystem as a Public Utility Ecosystem based on the aqueduct concept. Illustrated by me.

7.5 Challenges in OGD Cultivation

In the previous three discussions, I have drawn on lessons learned about important factors for practitioners, researchers, and cultivators from each paper. In the following section, I will group the previous lessons from the three papers to draw lessons about challenges for the cultivators. Figure 7 presents challenges in cultivation grouped into cultivation areas for discussion. The challenges can be encountered when cultivating an OGD ecosystem. I discuss the areas one at a time below.

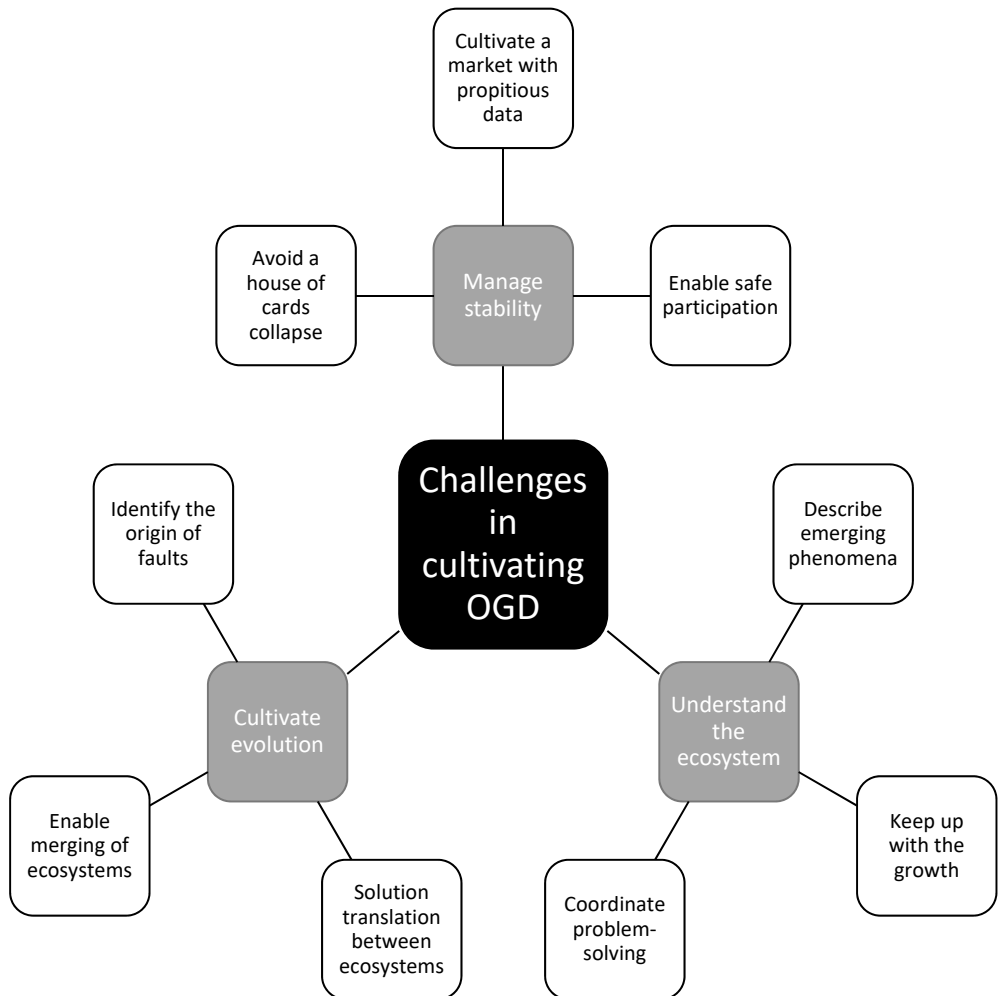


Figure 7: Challenges in cultivation grouped into areas of cultivation. White boxes are challenges. Grey boxes are cultivation areas. The black box is the overarching theme of the discussion. Illustrated by me.

7.5.1 The Challenge of Managing Stability

The normative OGD model (see section 2.2) lacks the stability provided by supplementary sources and voluntary exchanges. The lowered stability can enable a house-of-cards ecosystem where collapse is easier and actors are more open to harm, as such actors can naturally avoid organizing in the system. Cultivators need to compensate for the lowered stability and work to avoid cultivating an ecosystem of cards. For this reason, they need to cultivate a data market with propitious data and enable safe participation for the actors. The propitious data might already be solved in the normative model with interoperable data, whereas the later has still not been handled by current models. Table 6 presents the challenges connected to lessons from previous discussion with an added description.

Table 6: Cultivation challenges concerning ecosystem stability

Challenge	Lesson(s). Cultivators may benefit from...	Description
Avoid a house of cards collapse	Thinking about how to compensate for the loss of supplementary sources as a stabilizing force in the OGD ecosystem (Paper one). Investigating if introduced solutions for impediments will be sustainable (Paper two).	The loss of supplementary sources means that OGD ecosystems are vulnerable to collapse. At the same time, cultivation needs to result in sustainable solutions. The challenge is to avoid cultivating a house of cards.
Cultivate a market with propitious data	Considering the ability to combine data with other data and the common value of the data (Paper one).	Datasets are biased and a selection of available real data. The challenge is to cultivate a data market where data provides favorable conditions for use.
Enable safe participation	Viewing data and infrastructure as a stable foundation needed for a diverse OGD ecosystem (Paper two). Thinking about how to create safety for OGD actors (Paper three).	Infrastructure can limit and enable who can participate in OGD. At the same time, OGD removes the safety of who actors can make exchanges with. The challenge is to enable diverse safe participation.

7.5.2 The Challenge of Cultivating Evolution

Cultivating an OGD ecosystem involves both creating, managing, and changing conditions. I also believe cultivation involves guiding the evolution of the ecosystem towards the “greater good” (Mars et al., 2012). I see that the guidance could include identifying and addressing ecosystem faults, ensuring the ecosystem can merge with other ecosystems and distributing as well as translating solutions. The cultivator has to manage the evolution of the ecosystem to ensure it does not collapse or result in dystopian outcomes. At the same time, cultivators need to manage the growth of several ecosystems into a larger ecosystem where each can have a different maturity. Table 7 presents the challenges connected to lessons from previous discussions with an added description.

Table 7: Cultivation challenges concerning ecosystem evolution

Challenge	Lesson(s). Cultivators may benefit from...	Description
Identify the origin of faults	Working with understanding actors’ activities and how they form the ecosystem and impact other actors (Paper one). Studying ecosystem faults to understand why an ecosystem is experiencing slow growth, degeneration, or collapse (Paper three).	Actors organize through activities into an OGD ecosystem and can contain faults. The challenge is to identify faults and their origin activities to remedy the problems.
Enable merging of ecosystems	Approaching OGD ecosystems as growing out of several contexts to form bridges of data between them (Paper three). Collaborating to ensure that they cultivate OGD ecosystems that can merge (Paper three).	OGD ecosystems grow from several different base ecosystems. The challenge is to cultivate them into one OGD ecosystem and change intersecting ecosystems to accept the new ecosystem.
Solution translation between ecosystems	Identifying the sources of common impediments and their impact (Paper two). Studying the positive conditions to understand why they are working before introducing them (Paper two).	Impediments in an OGD ecosystem can be resolved by solutions from other ecosystems. This is favorable, as it can enable merging. The challenge is that solutions in OGD ecosystems are not universal and cultivators need to understand the conditions surrounding both external solutions and internal problems.

7.5.3 The Challenge of Understanding the Ecosystem

I can see how the constant evolution of an OGD ecosystem, where new actors can create new roles every day, makes it challenging for cultivators to understand the system. New roles can, for example, be born through changes in activities or that the normative OGD model is introduced to a public organization that has unique data management or data compare to other publishers. The normative OGD model (see section 2.2) gives only two roles to describe the ecosystem: publisher and user. The OGD ecosystem model (see section 3.3) adds OGD portals, end-users, and cultivators. However, as identified in paper one, these do not capture the roles of an OGD ecosystem well enough. It seems that practices have started to out run the current models of OGD. If cultivators cannot describe the phenomenon they are cultivating, it will be challenging to communicate and collaborate with other actors. Worse is that actors can perceive themselves to be a role they are not and try to apply solutions that do not match with their needs. This situation can also result in needs being left out. As a result, cultivators can face challenges describing the phenomenon they are encountering, keeping up with the rapid growth of ecosystems (not only their own), and coordinate the problem-solving within and between ecosystems. Table 8 presents the challenges connected to lessons from previous discussion with an added description.

Table 8: Cultivation challenges concerning understanding an OGD ecosystem

Challenge	Lesson(s). Cultivators may benefit from...	Description
Describe emerging phenomena	Developing a more precise language to describe roles and their impediments (Paper one). Being careful with informing actors about OGD by distinguishing it from any similar phenomena (Paper three).	OGD is an abstract idea and does not fully capture real OGD ecosystems. The challenge is to describe the emerging phenomena of an OGD ecosystem to new and old actors.
Keep up with the growth	Adapting the ecosystem model, the normative OGD model, or practice to each other over time (Paper one). Developing the normative OGD model to include a broader range of publishers and users (Paper one).	OGD ecosystems are vast and can grow rapidly, especially, if they merge with other OGD ecosystems. The challenge for cultivators is to keep up with the growth and have models representing the ecosystem.
Coordinate problem-solving	Thinking about how impediments are addressed in the OGD ecosystem (Paper two).	OGD means a change to a diverse group of base ecosystems. The challenge is to coordinate OGD actors solving impediments in relation to the normative OGD model and the OGD ecosystem. There are no silver bullets.

8 Conclusions

In the following chapter, I first present the answer to this thesis's title. This answer takes the form of a summary of the cultivation challenges mentioned in the above discussion. Then, I present theoretical contribution and implications followed by practical implications as recommendations to cultivators. The theoretical contribution is drawn from the above discussion, and the implications are some of the more important lessons drawn from my research. These lessons are based on the lessons presented and discussed in chapter 7. By answering the thesis title and presenting the implications, I have attempted to achieve the purpose of this thesis, which is to draw lessons about challenges in the cultivation of OGD. The thesis ends with presenting reflections on used methodology and this thesis contribution, and future research.

8.1 Why is it so Challenging to Cultivate Open Government Data?

Actors, in the role of cultivators, are facing towering challenges in their effort to cultivate an OGD ecosystem. The system is vast, complex, and it interacts with other ecosystems. There is a need to harmonize the new organization with the base organizations to grow a system that can be viewed as a public utility (see section 7.4). The growth, in a metaphorical sense, is not a stone on the other, rather new materia organized out from the old as external materia is introduced, such as ideas, practices, norms, and technology. Cultivators introduce the idea of OGD to actors that then can organize as a system through their activities into an ecosystem; changing both the idea and their practice. This intermingling can be challenging to understand since new phenomena are constantly emerging until stability in change is reached or the system collapses. The structure is more of a living organism than a static structure, but at the same time anchored in something solid and hard to change. Cultivators can need to guide the evolution and growth of the organic structure towards a higher purpose and in this create stability. At the same time, OGD ecosystems can only deliver value to the participating actors, once several of the actors and infrastructure are organized. As a result of the research in this thesis, cultivators can experience three identified challenges when cultivating OGD and public utility ecosystems in general:

Firstly, cultivators can experience challenges with managing the stability of ecosystems. They may need to manage stability in growth, value, and participation (see section 7.5.1). The ecosystem grows out of several preexisting ecosystems; as such, local impediments can be experienced. At the same time, the organized actors are required to stay in place until other key actors are ready for interaction. Once the actors are organized, the system needs to steadily provide a resource that has a stable value. If a disaster were to strike, the system needs to recover or risk collapse as actors leave. *The challenge for cultivators can be to cultivate a system that can manage stability by itself without constant involvement of the cultivators.*

Secondly, cultivators can experience challenges in cultivating evolution. Ecosystems are not built or created; rather conditions are introduced, changed, managed, or removed from the systems to encourage change towards a “greater good.” In cultivating evolution, cultivators may need to identify the origins of faults, enable the merging of ecosystems, and enable the translation of solutions between ecosystems (see section 7.5.2). As the ecosystem grows out of different contexts, it starts as several budding ecosystems that might be unable to stay in place, cannot merge, or cannot alone create value. These problems can come from faults in the system. To solve the faults the cultivator needs to identify their origins, which can be challenging when several different actors are participating. At the same time, the budding ecosystems need to be able to merge into a larger system and the surrounding ecosystems need to allow it (e.g., the legal framework can make publishing impossible). In the process, actors can experience impediments and can either invent their own solutions or introduce external solutions. The latter is favorable since it encourages merging. However, for cultivators, this introduction means they have to understand the conditions of the ecosystem’s problem and conditions surrounding the solution to either adapt the solution to the problem or find another solution. *The challenge for cultivators can be to cultivate a system that is capable of evolving towards a “greater good” by itself.*

Thirdly, cultivators can experience challenges in understanding what they are cultivating. They can need to describe emerging phenomena as the ecosystem mature, keep up with the growth, and coordinate problem-solving with other actors (see section 7.5.3). The cultivators can enter with an idea for what to cultivate (see section 2.2), which once organized by other actors as an ecosystem may no longer be consistent with the initial idea (compare section 3.3 and 7.4). The system keeps growing and evolving, and new phenomena emerge at several locations (and so does our understanding of it). The new can be described using old concepts or new concepts need to be constructed. If something is new, the concept needs to be spread to others to allow for intersubjective understanding. At the same time, old phenomena may take new forms, and concepts might need to change. *The challenge for cultivators can be to have an up-to-date precise vocabulary for a self-evolving system that enables inter-subjective understanding for coordinating problem-solving.*

8.2 Theoretical Contribution and Recommendations

The following section condenses my findings into a theoretical contribution and theoretical implications. Several implications are mentioned at the end of section 7.1, 7.2, and 7.3. In previous research, the use of the ecosystem metaphor has been fragmented with a narrow focus (Zuiderwijk et al., 2014c), but has seen an increase in use (e.g., Lindman et al., 2016; Najafabadi et al., 2016). In addition, to my knowledge, the OGD ecosystem concept lacks an academic definition for its ecological situation; as such, I created an OGD ecosystem model from previous research that focuses on human activities supported by technology in the local context (see section 3.3; Nardi & O'Day, 1999; Davies, 2010; Harrison et al., 2012; Heimstädt et al., 2014b). I sought to understand how actors occupying groups of activities (read roles) at different geographical locations could organize as an OGD ecosystem. However, through my research process, I have reached the insight that OGD ecosystems cross several contexts, seek less stability in motion, and are heavily dependent on infrastructure and not merely served or support by it (e.g., see paper three). Rather, infrastructure, actors, and activities seem to play an equally important role for OGD (e.g., Davies, 2011; Kalampokis et al., 2011a; Van Schalkwyk et al., 2016). If actors and activities are highlighted at the cost of OGD infrastructure, there is a risk that essential parts of OGD systems are forgotten (e.g., OGD's dependency on the Internet), important relationships are obfuscated (e.g., OGD portals and publishers' data inventories), and a focus on human change over socio-technical change. The risk is to miss a whole dimension of data flows, navigation networks, and products that actors are trying to create for the purpose of organizing OGD. As a result, my contribution to theory is that **an OGD ecosystem can be viewed as a public utility ecosystem (see section 7.4)** rather than an organizational ecosystem. Moreover, when researchers are studying OGD ecosystems, I recommend that they:

... approach the "construction" of ecosystems as the cultivation of evolution rather than the construction of structures. OGD actors are organizing following and using introduced ideas, technologies, activities, and expertise from cultivators. Researchers may cultivate and study the actors' organization to understand how conditions affect the ecosystem, but also how ecosystems' evolution can be directed. However, OGD ecosystems seem to contain a paradox. The ecosystem metaphor assumes stability in motion, which large parts of the OGD ecosystems appear to avoid. Some actors want the infrastructure and data to follow specific standards that lock them in place to allow for motion on top. This standardization, in turn, can mean publishers have to sacrifice their adaptability in other ecosystems. For example, publishers might need to standardize how data is collected, stored, processed, and distributed in their organizations.

... consider the ecosystems' stability in growth, value, and participation. OGD ecosystems are more than an interaction between publishers and users and involve extensive infrastructure and several actors at different locations (e.g., Davies, 2011). This infrastructure can be deeply integrated into the publishers and can require them to change, as their data production has to account for external usage and IT-systems needs to share data (see paper two and paper three). At the same time, from an organizational ecosystem

perspective (Mars et al., 2012), the OGD systems seem to lack properties that create stability in other ecosystems, such as supplementary sources and voluntary exchange.

... are cautious with how they label and describe OGD actors. The archivist and the contributor can be similar on the surface, but are different on the inside, especially, in how much control they have over data production (see paper one). The problem is that once an actor is introduced to the idea of OGD, they can attempt to organize and once organized, the idea is all of a sudden more than “...*interoperable data, which is collected by and shared over the Internet by public organizations to be used by anyone without restrictions...*” (This thesis, p. 20). Parts of the actor’s previous data management activities and infrastructure is now a part of the OGD ecosystem.

8.3 Recommendations for Cultivators

The following section condenses my research into practical advice for cultivators. Several implications for practitioners and cultivators are already mentioned at the end of section 7.1, 7.2, and 7.3. I recognize that cultivators are standing before towering challenges and, as such, based on my research in this thesis, I can recommend that cultivators:

... to be cautious with giving OGD actors too much freedom to evolve. Actors participating in OGD can be more open to harm as a house-of-cards system may be enabled. Some actors might perceive this risk as too high and avoid participating (e.g., fear of abuse). Some stability can be achieved by developing a solid standardized infrastructure (e.g., make JSON the data format standard) to support the organizing actors. Another approach can be to cultivate a guiding social environment where the community can identify and create solutions to some of the stability issues. Creating trust could be central to realizing OGD. What I want to say is that cultivators can guide the freedom of the actors to help them organize.

... avoid approaching OGD ecosystems as the construction of a building. Rather, view it as the management of evolution (growth) towards a purpose. Growth can be influenced by introducing, changing, managing, or removing ideas, technologies, practices, and expertise. Here, explaining the value and purpose of these may be important to enable intersubjective understanding. For example, hackathons can be used to introduce OGD to communities as something too innovative with, while the OGD portal can help users to identify data similar to a dataset phonebook. Cultivators can work to create situations where actors are allowed guided growth but also where ideas, technologies, practices, and expertise can spread.

... view cultivation as a collaborative effort where cultivators can supply ideas, technologies, practices, and expertise to different actors to help them organize. In return, the actors can give feedback to help improve the introduced material. Together, cultivators and actors can create a temporary symbiotic relationship to grow the ecosystem based on motivation for and idea of a higher purpose. This growth can be a step-wise process as material and feedback are exchanged, and both sides have to adapt over time. This adoption can be important since it allows the actors to take part of each other’s expertise and experience, but also turn an abstract and general idea to a practical and local organization.

8.4 My Reflections

The following section presents my reflections of the methodology applied in this thesis and my contributions. In the methodological reflections, I will focus on my research approach, my used methodologies and methods, and my use of metaphors. In the reflection on thesis contribution, I will focus on impediments and OGD.

Methodological Reflections

Research approach. My research started with a pilot study and I then followed the OGD community to then conduct two studies. I then explored the Swedish OGD ecosystem, and, finally, I wrote a compilation licentiate thesis to synthesize my research. Overall, my research focused on challenges in cultivation by studying impediments from an ecosystem perspective. I did this by first studying roles and how they can organize into an ecosystem. I then reviewed what is previously known about impediments, and, lastly, I explored a national OGD ecosystem. This approach allowed for a deeper understanding of the phenomenon and related problems. However, in retrospect, this approach can be deemed as less optimal for the intended purpose. My approach focused more on the phenomenon under cultivation, rather than the activities of cultivation. Alternatively, I could have had started with studying what OGD is to understand what actors are trying to organize into, then reviewed different methods to cultivate an OGD ecosystem, and end with exploring cultivation in practice to identify impediments inductively.

Consequently, I would have had anchored my research more in the perspectives of the cultivators, but less in the challenges existing inherently in the phenomenon. In a metaphorical sense, I would have had studied the day's work of the gardener, rather than the garden itself. The strength with this approach would be that it could allow insights into the activities and impediments of the cultivators from their perspectives, while the limitation would be their focused and local understanding of a vast and complex system. In my research approach, I focused on the phenomenon the cultivators are trying to cultivate. This allowed for an understanding of why the phenomenon can be challenging to cultivate, rather than the current challenges experienced by the cultivators. As a result, I believe that the knowledge produced can have a longer life expectancy and enable a basic understanding of OGD systems.

Methodologies and methods. In my Ph.D. studies, I have learned substantially about research. I have studied research philosophy, practiced methodologies, and used different data collection methods and analytical methods. My journey has been challenging, as I have attempted to be a jack of all trades rather than a specialist in one. This mixed approach resulted in encompassing knowledge production with a triangulation of methods, methodologies, and thoughts while being time-consuming and complex. I have had to integrate different thought styles and read my fair share of texts. Alternatively, I could have had focused on making an interpretative case study of a publisher, a user, and a cultivator, using face-to-face semi-structured interviews, documents analysis, and coded my data through thematical coding. Triangulation would have been achieved by interviewing actors in different organizational roles and studying documents. This approach could have had resulted in knowledge more based on the specific OGD roles by capturing their perspectives of the phenomenon. At the same time, it would have had allowed me to dig deeper into and master very specific methodologies and methods. However, I believe this approach would have been suited more for understanding local systems. I studied OGD as a national system, which I believe can best be studied by using different methodologies, methods, and thoughts. For example, I would not have had the time to conduct face-to-face or phone interviews with all participants in the third study. E-mail interviews were needed to reach to all corners of the Swedish OGD ecosystem.

Metaphors. In this thesis, I have used several metaphors to describe my research findings, contributions, practice, and thoughts. One of the challenges I have experienced in my research was to find a representation of OGD that made the concept less abstract and easier to understand. Metaphors have helped alleviate this challenge. Metaphors are a way of seeing and a way of thinking that highlight

certain interpretations and force others to the background (Morgan, 1997). Metaphors are also a trope in rhetoric that can make an argument easier to convey and more persuasive (Longaker & Walker, 2011). I find that the biome metaphor (see section 7.2) is persuasive, as I think it captures the cultivation challenges in a clear manner. This metaphor gives a rich vivid description that can be perceived by readers. However, the biome metaphor also gives the impression that actors are digging ditches. In practice, actors are using the Internet that is already implemented and maintained by other actors outside of OGD. Thus, metaphors can come with both strengths and limitations. Also, I identified a positive possibility when using several different metaphors to understand one phenomenon. Reflecting on the biome metaphor with the bridge metaphor from the same section, I experienced a eureka moment. OGD is similar to the ancient Roman aqueduct system that I had read about a few months before. After some additional reading about water systems, I realized that water systems are public utilities and OGD is similar to them. Consequently, I see that metaphors are a good way to convey a thought to a reader but need to be handled with care and skill. I think, I have succeeded overall with my use of metaphors and, hopefully, given some readers a smile while reading my work while they have come to understand challenges in the cultivation of OGD.

Reflection on thesis contributions

Impediments. OGD impediments are annoying phenomena since they obstruct or prevent important activities while also taking a multiple of forms and their creation can be far away and almost impossible to identify or influence. At the same time, if impediments pile up and the actors and the system cannot overcome them, the impediments can become faults that can grind the system to a halt. Previous research has tended to focus on specific locations in the OGD ecosystems, which has opened for local solutions. I think one of the major problems in current OGD approaches is that they tend to approach the system from the bottom-up. I agree that the impediments are experienced by the actors at the bottom, but as impediments can traverse the system, they need to be solved and managed from a top-down perspective too. The ecosystem perspective is one top-down perspective that can enable actors to understand and manage the system. Here, the idea of cultivation can be used to talk about designing, managing, and organizing the ecosystem, but should not be viewed as the construction of the system. Rather, cultivation is an attempt to influence different actors to cause an organization for a certain purpose. To understand the resulting system with impediments, I used the Nardi and O'Day and Mars ecosystem perspectives that focus on social organization and as such place technology a bit in the background. These perspectives can be used to understand OGD impediments, but do not fully capture the technical nature of the OGD ecosystem. As I noted previously, technical infrastructure is important for OGD. Thus, there is an imbalance between impediments and the understanding of the system.

Open Government Data. OGD can refer to several different phenomena. Everything from a normative idea to the data shared by publishers. These variations can make it hard to discern what is talked about but also open for the jumbling of the internal relationships between the phenomena. The normative idea comes with law-like assumptions about what should be done to achieve a (possible) higher purpose. These assumptions can easily be transferred by mistake into research and practice. Thus, assumptions may become laws (e.g., OGD will lead to benefits or OGD must be in a certain way). These assumptions are important for the coordination of a system as vast and complex as OGD. However, in previous research and practice, the understanding and meaning assigned to the phenomena vary. The intersubjective understanding is still developing about OGD. The problem is that OGD has existed for more than ten years but many of the core concepts have not been developed to capture the nuances of practice, and there is still a search for a fruitful perspective. The world-wide OGD movement seems to be on a slowdown and researcher has noted a lack of OGD use. It might be time to take a step back and try to understand what has been achieved both in research and practice to reflect and evaluate.

8.5 Future Research

My research presented in this compilation licentiate thesis has opened for avenues for future research. In specific, my research has opened three new research avenues:

OGD value sustainability. Several impediments stand between OGD actors and the possible value from publishing and using OGD. I do not refute the idea that OGD can lead to value. The idea of OGD has developed over time and been tested in different contexts. The possible value of OGD can be compared with the properties of the system (stability), and we can ask whether the value can be predictably and sustainably delivered. For example, water and food have supplementary sources. In the worst case, in the summer of Sweden, I can find a lake and boil water over a fire, while eating wild berries and fruit. OGD seems to lack the same supplementary property. More research is needed both on the technophilic and dystopian sides of OGD, especially, their conditions, but also if OGD in its current form can be sustainably provided. It can be that the value of OGD is not in the areas we believe today. This avenue raises two questions: do OGD ecosystems need further stabilization to generate value? If so, why and how? How can OGD be sustainably provided and used?

OGD cultivation. This thesis has given insight into some of the challenges experienced by the cultivators of OGD ecosystems. Further research is needed about how to cultivate ecosystem's evolution, the "greater good" or higher purpose of OGD (beyond the benefits), and how to manage the possible deficiencies in ecosystem's stability. At the same time, the "greater good" of the OGD ecosystem may need further exploration. This avenue raises the question of how can OGD systems be cultivated towards a higher purpose?

OGD metaphors and system properties. The normative OGD model helps actors to organize as a system with certain properties, and the system can be described through a metaphor to allow for action. OGD has been described as a process (e.g., Janssen & Zuiderwijk, 2012), a life cycle (e.g., Attard et al., 2015), and a ecosystem (e.g., Dawes et al., 2016). However, research seems to still grapple with the question of how to describe the system and the properties of the system. Future research on these topics can help us understand, manage, design, and develop the organization of OGD systems. In this research, I have identified a possible paradox in the OGD ecosystem perspective and introduced the idea of viewing OGD as a public utility. The public utility perspective comes with different assumptions than the ecosystem perspective, but both are still only buds and there may be other perspectives more suited for understanding OGD. I believe the public utility perspective can be fruitful for understanding OGD but is in need of further exploration, development, and research. Thus, this avenue raises one question: how can OGD systems be described and understood through different metaphors?

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APPENDIX 1: My Three Papers

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