Why Open Data Applications fail

A multiple case study of five Swedish open data applications

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by

Adrian Bratteby
Varför Öppna Data Applikationer misslyckas

En flerfallsstudie av fem svenska öppna data applikationer

Adrian Bratteby
Abstract

In the 21st century data has become a very valuable resource, being collected by individuals, companies, organizations and governments. Unfortunately, as more and more data is being collected, more time is also spent on locking it up, centralizing power and knowledge to a few actors. Open data is an idea and field of research, with a clear aim to make data available to everyone without restrictions. Among various benefits, it has been suggested that open data has great economic potential, but since most people lack the necessary skills to make use of the data there needs to be an actor which creates a service around it. However, despite the predictions of wealth open data service creation is still in its infancy; few services are being created and most projects do not last beyond prototype stage.

This thesis investigates reasons for why many open data applications (ODAs) do not continue developing and how one can overcome these obstacles. The study is carried out as a multiple case study on five Swedish cases that all were created during a publicly funded hackathon, Hack for Sweden. The cases are analyzed from multiple perspectives, including common reasons for startup failure, market failure theory and business model analysis.

Findings suggest that the failure of an ODA is a multi-dimensional problem, which is in line with previous research on general startup failure. The study concludes that failure of an ODA can be attributed to factors related to the product and the entrepreneur(s), but also to general characteristics of ODAs. These characteristics come into play when the ODA aims to create value for society or a public actor. In such cases the study concludes that in order for more ODAs to develop sustainably and create value in the long-term, actors from the public sector must support and cooperate with ODA-creators in the development of the services.

Key-words: open data, open data application, public sector, citizen innovation, startup failure, business model, public goods
Sammanfattning

Under 2000-talet har data blivit en mycket värdefull resurs och samlas in av individer, företag, organisationer och offentlig sektor. I takt med att mer och mer data samlas in spenderas tyvärr också mer tid på att begränsa åtkomsten till datan - vilket centraliserar makt och kunskap till ett fåtal aktörer. Öppna data är en idé och forskningsområde som syftar till att tillgängliggöra data för alla, utan restriktioner. Utöver transparens och andra demokratiska fördelar har det föreslagits att öppna data har en signifikant ekonomisk potential, men eftersom de flesta saknar nödvändiga kunskaper för att dra nytta av datan behövs det en aktör som bygger en tjänst kring den. Trots förmodan att öppna data har en stor ekonomisk potential ligger öppna data-tjänsteskapet fortfarande i sin linda; endast ett fåtal projekt skapas och de flesta fortsätter inte efter prototyp-stadiet.


Nyckelord: öppna data, öppna data applikationer, open data applications, offentlig sektor, medborgardriven innovation, startup-misslyckanden, affärsmodeller, kollektiva varor
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# Glossary

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<td>Application Programming Interface (API)</td>
<td>A particular set of rules and specifications that a software program can follow to access and make use of the services and resources provided by another particular software program that implements that API.</td>
</tr>
<tr>
<td>Data</td>
<td>Information in digital form that can be transmitted, or processed.</td>
</tr>
<tr>
<td>Digitalization</td>
<td>The process of restructurining domains of social life around digital communication and media infrastructures.</td>
</tr>
<tr>
<td>Digitization</td>
<td>Encoding analog information to a digital (binary) format.</td>
</tr>
<tr>
<td>License</td>
<td>A licence is a legal instrument a copyright holder can use to instruct others what is permitted to do with something (e.g. data).</td>
</tr>
<tr>
<td>Machine-readable format</td>
<td>A data format which a machine is able to parse and understand. For example &quot;pdf&quot; is a non-machine-readable format (easy for reading and print), while &quot;csv&quot; is a machine-readable format (structured and easily parsed). More granularly defined in chapter 2.</td>
</tr>
<tr>
<td>Open Data (OD)</td>
<td>Any data that is free to use, re-use and redistribute - without any legal, technological or social restriction.</td>
</tr>
<tr>
<td>Open Data Application (ODA)</td>
<td>An entity that processes and reuse open government data, with or without the combination of private sector data, to generate and distribute meaningful information for users in specific application domains.</td>
</tr>
<tr>
<td>Open Data Application value centric Business Model (ODA-vBM)</td>
<td>A business model framework that puts the value creation aspect of ODAs in focus and can be used by practitioners and organizations looking to build services around open data.</td>
</tr>
<tr>
<td>Public Sector Body (PSB)</td>
<td>Local, regional or state authorities, bodies governed by public law and associations formed by one or several such authorities - or one or several such bodies governed by public law.</td>
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First of all, I would like to thank the people at DIGG and Hack for Sweden for helping me with this thesis. Especially I would like to thank Kristine Ullander at DIGG who introduced me to the subject of open data in Sweden and provided valuable knowledge and support through the thesis. I would also like to take the opportunity to thank the case informants and all other interviewees for participating in this study and contributing with valuable and interesting conversations - without you this thesis would not have been possible.

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Adrian Bratteby,
June 3, 2019
1 Introduction

This chapter introduces the thesis and sets the context for the research. It begins with a background in the subject of open data, service creation and the current situation in Sweden. Then the chapter presents the problem and the research question to be studied. Purpose, contribution and limitations are touched upon and the chapter ends with a summary of the chapters to come.

1.1 Background

Arguably, one of mankind's biggest merits is the collection and distribution of information among themselves and across generations. The printing press, developed in the 15th century, extended the accessibility of the written word from monks and scholars to common people (Eisenstein, 1980). Through the process of digitisation, the computer - introduced in the 20th century - enabled storage and processing of vast amounts of information. Finally, with the invention of the world wide web in the early 90's (T. J. Berners-Lee, 1989), the process of distribution (and later on also collection) of data was once again revolutionised, by enabling distribution of digital information globally, almost with the speed of light and at a marginal cost close to zero.

Today digital information, from here on referenced as data, is the fuel of many organisations and corporations and has been called "the lifeblood of the knowledge economy" (European Commission, 2011). Data is indisputably a valuable resource, but only when it is not locked up. From here stems the idea of open data. Open data can be defined as any data that is "free to use, re-use and redistribute - without any legal, technological or social restriction" (Open Knowledge Foundation, 2019b). It is worth to point out that this definition is ambiguous, e.g some argue that "without technological restrictions" implies that data must be in a machine-readable format (Statskontoret, 2018). Thus the exact definition will depend on the author. This thesis takes a relaxed approach and also consider data published in non-machine-readable formats, such as pdf, as open - see section 2.1.2 for an elaborated discussion.

Besides promoting transparency of the entity that opens the data, it has been shown that re-use of data in a new context has great economic value for society. For example, European Commission (2018) estimates the market size for re-use of public sector data, collected in the 27 member states of the EU, to be 52 billion euro in 2018. That is value derived from cost savings and new services, built on re-used data that previously have been used internally within public sector bodies.
Governments and public sector bodies have long been some of the largest collectors of data (Temiz and Brown, 2017), storing information about everything from weather and infrastructural data, to public records of students’ grades. Also, data collected by a government arguably belongs to its’ citizens; thus, public sector information makes a great case for open data. However, the process of realizing the economic potential of this data is complex and requires collaboration between several public and private actors. One must first identify what high valuable datasets to open, then actors must collaborate to standardize, document and publish the data. But to create value it is not enough to simply open it up for the public to use (Lee, 2014), since making use of it and understanding the data requires special expertise (Hellberg and Hedström, 2015). Therefore, in the end of the value creation process there must be an actor, a "hacker" or an "entrepreneur", who builds a service around the data for common people to use (Kuk and Davies, 2011).

Value creation from innovation, by an entrepreneur, is a topic dating back to the early 20th century, with the works of Joseph Schumpeter (Hagedoorn, 1996). The idea is that through new combinations an entrepreneur introduces new products, services and processes, which ultimately contributes to economic growth (Blomkvist, Johansson, and Laestadius, 2016). Throughout the century, researchers, such as Abernathy and Utterback (1978) and Henderson and Clark (1990), have expanded on the works of Schumpeter, classifying innovations in different types of categories and researching various characteristics around them. Nowadays, focus often lies on startups, as the subject creating new innovative services and products. Startups are small temporary organizations, with little to no operating experience, that oftentimes focuses on dynamic technology and markets (Sutton, 2000) - which makes them productive innovators. Very few startups manage to exist for more than a couple of years (Giardino, Wang, and Abrahamsson, 2014; Marmer et al., 2012; Feinleib, 2011), but those who do are sometimes even able to compete with incumbents and provide services we use everyday.

There are a number of reasons to why startups may fail, for example a startup may discontinue because the entrepreneur(s) are lacking passion for their project (Giardino, Wang, and Abrahamsson, 2014). Another reason is failure to identify how and for whom the firm creates value for (Nair and Blomquist, 2019), which can also be described as failure in proper business model development. Though there is a lot of ambiguity around the concept, Zott, Amit, and Massa (2011) tentatively define a business model as a model which: "/../ emphasizes a system-level, holistic approach to explaining how firms do business". Looking at business model research (Zeleti, Ojo, and Curry, 2014; Zuiderwijk and Janssen, 2014; Biedenbach and Boström, 2018), there seem to be a myriad of different business model frameworks and why may wonder why every domain of business need their own type. Amit and Zott (2001) explains the reason for this being that a business model need to address the issues related to the specific phenomena (on which business is conducted) and capture its unique features.
Returning to the topic of open data service creation, it seems to be an even more difficult process. Looking at the context of Sweden, there exist few examples of open data services that have been able to remain active over a longer period of time (Temiz and Brown, 2017). In general Sweden is doing well in the general process of digitalization, ranking 2nd in the EU digital economy and society index DESI (2018a). Yet, in the category of open data Sweden ranks 26th - well below average (DESI, 2018b). This composite index do not only measure economical impact of open data, but a number of other aspects - such as open data policies in place, data availability and so on - however, all these factors tie in together.

As Sweden aims to be a leader in utilizing the benefits of digitalisation (Regeringen, 2017) actions have been taken to close the gaps in open data maturity. First, there have been several investigations (Statskontoret, 2018; Gartner, 2018; Riksarkivet, 2018) to research why Sweden is falling behind. The conclusions from these reports show that there are technical barriers, knowledge barriers, lack of proper governance and public funding. The same reports also tell a story about some salient actors in the public sector ecosystem of open data. _Kraftsamling Öppna Trafikdata_ is such an example, where actors from the transport sector, such as the National Traffic Agency, Vinnova and regional transport agencies, came together to solve the previously mentioned issues (Forum för transportinnovation, 2017).

Second, Sweden founded a new public authority for digitalisation, _Myndigheten för digital förvaltning_ (DIGG), whose aim is to coordinate IT-governance in most public sector bodies (Svensk författningssamling, 2018). Finally, there are several ongoing initiatives to promote the service creation and re-use of the open data from public sector bodies.

As previously mentioned, data is not very valuable when it is locked up, the same is true when it is hiding in plain sight - but nobody utilizes it. One of the initiatives for promoting re-use of public agencies open data is Hack for Sweden - a yearly open hackathon (a form of programming competition), where participants are invited to use Swedish government agencies’ open data to create solutions for public beneficiaries (Hack for Sweden, 2019a). The project has been a success in terms of growth and amount of initiatives based on public sector open data, growing from 75 contestants and 13 participating public agencies in 2014 (Hack for Sweden, 2014a) - to 220 contestants and 30 public agencies in 2018 (Hack for Sweden, 2018a). However, there is concern whether Hack for Sweden, or similar open innovation contests, really contributes to long-term value creation, as the participating teams seldom continue with their projects after the contest is over (Temiz and Brown, 2017; Kuk and Davies, 2011). This raises several questions. First, why do the projects, though deemed promising by the hackathons’ judges, discontinue after the contest? Second, how can incentives to further develop the open data applications be introduced in this context? Third what is the motivation of these contests and do they promote long-term value?
1.2 Problematization

The problem addressed in this thesis can be expressed as following: realizing the potential of open data is a complex process, which requires collaboration between several parties (Lee, 2014; Davis, 2012) and especially the very end of the process - the development of open data applications that are able to progress beyond prototype stage - is halting (Temiz and Brown, 2017; Kuk and Davies, 2011).

Previous research in this field have mainly focused on open data adoption and impact (Temiz and Brown, 2017; Temiz, 2018; Hellberg and Hedström, 2015) and socio-technical barriers for open data (Zuiderwijk and Janssen, 2014; Statskontoret, 2018). Research focusing on open data value creation have touched: mapping the ecosystem (Lindman, Kinnari, and Rossi, 2014; Lindman, Kinnari, and Rossi, 2016), finding suitable business models, (C.-C. Yu, 2016; Zeleti, Ojo, and Curry, 2014) and who - in the end of the value chain - creates the, by advocates promised, value for society (Kuk and Davies, 2011). Some of the difficulties can also be attributed to the distribution of open data, which is hindered by technical barriers and lack of knowledge within public sector bodies (Statskontoret, 2018).

Findings from these studies suggest that the utility from open data is accumulated by the creation of new artifacts/services by entrepreneurs/hackers (Kuk and Davies, 2011; Lindman, Kinnari, and Rossi, 2014). However, few of these created open data applications are maintained beyond the initial creation during a hackathon, or a one time event (Temiz and Brown, 2017; Kuk and Davies, 2011). Furthermore, besides a definition by C.-C. Yu (2016) and some work on business roles by Lindman, Kinnari, and Rossi (2014) and Lindman, Kinnari, and Rossi (2016) there is not much detail on what actually constitutes an open data application and what kind of characteristics they share. Finally, Kuk and Davies (2011) conclude that there is "no straight line from the release of open data to service innovation" implying that action from lone hackers are insufficient to realize the potential of open data (Hellberg and Hedström, 2015).

From previous research and motivations in the last paragraph, the need for further research on several topics emerges. First, in order to discuss open data applications more stringently they need to be documented in further extent and have common characteristics described. Second, as many promising open data application projects/companies stop at prototype stage, or discontinue early on, there is a need for further research on why they discontinue, as well as what kind of open data business can attract a user base and remain active. Third, considering a) one cannot expect lone entrepreneurs/hackers to create value, simply by releasing data and b) publicly funded hackathons are unable to produce new businesses or projects that create value in the long-term, further research needs to be done on what
the role of the open hackathons and public sector is in the process of creating value from
open data. From these research gaps three research questions are formulated:

RQ1: What are common characteristics for open data applications?

RQ2: Why do many open data application initiatives discontinue early in development?

RQ3: How can the public sector and open hackathons support the creation and development
of open data applications?

1.3 Purpose

This thesis will investigate five ODA initiatives, created during the publicly funded open
hackathon Hack for Sweden, to identify reasons to why ODAs discontinue and how these
ventures can be supported to increase their longevity. The open data application is the final
link in the open data value creation process, thus integral in order to realize the potential
of open data.

1.4 Contribution

This thesis makes several practical and theoretical contributions. The first theoretical
contribution the thesis makes is increasing the knowledge about reasons to why open data
applications may fail. These findings build on previous research on startup failure and
expands with context specific reasons for the field of open data. Second it expands the
knowledge about open data applications, derived from examining the general characteristics
of open data applications studied in the thesis. Finally the thesis contributes an extended
model of the Swedish open data ecosystem, which may be used in future studies on the
topic of open data.

The research also contributes to practitioners. For entrepreneurs, interested in entering
the field, the thesis may serve as a guide on what to look out for. For public actors it
highlights problems that need to be solved in order to achieve long-term value creation
from open data.
1.5 Delimitations

Although the themes in this thesis are general this thesis will focus the Swedish open data ecosystem, with all its possibilities and barriers. The restriction to investigate one country is due to complexity of the ecosystem and performing a multi-national comparison would require substantial resources and time. With that being said, the outcomes of the thesis is most certainly applicable to similar countries in the Nordics and members of the EU, as these ecosystems share many environmental and legal similarities with the Swedish ecosystem.

A chosen delimitation was to only focus on projects which had competed and won the hackathon Hack for Sweden. This choice made mainly due to two reasons. First there are a limited amount of companies working with open data as their core business (Temiz, 2018). Second, as a result of reason number one, finding projects that are comparable is difficult and the findings of the thesis would not be interesting if, for example, projects at large corporations were to be compared to initiatives from small start-ups. Making this delimitation makes comparison fair and interesting.
1.6 Thesis outline

This section explains the structure of the thesis and what one may expect to find in each chapter.

Chapter 1 - Introduction, introduces the thesis, presents the problem under study, as well as its purpose and limitations.

Chapter 2 - Open data, presents the field of open data and its components. The chapter summarizes previous research done in the field, combining academic and practical perspectives to present new ideas where it seem fit.

Chapter 3 - Literature review, explores previous research and theory to be applied on findings in the analysis and discussion chapters. The aim is to provide a broad background in relevant concepts that have been used to explain empirical findings.

Chapter 4 - Method, explains the overall research design, choices made regarding the cases and chosen methods for data collection and analysis. Finally research quality is briefly discussed.

Chapter 5 - Case description, introduces the five studied cases, their ideas, project history and motivations for making different decisions. Additionally it presents background information on Hack for Sweden, the context surrounding the cases.

Chapter 6 - Findings & analysis, aims to build a solid base for the discussion, by cross-comparing results from the five cases. In order to do so, it presents empirical findings and analysis from different perspectives. The chapter begins by a characterizing open data applications in general. Then it moves on to analysis of the informants views, analysis of the ODAs from a business model perspective and finally comparing them to common reasons for startup failure.

Chapter 7 - Discussions, discusses empirical findings and results from the analysis. The discussions attempt to answer the chosen research questions and elaborate on other problems which arise during discussions.

Chapter 8 - Conclusion, concludes the thesis by summarizing answers to the posed research questions. The chapter also explains what implications the findings have for practitioners, as well as academia and makes suggestions for topics to be studied in future research.
2 Open data

This chapter aims to explain the concept of open data and its components. As the concept is relatively new and it is the central topic of this thesis, it’s necessary to establish an understanding of what open data actually is, the ecosystem around it, fundamental use cases and barriers to realize potential value. The chapter presents the empirical arena by combining findings from theory and practitioners and provides interpretations where seem fit. Section 2.1 introduces the chapter with a historical background, then moves on to explaining what open data is and the rational for organizations to publish open data. Then section 2.2 presents attempts to map out the ecosystem of actors within open data sphere and then an extended model of the Swedish open data ecosystem.

2.1 Generally about open data

“Numerous scientists have pointed out the irony that right at the historical moment when we have the technologies to permit worldwide availability and distributed process of scientific data, broadening collaboration and accelerating the pace and depth of discovery... we are busy locking up that data and preventing the use of correspondingly advanced technologies on knowledge.”
- John Wilbanks, Executive Director, Science Commons (Groen, 2012)

2.1.1 A little bit of history

According to Meriam-Webster (2019a) data is defined as "factual information (such as measurements or statistics) used as a basis for reasoning, discussion, or calculation", or "information in digital form that can be transmitted or processed". The first known usage of this term goes back as early as in 1646. In this sense, data has been collected by researchers through experiments, governments through census and other means and later on by companies and other organization, for making qualitative decisions. After collection, non-governmental organisation are free to do what they want with this data. Also among governments, with a few exceptions such as Sweden’s Offentlighetsprincipen which dates back to 1766 (Konkurrensverket, 2017), default has been to not disclose collected information with the public. In the aftermath of the two world wars, the idea of open government was coined in the U.S, for reinforcing transparency and accountability to public agencies (H. Yu and Robinson, 2011). This was the result of U.S policy makers concentrating power and sensitive information in agencies, such as the Central Intelligence Agency (CIA) and National Security Agency (NSA), which left citizens with few methods to obtain informa-
tion (Schrock, 2016). In the late 1940’s the American Society of Newspaper Editors made a sequence of policy statements, culminating in their Harold L. Cross to write *The People’s Right to know* (Schrock, 2016). There he concludes that: ”there is no enforceable legal right in public or press to inspect any federal non-judicial record.”, advocating for new laws of openness within the public sphere. This eventually led up to president Johnson signing the Freedom of Information Act in 1966 and so a new era of public disclosure began, where Sweden was no longer unique in the sense of openness.

With help of the internet and the process of digitization (not to be confused with digitalization), here defined as encoding analog information to a digital (binary) format, the marginal cost of distributing the data collected by governments, companies and organisations have been reduced close to zero. With knowledge of this and the historical events described in the last paragraph, one could think that every piece of information, known by any human, should be widely accessible to any other human with an internet connection. However, as will be explained further on, data available on request, in the sense of being transparent, is not the same thing as data being open (Temiz and Brown, 2017).

### 2.1.2 What is open data?

The Open Knowledge Foundation (2019b) - a global non-profit organisation focused on realising open data’s value to society and generally acknowledged actor in the field of open data - defines open data as any data that is: ”Free to use, re-use and redistribute - without any legal, technological or social restriction.”

Although the foundation for this definition is widely recognized by researchers (Temiz and Brown, 2017; Lindman, 2014; C.-C. Yu, 2016) and governments (Statskontoret, 2018; European Commission, 2019), the definition is open for interpretation and may vary depending on the author. First, there’s uncertainty regarding for whom the data should be open to, where some consider data as open even if it’s only internally open, e.g to the employees of a company (Tammisto and Lindman, 2012). Second, there’s uncertainty around the what may considered as technological restrictions. Some interpret this as that data must be in a machine-readable format as described in the linked open data rating system by T. Berners-Lee (2009) (the inventor of the World Wide Web) - see figure 1.
The rating system could need some explanation:

- 1 star - any data made available on the web (with an open licence)
- 2 star - making the data available in a structured format
- 3 star - making the data available in a non-proprietary open format
- 4 star - using URIs (e.g. a web address) as identifiers
- 5 star - linking data to other data sources to provide context (e.g. click here if you read this thesis in a pdf)

5-star data is considered to bring most benefits and each level builds on the requirements of the previous level, for example 3-star data must meet the requirements for 1, 2 and 3-star data. Without going too much into details, the essence of the system is that 1-star data is any data made available on the web (with an open licence), while 2-star data and upwards is considered as machine-readable structured data (T. Berners-Lee, 2009).

Since it is clear from the definition that restricting access of data to a limited crowd is a social restriction, this thesis will only consider data accessible by anyone as open. For the second uncertainty this thesis will take a more relaxed approach. While publishing data in a machine-readable format is critical for the usability of the data (Statskontoret, 2018) and thus its value, data in the form of pdf:s and other non-machine-readable formats does not entirely restrict use of the data from a technological perspective - hence, it will be considered open (which is in line with the previous definition by Open Knowledge...
Foundation (2019b)). That being said, any publisher should strive to provide at least 2-star open data.

2.1.3 Why open data?

Data has been referred to as "the lifeblood of the knowledge economy" by European Commission (2011) and "...oil of the 21st century" by Joe Kaeser (2018), the CEO of Siemens, i.e there seems to be consensus on data being a valuable resource. Normally when something is valuable, organizations tend to keep it to themselves. Thus, it’s reasonable to question the very motivations behind opening data to the public and what is in it for the publishing organization - this section tries to answer that question. Since the main focus of the thesis is open data provided by public sector, it will be the main focus in this section. However, per definition open data can be published by any organisation, institution, company or individual, therefore a brief motivation for non-governmental organizations to publish open data is provided as well.

Public sector

Governments are the biggest collectors of information in most national ecosystems and also the biggest providers (Temiz and Brown, 2017). In many democratic countries, the right for any citizen to request this information is not something new. For example in Sweden "Offentlighetsprincipen", which gives any citizen the right to request public information that is not classified as secret, has existed since 1766 (Konkurrensverket, 2017). Such laws have been motivated by making governance transparent, but if data is only available on request it is not considered open. However, since the early 2000’s public data in Sweden and other member states of the EU is also governed by the PSI-directive (European Commission, 2018). According to the European Commission (2019) PSI, or Public Sector Information, is information that any public sector body produce, collect, or pay for - such as geographical information, weather data, etc. While the decision remains in the member states to implement it, what this directive does is extending the former laws of right to information by request, to right to information by default (Council of European Union, 2003) - i.e open data.

In such manner, Sweden and other member states of the EU have a legal incentive to open data, but according to European Commission (2018) there are certainly motivations behind the directive and why the countries should follow it. The first motivation for the governments to open data is that data collected by public agencies is effectively paid by the citizens and should therefore be freely available to them. Second, similar to the motivation behind right to information-laws opening public data promotes transparency of the government. Third, it reduces unfair competition in the sense that public sector
bodies having an information advantage over private sector. Finally, there is the argument of economic growth. When governments release their data it creates a new market, where third party service creators can use this data, enhance it and redistribute it as new services. European Commission (2018) claims that in the EU this market was 52 billion euro in 2018. This number should be taken with a grain of salt, as it is an estimate produced by the company Deloitte, aggregating estimates from several older sources, such as Vickery (2011) and Dekkers et al. (2006). While the exact number is not interesting, it is clear that open data indeed has an economic potential which should serve as a good incitement for governments to open their data.

Companies and other non-public organisations
Public sector bodies may be the largest providers of open data, but by definition it could be published by anyone and organisations may benefit from publish open data as well. Tammiesto and Lindman (2012) defines five aims for organisations to publish data externally: increase transparency, express organisational identity, benefit from combination of many datasets, enable external contribution to service development and provision and boosting the economy. While the last may be more of an ideological motivation and thus more common in the public sector, it is easy to find examples of the other four. One example is when publicly listed companies publish annual and quarterly reports. While obliged to publish such reports by law, it also lies in the interest of these companies to disclose important information with shareholders to maintain status (Cooke, 1989). Another reason is that opening internal data to the public may reduce costs of internal processes (Zeleti, Ojo, and Curry, 2014). That is, instead of developing every single feature in-house, companies may open their services, with API:s, for other service providers to extract data and build services on top of it.

2.1.4 How to open data

Just like physical products, data can be considered to be produced in a supply chain, meaning that data is collected and enriched through several stages, involving different people (Davis, 2012). This has implications that the process of collecting and compiling data is complex and very time consuming (Davis, 2012). Also, as the process will differ with each case, it is difficult to model the exact process and therefore it is left out of the scope for this thesis. When data has been collected, it is stored digitally in some kind of database, in some kind of format and is called raw data (Open Knowledge Foundation, 2019a). According to Open Knowledge Foundation (2019a) there are four main steps to be taken for opening this raw data to the public: chose what data to publish, apply an open licence, make the data available and make the data discoverable.
Choosing what data to publish may sound easy, but is a non-trivial task. Because a dataset (a collection of data), can contain personal/sensitive information, be of low quality (missing samples, restricted format) and be more or less demanded by the community (Lee, 2014), an open data publisher must think carefully to not publish data that should remain restricted, or that nobody will use.

Applying an open licence entails determining what intellectual property exists in the data and attach the dataset with an appropriate open licence if the data conforms with it - which makes the data open in a legal sense. A licence is a legal instrument a copyright holder can use to instruct others what is permitted to do with the data (Open Knowledge Foundation, 2019a). One example of an open license is the "Creative Commons CC Zero License" (CC0) (Open Knowledge Foundation, 2019a). Through this licence, a publisher waives all its rights to the work worldwide - effectively permitting copying, modification, distribution and use of the data for commercial purposes, without the need to ask the publisher for permission (Creative Commons, 2019).

Make data available is the process of actually publishing the data for the public to use (Open Knowledge Foundation, 2019a), which makes the data open in a technical sense and fulfills the second part of openness definition (Open Knowledge Foundation, 2019b). Publishing, in this context, means making a dataset available for download, in bulk or by sample, on the internet and could be done in various ways. For example publishers must decide whether they should host and expose the data themselves, e.g on their website, or outsource the storage to a third party. Furthermore, one must consider in what format to distribute the data in, e.g in bulk as a csv-file (Comma-separated values), or more granularly via a custom Application Programming Interface (API). Each method and format has its’ pros and cons. This is also a non-trivial task. As described in section 2.1.2 a publisher should aim to publish the data in the most machine-readable format as possible. However, when a public sector body possess raw data, it is often stored in some kind of custom built system with its own data model and extracting the data in a high-qualitative format is a difficult task (Statskontoret, 2018).

Make data discoverable relates to the fact that open data holds no value if nobody is using it and the publisher must therefore make sure that the newly opened data is easily found (Open Knowledge Foundation, 2019a). The open data portal mentioned in the Open Data Ecosystem-model, see figure 3, serves the purpose of making data easily discoverable and the publisher should seek to making its data available at such a portal.
2.2 The open data ecosystem

For open data practitioners it’s obvious that just publishing open data won’t realize the value potential in the information (Lee, 2014). There are many types of actors in the domain of open data: politicians, government officials, citizens, companies, etc. each with their own interests. Davies (2011) introduces the idea of an open data ecosystem to understand these actors and help identify and evaluate strategies that organizations can adopt to realize the potential of open data. While several researches have tried to model this ecosystem (Lindman, Kinnari, and Rossi, 2016; Immonen, Palviainen, and Ovaska, 2014; Davies, 2011), as the research field of open data is a relatively new one, there’s no consensus on how the ecosystem should look like exactly. Furthermore, due differences in national regulation and environment, the ecosystem will look a bit different depending on the country one is operating in.

This section is concerned with finding a model for the Swedish open data ecosystem. The discussion begins with a proposed model by Lindman, Kinnari, and Rossi (2016). This model was chosen due to being intuitive and the authors being Finnish it is assumed that conditions are similar to the Swedish environment. However, their model is then extended to fit the purpose of the thesis, as the original model is too simple.

Attempt to model the Swedish ecosystem

Lindman, Kinnari, and Rossi (2016) proposes a model, ”Open Data Value Network”, mapping actors to a business role in the ecosystem and dividing actors into one of five business roles: open data publisher, data extractor and transformer, data analyzer, user experience provider and support service provider. Not stated as business role, but included in the model is also the end user. According to the model these are organized in a sequential fashion, see figure 2, indicating that open data flows from publishers to end users.
Open data publisher
An open data publisher is (most often) a public organization, such as municipal, regional, state, or national governments, which collects data through different processes and makes this data available for use by others. One example of an open data publisher is the Swedish Tax Agency, which publishes several data sets, e.g., most recent data on per diem (Öppna Data och PSI, 2019), served as APIs.

Data extractor and transformer
This is an actor that takes the raw data provided by the publisher and performs enhancing transformations on it. Depending on the state of the raw data, these transformations could include but are not limited to: converting it to a suitable format for analysis, normalizing it to allow cross-analysis over several data sets and cleaning it from errors. As with any data processing, this step is time-consuming and could account for 50% of the total workload (from raw-data to finished product) (Lindman, Kinnari, and Rossi, 2016).

Data analyzer
These are actors which gather data and perform some kind of analysis on it, such as statistical analysis or visualizations. The analysis is then to be used either directly by the end user, or by an user experience provider.
User experience provider
This actor gather, combine and present data for end users in a user friendly interface - often through a mobile- or web app. One example of this is Res i STHLM, a mobile app that aggregates route data on public transportation in the Stockholm region and provides the commuter with simple way to plan its journey.

Support service provider
The support service provider is an actor that help the other four actors in the model with open data-related tasks. For example: consulting on open data release procedures, user experience enhancement, website hosting, or data storage.

While being an intuitive model for the business roles in the open data sphere, the proposed model by Lindman, Kinnari, and Rossi (2016) is not ideal and can hardly be considered an ecosystem (where entities are co-dependant and interact with each other). As argued by Pollock (2011) such a model, while being an accurate description of the present state of open data sphere, describes data processing as a ”one way street”. This kind of description fails to incorporate feedback loops back to data publishers and sharing between intermediaries (Pollock, 2011). Another problem with the proposed model is that it’s missing, or at least fails to distinguish, important actors. One example in the Swedish and most other cases in EU member states, is the presence of a national open data portal, an actor which harvests data sets from all individual data publishers, makes them searchable and presents them in a standardized way (Öppna Data och PSI, 2019). Such data portals neither performs any transformations on the data, nor serves as storage facility for them, thus can’t be represented as a data extractor and transformer, or support service provider. It also fails to explain the role of the end user. Seemingly an obvious actor, the role of the end user differs depending on the situation: is the ”end user” just the user of the service provided by user experience provider, or is it also the paying customer of the service?

An extended model
To account for the discrepancies between the model by Lindman, Kinnari, and Rossi (2016) and the Swedish open data ecosystem, I propose an extended model as seen in figure 3. Modeling complex socio-technical systems is not easy and I do not claim the model to be a complete representation of reality. With that being said, the extended model - from now on called the ”open data ecosystem model” or ODE-model - deals with some important issues brought up in the previous paragraph. A detailed description of the new model will follow, but first I want to address three important improvements with the ODE-model, compared to the open data value network. First, the ODE-model incorporates the suggested feedback-loops in the form of a cyclical flow of information: from open data publishers, to open data service providers, to users and back to the publishers. Second, the proposed model adds some important actors to the ecosystem, such as the open data portal which aggregates and harvests open data from several publishers. Third, the ODE-model clusters actors in
four different stakeholder categories: Society and nation, public actors, business actors and open data application (ODA).

![Figure 3: The ODE-model, an extended version of the open data value network](image)

**Business actors and the ODA**
This stakeholder category is familiar as it comprises the actors of the open data value network, with end users being excluded. Three of the actors within this category have been merged together into a new category called ODA - Open Data Application. Defined by C.-C. Yu (2016), an ODA is an entity that: "processes and reuse open government data, with or without the combination of private sector data, to generate and distribute meaningful information for users in specific application domains". In Lindman, Kinnari, and Rossi (2016)'s model these are three separate stakeholders to emphasize that in a mature open data ecosystem they serve as three different business opportunities. However, as most cases of open data companies in Sweden will take on all the responsibilities of data extraction and transformation, analysis and user experience, the merge of the three stakeholders to a single one is meaningful to the model and the thesis. Therefore, from here on the term open data application is used synonymous with what some would call an open data service/company/project/etc.

**Public actors**
As a counter part to the business actor category, we have the public actor stakeholder category, consisting of: policy makers, public sector bodies, open data publishers and the open data portal. Starting with the open data portal this is a web portal, harvesting and aggregating data from the open data publishers. While not publishing or storing any data
itself, the data portal is an important stakeholder in the sense that it (ideally) serves as a one-stop-shop for any business actor looking for interesting data to build services on top of. The actor "Public Sector Bodies" (PSB) has been added to the model. PSB was separated from the open data publisher actor for two reason. First, to address the fact that sometimes the customer of the open data application is not the end user, but the PSB is. The second reason for the separation is that the data from one open data publisher could be aggregated from several public sector bodies. One example of this is Trafiklab.se which publishes data from several public sector bodies such as: Trafikverket, SL, Skånetrafiken, etc. (Forum för transportinnovation, 2017). Policy makers are national, regional and local politicians. While not participating in the direct work with open data, they govern and fund the public sector bodies, which have consequences that will be discussed later on in section 6.

Society and nation
Finally, we have the stakeholder category society and nation. Here we find the neglected role of end user. The end user in this model is the user of the ODA. It could also be the customer, but in some cases the customer will rather be a public sector body or other interest organization that finds value in the service. To indicate that all stakeholders in the ecosystem are in fact part of a bigger category, I have also encapsulated the other stakeholder categories within society and nation. As described earlier, open data’s raison d’être is promoting transparency and creating value, by re-using already collected data. Thus it is necessary to factor in the opinion of the society when modeling interests in the open data ecosystem.
3 Literature Review

This chapter introduces theoretical concepts which, together with the findings from the last chapter, lays the foundation for analysis later on in chapter 6. The chapter begins with a discussion about innovation and value in section 3.1, then moves on to section 3.2 describing common reasons for why business fail. In section 3.3 the concept of a business model is elaborated and in section 3.4 the problems of non-private goods are discussed. Finally section 3.5 presents the framework to be used analysis, which will aid finding answers to the research questions under study.

3.1 The creation of value through innovation

The previous chapter discussed that open data has the potential to create value. It was emphasized that simply publishing data in itself is not valuable, but some kind of service has to be created for people to use in order for the data to become valuable. This, however, raises several questions. First, what exactly is value? Second, how is it created? This section introduces the concept of an "innovation" and how researchers have developed theory around how value is created through it.

Introduction to innovation theory

Innovation is the creation of a new combination (Blomkvist, Johansson, and Laestadius, 2016). Dating back to the 1930’s, this definition by Schumpeter refers to the introduction of a new product, a new method of production, a new market, etc. (Hagedoorn, 1996). Challenging the popular economic models in the early 20th century of steady state equilibrium, Schumpeter’s theory is applied to explain economic growth after a change in a company’s routine (Hagedoorn, 1996). Before moving on further in this discussion, there is one core concept that needs to be clarified - namely "value". Economic growth is defined as the process by which a nation’s (and it is easy to see how the definition extends to a company) wealth increases (Encyclopedia Britannica, 2019a). According to Meriam-Webster (2019b) Wealth is defined as all property that has money value or exchange value (a concept that will be discussed later on). Thus: Economic growth is really a process by which some entity’s possession increase in "money value", or "exchange value" - and the core component here is something called "value". As Schumpeter argues that the premise of economic growth, i.e the increase in some kind of value, is the motivation for innovation (Hagedoorn, 1996), the concept of value is central to this thesis. However, lacking a common definition among researchers, philosophers and in general, it first need to be defined what value means in the context of this thesis.
The concept of value
Bowman and Ambrosini (2000) begin their discussion about the concept of value in resource-based theory, where value stems from a resource’s ability to meet customers' needs. This poses the question on how consumers make judgements about to what extent a resource meet their needs, so the authors go on to discuss assessed value. They derive the concept of assessed value from utility theory in economics (which in turn stems from utilitarianism in philosophy), where early neoclassical economists argued for the rational human - who spent its income to maximize its satisfaction (a notion that later relaxed by Bach et al. (1987) to be stated as: "people spend their money on what they expect to give them most satisfaction"). Finally, from classic economists, Bowman and Ambrosini (2000) divides the concept of value into two categories: use value and exchange value.

From the definition by Bowman and Ambrosini (2000), use value refers to subjective value of something for an individual, e.g the styling of a car or the taste of an apple. The exchange value refers to the monetary amount that is agreed upon exchange of something between two individuals at a single point of time. This implies that the value of something is subjective, can fluctuate over time and needs to be agreed upon, when an exchange of that something occurs.

Lepak, Smith, and Taylor (2007) broaden these two concepts of value to include multiple levels of analysis: individual, organisational and societal. From this, they also suggest a definition of value creation: "Value creation depends on the relative amount of value that is subjectively realized by a target user (or buyer) who is the focus of value creation - whether individual, organization, or society - and that this subjective value realization must at least translate into the user’s willingness to exchange a monetary amount for the value received”.

To summarize and break down these topics: The value of something is subjective to the user and needs to be agreed upon when exchanged. By definition, the exchange causes value to be created and occurs when two parties agrees on the exchange value of X and the buying party’s use value of X is higher, or equal to, the negotiated exchange value. However, this definition is limited to existing things and does not account for the value created when completely new things are created as Schumpeter discussed. Moving on, we keep this in mind when broadening the concept to how value is created through new combinations.

Continuing on innovation theory
From the previous discussion it is understood that Schumpeter meant that economic growth, i.e increase in value, is the rational for innovation. Early works of Schumpeter points out that innovation, i.e new combinations resulting in new products and processes, is created by an entrepreneur (Blomkvist, Johansson, and Laestadius, 2016). The en-
trepreneur is the "personification of innovation" (Hagedoorn, 1996), a person who is not necessarily an inventor, capitalist or belong to a specific social class, but simply the person carries out the new combinations. An entrepreneur might become a capitalist, but she or he stop being an entrepreneur the moment they fail to continue innovating and returns to only capitalist routines. Later works of Schumpeter changed focus from the individual entrepreneur, to large corporations and their ability to preserve its capacity for creativity and innovation (Blomkvist, Johansson, and Laestadius, 2016). There, innovation can be reduced to a routine and is carried out by trained specialists, who analyzes requirements and create solutions that work in predictable ways (Hagedoorn, 1996). So, innovations can be created by individuals or by firms, but until innovation has only been discussed in general terms.

Subsequent researchers have continued the works of Schumpeter, distinguished different types of innovation, their importance and how it diffuse in society. Abernathy and Utterback (1978) argues that a new innovation does not always need to be big changes in a company’s product, or processes and distinguishes between incremental and radical innovations. Incremental innovations are smaller improvements to an existing innovation, for example improving the quality of a processor in a computer so the overall performance increases. Radical innovations, on the other hand, take a major leap from an existing solution changing the meta in a "radical" way. A suitable example of this is the innovation of the silicon transistor, which dramatically impacted the semi-conductor and computing industry Abernathy and Utterback (1978). Continuing their works Henderson and Clark (1990) deems the categorization of innovation as either incremental or radical as incomplete, since a seemingly minor innovation in the composition of a product may have significant competitive implications. To amend this gap, they further distinguish innovations as either a component-, or architectural innovation. A product often comprise several smaller parts, e.g. a desktop computer is a complex system where some key components are memory, processor, motherboard, etc. A component innovation would be to upgrade any one of the units in the system. Rearranging the components into a smartphone would be an architectural innovation. Obviously you could not use the exact same components in the desktop computer as the smartphone; the essence of the innovation is the architectural rearrangement, but it does not mean that all components are left untouched (Henderson and Clark, 1990).

So, value can be created through innovation, which can be done either by a single entrepreneur or an organization with creative processes. Innovation can be classified and categorized in a number of ways, where incremental vs radical, component vs architectural have been explained here. Continuing on, this chapter will continue discuss the topic of

\[1\] If one was interested in the impact of open data in general one could continue discuss the works of Clayton Christensen, sustaining vs disruptive innovation and so on. However, since this is not the focus of the thesis, it is left out.
business failure, which will elaborate on the fact that simply creating innovations is not enough to achieve long term value creation - as it can only continue as long as the innovator is in business.

3.2 When value creation ceases - why business fail

As mentioned in section 1.2, researchers have found that there has been several initiatives to create services based on open data, but many discontinue early on (Temiz and Brown, 2017; Kuk and Davies, 2011). There is a need for further research on why that is and how it can be avoided. As this thesis aims to look at why this process of value creation cease and how it can be avoided, it is necessary to understand what research has been done on the topic in similar areas. One should note that the projects studied in this thesis are not full-fledged businesses and the word ”fail” in this context essentially means to cease operations, whether its voluntary or not. What we seek to find out is why they do not develop into sustainable businesses.

3.2.1 Why firms fail

In the 70’s scholars began to interest themselves in business failure, as the decade had displayed an increased amount of large firms, with assets more than $25 million, failing (Altman, 1983). Studying business failure is arguably more difficult than studying business success, as there is a problem with sampling individuals willing to speak about their experience and the reasons for failure is not always straightforward, reasoned Bruno, Leidecker, and Harder (1987). From a set of 250 American high-tech companies founded in the 60’s they performed a multiple case study on 10 that had failed and identified three factors for business failure:

- Product-market fit
- Financial
- Managerial/Key employee problems

Financial problems causing failure could be initial under-capitalization, the lack of a well though out business plan, or problems with developing & sustaining a relationship with venture capital. Managerial/key employee problems entitles the importance of building an effective team, while avoiding human failings - that is problems with a company consisting of humans that causes human errors. Finally, failure in product-market fit is emphasized,
as Bruno, Leidecker, and Harder (1987) notes this being the most important reason for failure. This includes problems with timing, product design, distribution/sales, definition of business, or relying to much on one customer.

### 3.2.2 Why startups fail

However, both the works of Bruno et al. and Altman focus mostly on larger companies when discussing business failure. The businesses studied in this thesis are sometimes not more than a business idea and a prototype, thus they reassemble more a startup in its earliest phases. A startup is here defined as a temporary organization, with little to no operating experience and oftentimes focusing on dynamic technology and markets (Sutton, 2000). As opposed to large multi million dollar enterprises, failure is much more common among startups. Research and business articles (Giardino, Wang, and Abrahamsson, 2014; Marmer et al., 2012; Feinleib, 2011) will frequently cite statistics on this topic, stating that this or that many percent of startups fail within X years. While the exact number is not interesting, a moderate claim can be made that a majority of startups fail within the first two-three years of development. While this may sound disheartening some who are familiar with area claim that failure should be embraced as an opportunity to learn from ones mistakes and rethink their approach (Blank, 2011). Nonetheless it is interesting to know what the reasons for failure are and how they could be avoided, so that one may eventually succeed.

Reviewing literature on startup failure and management of startup failure, one discovers that researchers and practitioners seem to agree on a couple of themes particularly important: the product\(^2\), the entrepreneur(s) and the process (Giardino, Wang, and Abrahamsson, 2014; Feinleib, 2011; Marmer et al., 2012; Nair and Blomquist, 2019).

**Failure theme: product**

Just like Bruno, Leidecker, and Harder (1987) argues, factors coupled with the product are emphasized in startup failure. According to Nair and Blomquist (2019) failure to identify \textit{how and for whom} the firm creates value for is a key factor associated with venture failure. A formalization of this statement would be that in order for a startup to succeed, it must discover and validate the right market for an idea. Giardino, Wang, and Abrahamsson (2014) argues that it does so through a two stage discovery process. First the firm must find the right problem/solution fit, that is testing the most critical hypothesis of a problem by implementing a first solution. The second step is to find the right product/market fit, which implies identifying and building features that solves real customer needs. If

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\(^2\)The term “product” here refers to both products and services, often used interchangeably when discussing software or tech-related startups.
the product/market fit is not achieved the entrepreneur must go back and find a new problem/solution fit, which is the act of pivoting. Sometimes finding a product/market fit is not enough to avoid failure; one example of this is when a viable product/market fit have been found, just to discover that the actual market is very small (Feinleib, 2011). Another construct for understanding how a business address the problem/solution fit, via some product, is the business model (Nair and Blomquist, 2019). This concept is further discussed in section 3.3, but for the reader to note is that a startups failure in pursuing the right product/solution, or product/market fit can be expressed as failure in proper business model development.

Failure theme: process

Though a startup is pursuing the right product, it may fail due to the process different activities are prioritized. For example, in a study of 3200 internet startups, 70% failed due to premature scaling of the business (Marmer et al., 2012). Premature scaling entails that a startup early on focus on activities, such as marketing and sales, when it is in a phase in the life cycle where it should pursue product oriented activities. The startup life cycle can be split up in different phases, describing main activities the venture should mostly be occupied with at a given point in time. The exact amount of phases and their names depend on the author. One take on it is Marmer et al. (2012)’s six phase model: Discovery, Validation, Efficiency, Scale, Sustain and Conservation. The phases are rather self-explanatory, the earlier stages focus on finding the right problem/solution & product/market fit, while the later stage startups search for a scalable business model that may transform the startup into a large company. Ultimately, to know whether a new venture is taking a step into a new phase one must look at the data: is the venture able to acquire new users in a repeatable and efficient way? (Feinleib, 2011). Failing to do so will eventually lead to resources being spent in a sub-optimal way.

Since the projects studied in this thesis can be described as startups in a very early phase, premature scaling is not really a plausible problem area and thus process-problems will not be described in more detail.

Failure theme: entrepreneur(s)

Problems related to the entrepreneur, or the core team executing the new venture, are often repeated in literature (Giardino, Wang, and Abrahamsson, 2014; Feinleib, 2011; Marmer et al., 2012; Nair and Blomquist, 2019). One of the most obvious reasons for startup failure is that the entrepreneur, or team, is lacking passion for the project. Giardino, Wang, and Abrahamsson (2014) argues that ”people who lack passion often use the first barrier they encounter as an excuse for failure”. While this is statement is a bit harsh, it is easy to see how a roadblock in the way of the uninspired entrepreneur may put the project to an end. Another reason for failure is that the founder(s) is missing ”entrepreneurial characteristics” (Nair and Blomquist, 2019; Feinleib, 2011). It can be debated what characterise the optimal
entrepreneur, some argue it is a scientist, with acquired business skills (Blank, 2011) and some argue it should be a market visionary, with a background in sales and promoting (Feinleib, 2011). The truth may lie in-between, or maybe it does not exist such a thing as an optimal entrepreneur. However, in order to take an idea, transform it to a well defined product and then be able to sell it to customers and investors, it is obvious that within the startup some traits must exist from both a business and technical perspective. Which lead us to another reason that may contribute to failure: the absence of a balanced team (Giardino, Wang, and Abrahamsson, 2014). A single entrepreneur may have all the necessary characteristics to successfully build its startup and being alone is not a reason for failure in itself. However, this is not always the case and a team of a few dedicated entrepreneurs may compensate for each others’ flaws. Furthermore, Marmer et al. (2012) showed that solo founders take 3.6 times longer to reach scale stage, compared to a founding team of two and they are 2.3 times less likely to pivot. Time may be a critical factor in a competitive market and as have been discussed before, being able to pivot when needed is important to avoid failure.

3.3 A formalization of value creation - Business models

“Efficient business model design is particularly relevant for early-stage technology ventures as a well-developed business model creates a heuristic logic that connects technical potential of the early stage technology with the realisation of economic value” (Giardino, Wang, and Abrahamsson, 2014). The previous section 3.2 discussed reasons for business failure, in particular reasons that are relevant for startups, and it was mentioned that a reason for failure is proper business model development. This section dissects the concept of a business model and how it can be used to analyze a business from a holistic perspective.

Through a literature review of over thousands of articles on the subject of business models, written between 1975 and 2009, Zott, Amit, and Massa (2011) concluded that despite the topic being well studied, researchers lack a common definition of what a business model is. That being said, they identify a common trend amongst researchers that ”a business model emphasize a system-level, holistic approach to explaining how firms do business”. A rephrasing of this definition comes from Zeleti, Ojo, and Curry (2014), which argues that a business model describes how value is created and captured by an organization. Thus, a business model can be seen as a way to formalize of how organizations create value.

In the field of open data research, business model research is a relatively new branch, previously overlooked for investigating technical and legal barriers, platforms and data interoperability (C.-C. Yu, 2016). However, this has seen a recent shift coupled with the increasing interest for the economic value of open data assets (Zeleti, Ojo, and Curry, 2014).
Even then, focus have mostly been on busines model for publishing data (Zeleti, Ojo, and Curry, 2014; Zuiderwijk and Janssen, 2014; Biedenbach and Boström, 2018) and less on business models for the entrepreneurs & companies, looking to utilize published open data to build new services. One might ask why service creators who are looking to exploit the value potential of open government data need a special type of business model. In many ways these businesses are similar to any other type of e-business, or at least data driven business and thus could utilize the business models developed for these niche industries. The answer to this question is arguably the same as when Amit and Zott (2001) studied new business model for e-business: a business model need to address the issues related to the specific phenomena and capture its unique features.

3.3.1 The Open Data Application value-centric Business Model

Recently C.-C. Yu (2016) proposed the Open Data Application value-centric Business Model (ODA-vBM) framework. It is a framework for developing a business model, which puts the value creation aspect of open data applications in focus and can be used by practitioners and organizations looking to build services around open data. The foundation of the framework is a model for how the services & systems of the open data application ties four stakeholder groups together: Public Beneficiaries, Executive Organizations, Service Chain Participators and Society & Nation - see figure 4.
As illustrated, the model puts the open data application and the value it creates for these four stakeholder categories in center. In each stakeholder category a variety of components is modeled, most notably what value is created for the the stakeholder through objectives, as well as needed resources and derived costs for utilizing the ODA. By modeling an open data application with the ODA-vBM one will discover if there exist strategic gaps (C.-C. Yu, 2016), e.g the executive organizations cannot cover their costs with the resources at hand, which need to be addressed in order to achieve sustainable development. Next, the four stakeholder categories will be described in short and then components of the framework.

**Stakeholder categories**

**Executive Organizations** - The executive organization takes charge of running the open data application and can be either a private company or a government organization, such as a public sector body. Should a private company take charge in running the ODA, the governmental organization is placed in the service chain participant category and vice versa. Typical roles in this category are: founder, developer, business developer, etc.

**Public Beneficiaries** - This stakeholder category comprise the users of the ODA. They could be individuals, companies, governmental organizations, NGOs or other organizations, which are using the services and functionalities of the ODA.
Service Chain Participants - A business often cooperates with several other entities, in order to create value for its main target group. In the case of ODAs one service chain participant that is always present is the open data publisher, which the ODA executive organization is dependent on in order to continue its business. Other potential service chain participants include: cloud service providers, partnering organizations, other ODAs, etc.

Society and Nation - Similar to the Open Data Ecosystem model, described in section 2.2, the abstract stakeholder group "society" is included in the ODA-vBM framework. This category is represented by actors such as societal communities, special interest groups, or "the society and nation as a whole of the society and nation group that may influence and be impacted by the launch of open data applications" (C.-C. Yu, 2016).

Framework components

Systems and Services - ODA systems are the software and hardware that provides services for some stakeholder and together these can be said to be the entity that "is" the open data application. Depending on the application the system can be represented by anything; for an example it could be a mobile application that provides real time information about public transportation in a city.

Values and Objectives - C.-C. Yu (2016) uses these terms quite interchangeably. He refers to value as the function and acceptance features of the ODA systems and services. Fortunately, this thesis have already defined the abstract concept of value in section 3.1. So one can more precisely state that value provided by the ODA is either in the form of use value, the subjective satisfaction provided by its services, or exchange value - which is some value (e.g money) the individual receives for exchanging something. Objectives on the other hand are transformed value elements associated with systems, services and stakeholder groups. More specifically it is some kind of measurable performance to be achieved by the ODA, for example in the case of a public transportation app one objective could be to provide real time information about transport options.

Resources and Costs - Resources are assets at disposal for the stakeholder which are needed in order to develop or interact with the ODA. Resources include, but are not limited to: budgets, open data, technology infrastructure, equipment and human resources. Costs are the necessary expenditures for developing or interacting with the ODA. Examples of costs inflicted on the executive organization are developer salaries, costs for cloud resources, and marketing. Examples of costs for users in the public beneficiaries category could be charges for using the ODA and other indirect costs, such as fees for an internet connection. In figure 4 there are arrows between resources and costs, illustrating that costs must be covered by resources, or there will be an obvious problem with the business model.
**Functions/Processes/Activities** - These three components essentially describes the same thing: the necessary work to be undertaken for the ODA to fulfill its objectives. It is a bit confusing who the work is meant to undertaken by, since C.-C. Yu (2016) sometimes suggests that the functions/processes/activities always are to be undertaken by the executive organization (What work must be done on the ODA in order for it to fulfill its objectives) and sometimes by the given stakeholder category (What work must be done by the stakeholder in order to utilize the ODA). For clarity, the latter interpretation is used.

**Strategies/Action Plans** - This component represents the formalization of how to efficiently develop and maintain the ODA in the long-term. It includes the ODA scope, strategic objectives, budgets, key performance indicators and so on.

**Critique**

As explained in this section, the ODA-vBM framework by C.-C. Yu (2016) surely address issues specific to the phenomena of open data value creation, as advocated by Amit and Zott (2001). For example, the framework highlight the presence of different categories of stakeholders - from public sector bodies as data publishers, to citizens as users. On the other hand it also shares many aspects with other general business model frameworks. For example when comparing ODA-vBM to the business model canvas, by Osterwalder and Pigneur (2010), one notice they both emphasize similar elements, such as: value created for whom, the importance of partners, etc. ODA-vBM is comparably new and have not received that much attention yet, thus its usefulness is still under consideration. With this in mind, an adapted version of the framework will be used, further discussed in section 3.5.

**3.4 When the market fails to create value - Non-private goods**

Sometimes, value creation may fail not because innovation failing, or failure in business, but because the market is not able supply, or demand the innovation in an efficient way; such failure is defined as market failure (Encyclopedia Britannica, 2019b). Remember the discussion in section 3.1, where it was explained how the exchange value of something cannot exceed the use value of that particular something. However, if the individual can acquire that something free of charge, what motivates the individual to pay an exchange value greater than zero? This is one type of market failure where the market is unable provide non-private goods efficiently.

A public good can be defined as: "a good that benefits many people, whether or not they have paid for it, and whose benefits to any one individual do not depend on how many other also benefit" (Krugman and Wells, 2013). In economic theory public goods
are one type of goods which are different to ordinary private goods, in such ways that the market cannot efficiently supply them. Two criteria determine whether a good is non-private: whether consumption of the good is excludable and whether a good is rival in consumption (Krugman and Wells, 2013). Together these result in four different categories of goods: private, artificially scarce, common and public - see figure 5 for an illustration. According to Krugman and Wells (2013) the problem with goods that are of any other type of category than private is that "the market" cannot supply them efficiently. This is because of two reasons: goods that are non-excludable suffer from the free-rider problem, leading to inefficiently low production and goods that are non-rival in consumption suffer from inefficiently low consumption.

Figure 5: Classification of goods. Adapted from Krugman and Wells (2013)

The free-rider problem is when the consumption of a good cannot be restricted, individuals with a self-interest will not be willing to pay for it and they will take a "free ride" on anyone who does pay. The complication with this is obvious: if no consumer is willing to pay for the good, there will be no producer with a self-interest willing to produce it - leading to inefficiently low production. On the other hand, if a good is excludable - but non-rival in consumption - producers will be able to make a profit by making the good available only to those who pay for it and thus be interested in producing the good. However in these situations, where the consumption of the good by one individual does not prohibit another individual to consume it simultaneously, the marginal cost of consumption is zero (or at least close to zero). Consequently, the good motivates an efficient price to the consumer that is also zero. Should the producer charge consumers a price larger than zero, the consumer would pay a higher price than the marginal cost of consumption - leading to inefficiently low consumption.

**How to provide non-private goods**
If the market is unable to efficiently provide any non-private goods, these must be provided
by some other method. Society still enjoys goods such as clean water, sewage systems and public parks; in all these cases its thanks to the government, but there are also non-governmental ways to provide them (Krugman and Wells, 2013). One way is through donations, for example when scientific research is funded by private donations. Another way is through advertisement, which enables self-interested individuals and firms to indirectly make money of a public good, such as an open website. A third way is to deliberately make a public good excludable, e.g. licensing computer software. However, as previously explained this causes consumers to consume an inefficiently low quantity of the good, maybe not at all. Finally, for the most important public goods it is up to the government to provide them, since self-interest prevents individuals and companies from doing the same (Krugman and Wells, 2013).

To the public sector this is a decision of how valuable the public good is to society. In some cases it is a binary decision: provide clean water to a city, or not. In most cases though it is variable: how often should a municipality clean the streets? The way to decide how much of a public good should be provided (but a similar argument can be made for the binary case) is measured through the marginal social benefit, which equals the sum of all individual marginal benefits that are enjoyed by all consumers of that unit (Krugman and Wells, 2013). This is, again, because a public good is nonrival in consumption: individual X’s benefit of the public good does not diminish the benefit of individual Y’s consumption of the same good. This also implies that the social marginal benefit of a public good is always greater than the individual marginal benefit to any one individual - which is why no individual with a self-interest is willing to pay for the good (Krugman and Wells, 2013).

3.5 Research framework

This thesis aims to investigate problems related to the value creation process by using open data, especially why it ceases. To meaningfully answer the research questions knowledge about open data, value creation and why business fail in general, is required. Through chapters 2 and 3 the reader has been given a broad background in these fields. This section will now synthesize the acquired knowledge into a framework that will be applied later on in the analysis - see figure 6 for an illustration.
As illustrated in figure 6 the framework draws from the two major fields of open data and value creation. From the field of open data, knowledge about the ecosystem - its actors and their roles - is used to reason what is deemed valuable by whom and where potential conflict of interests may exist. The analysis also benefits from the formalization of the entity, that eventually creates value for an end-user, namely the open data application. From this body of knowledge the thesis can elaborate more precisely what differentiates businesses, whose core is servitization of open data, from other data driven businesses and where they are alike.

On the other side of the framework one finds the value creation aspect. Theory of why business fail and market failure is applied straight forward, as described in this chapter. Business model design is an important topic for new venture creation (Giardino, Wang, and Abrahamsson, 2014) and especially the ODA-vBM can guide new open data application projects in the process of value identification and creation of a value proposition (C.-C. Yu, 2016). However, the framework is extensive and in the process of identifying reasons for ODA failure modeling how a cloud service provider formulates its strategy, to target ODA creators, will be redundant and potentially overwhelming information in the analysis. By drawing upon previous research, on startup failure and value creation, one may exclude redundant parts of the ODA-vBM framework and focus on what is really important. As discussed in section 3.2 not being able to identify how and for whom a venture creates value is a key factor coupled with venture failure (Nair and Blomquist, 2019). Therefore it is absolute necessary to include the values and objectives components for each stakeholder category. Furthermore, section 3.1 discussed the concepts of use- & exchange value, where the exchange value is mutually decided, but must not exceed the perceived use value. This tells us that a stakeholder will not only act on perceived benefits of the ODA, but
also perceived costs. Thus components *Resources and Costs* are included as well. Finally components *Systems and Services* are described in the studied cases, but not emphasized in the analysis, since most cases never left prototype stage and describing hypothetical systems in-depth is not helpful for analysis. Considering these reductions the resulting concentrated framework has been used to guide interview questions and analyze the cases studied in this thesis - see figure 7 for an illustration.

![Diagram](image)

Figure 7: The adapted ODA-vBM framework used in this thesis
4 Method

This chapter describes the choice of research design and methods used for investigating the identified research questions. The chapter starts with an explanation of the general design of the study, then moves on to described methods for data collection & analysis and finally strategies to ensure quality of research are discussed.

4.1 Research Design

This thesis places itself in the interpretivist part of the research paradigm spectrum, as the focus for the research is on exploration of social phenomena, rather than measuring it (Collis and Hussey, 2013). A qualitative approach was chosen, as the area of study is relatively novel, requires contextual understanding and there exists a need for exploration and development of theory (Creswell, 2014).

In section 1, it was introduced how this thesis aims to explore questions around why open data applications discontinue development prematurely and how the initiatives may develop into sustainable open data application companies:

- **RQ1**: What are common characteristics for open data applications?
- **RQ2**: Why do many open data application initiatives discontinue early in development?
- **RQ3**: How can the public sector and open hackathons support the creation and development of open data applications?

According to Yin (1994) the nature of such questions, i.e a contemporary phenomena in a real-life context and stated as a why or a how, suits well to be researched through a case study. This is further motivated by the findings of the literature review, which revealed that little research has been done in this area, thus motivating an investigation of the phenomena from an exploratory perspective (Yin, 1994). The thesis could be argued to be a mix of exploratory and explanatory. It is exploratory in the sense of investigating why so many promising initiatives fail/choose to discontinue the development of their projects. It is explanatory in the sense of explaining how these projects can be supported to continue their development. Thus, this study will be treated as a case study, following the definition by Yin (1994): A case study is an empirical inquiry that...

- investigates a contemporary phenomenon within its real-life context
especially when the boundaries between phenomenon and context are not clearly evident

copes with the technically distinctive situation in which there will be many more variables of interest than data points

and as a result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion

and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis

Again, the research questions revolves around open data applications and the role of public sector and public hackathons in the open data value creation process. In an attempt to answer these questions this study investigates open data applications that sprouts from the publicly funded, open data innovation contest *Hack for Sweden*. The study will be treated as a multiple case study (Yin, 1994), with the unit of analysis being the open data application initiatives and the context is their common origin from a hackathon, within the Swedish open data ecosystem - see figure 8 for an illustration. Terminology aside, the main point of interest is neither a specific open data application, nor the hackathon, but the potential *value open data creates for people and society*. The way this thesis investigates this subject is through the capitalist assumption that value is created by people, organized in enterprises, for other people. Thus, the units under investigation may be the specific open data applications, but what is interesting is their ability to create value.

Figure 8: Illustration of the framing of the cases within multiple levels of context

While the hackathon is not mandatory for the creation of an open data application initiative, a preposition discussed in this thesis is that open data applications generally have
a short life-span. Investigating application initiatives from a publicly funded hackathon makes an interesting case, since these applications early on are scrutinized by the public and therefore may have a higher probability of creating services that truly are valuable for society - and ultimately succeeds/develops in a sustainable way. The rational for choosing Hack for Sweden in particular is that it is a typical case, as defined by Seawright and Gerr-ring (2008), of an open innovation contest and thus will probably generalize to any similar contest in Sweden, or other country with comparable prerequisites. The selection of open data applications to include in the case study is discussed in the next section.

4.2 Case Study

The study was divided into two phases. The first consisted of a pre-study, which helped contextualize the field of study and in general is a good way to direct the case study (Collis and Hussey, 2013). The main study consisted of inquires with former winners of Hack for Sweden, representatives from the public sector, reviewing of documents and attending Hack for Sweden 2019.

Pre-study
The pre-study was conducted in order to get enlighten in the relatively complex sphere that is the Swedish public sector and how it works with open data. According to Bogner, Littig, and Menz (2009), when the research is in exploratory phase, talking to experts is a more efficient way of gathering data than for example, surveys or participatory observation. As advised by Eisenhardt and Graebner (2007) a key approach to mitigate limit bias in interviews is: "using numerous and highly knowledgeable informants who view the focal phenomena from diverse perspectives". Therefore, the pre-study comprised unstructured interviews with several stakeholders in the Swedish open data ecosystem. Also, to get a contemporary perspective from academia an interview was conducted with a researcher at KTH, Royal Institute of Technology, who was researching with the subject.

Main study
The main study was conducted with the purpose to gather and analyze data that could explain the answers to the research questions under investigation. In order to do this it was necessary to collect data about the opinions and understandings of Open Data Application creators (winners of Hack for Sweden), as well as the public sector counterparts interacting with them.

The process of finding cases to include in a study is similar to how the laboratory investigator selects the topic for a new experiment, rather than how she or he selects the respondents for a survey (Yin, 2009). Meaning, a case study is not trying to generalize in
a statistical sense, where random sampling would be necessary, but rather in an analytical sense - further discussed in section 4.5. The intent was to select from a set of projects that had won in Hack for Sweden 2016-2018, as including projects before this would not be a fair comparison, due to the changes in the event over the years. This set totaled 16 projects. To contrast the perspective of creators of discontinued ODAs it was necessary to gather the perspectives of creators that had continued with development after the hackathon, as including just either or would potentially introduce selection bias to the findings. This was done through a screening procedure of the cases, as advised by Yin (2009) and Collis and Hussey (2013), by querying people knowledgeable about the candidates and collect some limited data about each case.

Finding ODAs willing to participate in the study would prove to be difficult, which is not unusual when studying business "failure" (Bruno, Leidecker, and Harder, 1987), at first - but then resulted in a satisfactory amount of cases. From the set of 16 ODAs, 5 responded that they were willing to participate in the study: two projects from 2016, one from 2017 and two from 2018. In this set of 5 projects, two had quit development shortly after the hackathon, two had continued developing the project after the hackathon, but had then discontinued and one was currently active.

Data collection about the cases comprised collecting secondary source information, such as documents & open code repositories, and primary data through in depth interviews with one or several creators of the ODA. The interviews in the pre-study had also provided some information about the sampled projects. To complement the perspective of ODA creators, the case specific data was complemented with data about the views of public sector bodies, representatives from Hack for Sweden and government officials. This was mainly done through unstructured and semi-structured interviews, attending Hack for Sweden 2019 and studying more secondary source data.

### 4.3 Data Collection

Evidence in a case study can come from many sources and a major strength of the method is to use more than one of them in the data collection process (Yin, 1994). Yin presents six sources of evidence: documentation, archival records, interviews, direct observations, participant observation and physical artefacts. Each of these has its strengths and weaknesses which may overlap, so using all of them is not necessarily the optimal. In this study the first four of the data collection methods were used in order to draw interesting findings from the studied cases and gain contextual knowledge around them. The collected data was stored digitally in a case study database, in this way it was easy to organize and retrieve

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3 see section 3.2 for a definition of failure in this context)
the data during the research period.

### 4.3.1 Documents and archival data

As case studies typically combine data collection methods (Eisenhardt, 1989) secondary data from digital archives and internal databases was collected. This method was used rigorously during the thesis to gain contextual understanding about the case, factual data about the units of observation and so on. Due to that fact that the subject under investigation is required by Swedish law (Offentlighetsprincipen) to disclose non-classified data on request, anyone could attain the documents used in the thesis. However, as this research was done in collaboration with DIGG and Hack for Sweden, access was granted to an internal database not necessarily accessible by the public.

In the pre-study, documents about Hack for Sweden and participants during the years were collected, to build contextual understanding for the case and serving as a basis for sampling projects that would be investigated further in the main study. During the main study, documents where gathered that provided the necessary background information to conduct effective interviews with the open data application projects. In additional to internal documentation, documents where gathered from other sources, such as project’s source code from GitHub (a web-service for managing a project’s source code, with help of the version control system Git), articles in local newspapers, and so on; essentially any piece of information that provided background information about the open data application projects.

### 4.3.2 Interviews

Remember the three research questions and how they largely revolve about actors perception of a subject, such as why a creator of an open data application chose to discontinue its project. To investigate such questions interviews is a suitable method, as it is concerned with collecting data about what a selected participant do, think, or feel about a subject (Collis and Hussey, 2013). Furthermore, according to Yin (2009) interviews are one of the most important sources of information in a case study. Interviews were held in both parts of the case study. In the pre-study it had the exploratory purpose to gain contextual understanding about the Swedish open data ecosystem, from knowledgeable actors within it. In the main study it had the explanatory purpose to explain the perceptions of open data application creators. A decision was made to pseudo-anonymize the name of interviewees. This was done not because the opinions and views of a particular interviewee in
the study are secret, rather because the identity of the individual is not relevant, but the role and position the interviewee holds (Swedish Research Council, 2017). However, this choice does have drawbacks for the reproducibility of the study (Swedish Research Council, 2017), further discussed in section 4.5. Interviews were recorded with a recording software in a cellphone or computer, when given consent from the interviewee. The recordings were used to reminisce important answers and ensure that data was reproduced correctly.

Pre-study interviews
The objective of the pre-study was to gain contextual understanding of the open data landscape in Swedish public sector, with the goal to focus the main study. Thus, in the beginning unstructured interviews with open ended questions, serving as discussion topics, was conducted - so that the interviewee could elaborate freely on interesting topics and guide the interview to points of importance (Collis and Hussey, 2013). Later on semi-structured interviews were utilized, where some open ended questions were prepared on beforehand to guide the beginning of interview and as the interview went by it transitioned more towards an open discussion. In the expert interview, with the academic professional, the interviewee was encouraged to speak freely as advised by (Bogner, Littig, and Menz, 2009). Again, the purpose of the pre-study was to gain understanding of the ecosystem, therefore interviewees was chosen based on their role and knowledge in it, in order to get the full picture. So called snowball sampling (Collis and Hussey, 2013) was used, where interviewees in the end of the session pointed to who could provide further information. This process was repeated until the author felt confident that enough information had been collected for the main study to be conducted in a well prepared manner. The targeted interview time was about 60 minutes. A summary of the pre-study interviews can be seen in table 1.
Table 1: Interviews during pre-study

<table>
<thead>
<tr>
<th>Id</th>
<th>Date</th>
<th>Type</th>
<th>Organization</th>
<th>Role</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>PS1</td>
<td>2018-12-17</td>
<td>Unstructured</td>
<td>DIGG</td>
<td>Analyst</td>
<td>Focus on DIGG’s role in digitalisation of Swedish public sector</td>
</tr>
<tr>
<td>PS2</td>
<td>2019-01-17</td>
<td>Unstructured</td>
<td>DIGG</td>
<td>Analyst / Open data strategist</td>
<td>Open data in general and DIGG’s role</td>
</tr>
<tr>
<td>PS3</td>
<td>2019-01-30</td>
<td>Expert interview</td>
<td>KTH</td>
<td>Ph.D. Researcher</td>
<td>Open data research and contemporary situation</td>
</tr>
<tr>
<td>PS4</td>
<td>2019-02-01</td>
<td>Semi-structured</td>
<td>DIGG</td>
<td>Strategist</td>
<td>Cooperation between DIGG and Hack for Sweden</td>
</tr>
</tbody>
</table>

Main-study interviews

In the main study, interviews were mostly concerned with documenting the views of the creators of open data application projects, but also complementing these with opinions of informants from the public sector. When interviewing ODA creators the format was semi-structured. These benefits from using some on beforehand prepared questions, which encourages the interviewee to talk about the main topics of interest and as the interview went by other questions were developed to keep the discussion flexible (Collis and Hussey, 2013). Interview templates with questions were developed in order to answer questions such as: who the project creators were, in what way their ODA created value and for whom and obstacles and reasons to continue/discontinue. See appendix A.1 for the full interview templates. Interview questions were modified depending on whether the project had continued, or not and whether the project was developed During hack for Sweden 2018, or earlier (for reasons discussed in the section 5). To ensure the maximum amount of information was collected from the interviews, the pre-prepared questions were enriched with probes (e.g what happened next?), hypothetical questions (e.g what would have cause you to continue?) and multiple questions at once (e.g what is X and why Y?) were avoided - as advised by Collis and Hussey (2013). When interviewing actors from public sector during Hack for Sweden 2019 (further discussed in the following section) the same interview techniques were utilized and questions were designed with collected data from the ODAs.
in mind. This gave the researcher the opportunity to complement different perspectives. A summary of the main-study interviews can be seen in table 2.

### Table 2: Interviews during main study

<table>
<thead>
<tr>
<th>Id</th>
<th>Date</th>
<th>Type</th>
<th>Organization</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS1</td>
<td>2018-03-04</td>
<td>Semi-structured</td>
<td>Cykelranking</td>
<td>ODA Creator</td>
</tr>
<tr>
<td>MS2</td>
<td>2019-03-11</td>
<td>Semi-structured</td>
<td>Biologg</td>
<td>ODA Creators</td>
</tr>
<tr>
<td>MS3</td>
<td>2019-03-13</td>
<td>Semi-structured</td>
<td>Warnbox</td>
<td>ODA Creator</td>
</tr>
<tr>
<td>MS4</td>
<td>2019-03-25&amp;26</td>
<td>Semi-structured</td>
<td>Projekt Skog</td>
<td>ODA Creator</td>
</tr>
<tr>
<td>MS5</td>
<td>2019-04-04</td>
<td>Unstructured</td>
<td>Upphandlingsmyndigheten</td>
<td>Head of communication</td>
</tr>
<tr>
<td>MS6</td>
<td>2019-04-05</td>
<td>Semi-structured</td>
<td>Regeringskansliet</td>
<td>Senior advisor for the government</td>
</tr>
<tr>
<td>MS7</td>
<td>2019-04-26</td>
<td>Semi-structured</td>
<td>Match Yourself</td>
<td>ODA Creator</td>
</tr>
</tbody>
</table>

#### 4.3.3 Attending Hack for Sweden 2019

If the phenomena of interest is not purely historical, some relevant behaviours and environmental conditions can be discovered through direct observation of the phenomena (Yin, 2009). Due to the event taking place during the time of the case study, the researcher was able to attend Hack for Sweden 2019. The event took place between the 4th to 6th of April and was located at Stockholmsmässan in Stockholm, Sweden. Leading up to the event the researcher was also invited to (thanks to the researcher’s collaboration with the public sector body DIGG) Hack for Sweden’s internal communication channels on Slack (a digital communication tool), which allowed participation in discussions between the co-organizing organizations.

While the researcher took a passive role in the event, attending public keynotes and following the major milestones of the hackathon, it gave the opportunity for informal conversations with various stakeholders in the Swedish open data ecosystem and one semi-structured interview. These conversations and interview provided valuable insights and nuance to the research, as the perspective of public sector bodies and key actors in the ecosystem could be added to the otherwise ODA-creator dominated perspective.
4.4 Data analysis

Yin (2009) argues that case studies, as all empirical research, have a story to tell and that there needs to be an analytic strategy to guide the researcher in crafting that story. For this thesis, the strategy chosen was *rely on a theoretical proposition*, more specifically: being able to identify what creates value for whom is key in order to avoid failure. This guided the data collection process and helped finding the theory relevant for the research.

In practice analysis have followed the general procedure to analyse qualitative data by Miles and Huberman (1994): reducing data, displaying data and drawing conclusions. *Data reduction* is the process of selecting, focusing, simplifying, abstracting and transforming data, that is collected en masse when using qualitative methods (Collis and Hussey, 2013). This process have occurred continuously during research, interviews and reviews, when the researcher have discarded seemingly irrelevant data, to keep transcripts and summaries clean and concise. Data reduction has also happened through restructuring of the data, when the researcher have organized collected data in different ways - either in an experimental manner, or into frameworks provided by researched theory. *Data display* is the process of summarizing complex data into a systematic visual format (Collis and Hussey, 2013). It have been used frequently in the research, to make sense of otherwise complex and dense findings. Illustrations and tables have been produced in an iterative way, in order to guide the researcher and draw tentative conclusions from early data, while new pieces of information have modified old constructs to paint an accurate picture. Finally, *drawing conclusions from data and verifying the validity of these* has been a continuous process throughout the study. Collected data have been enriched with notes and reflections, trying to identify patterns and gradually develop generalizations, which later have been compared to known theory or frameworks.

4.5 Research Quality

Case studies can be done in different ways and under different paradigms. Regardless of case design, Yin (1994) argues that the case study investigator must maximise four criteria to ensure quality of the research: construct validity, internal validity (only for explanatory, or causal case studies), external validity and reliability. For each criteria, Yin (1994) proposes a set of tactics, later extended by Gibbert, Ruigrok, and Wicki (2008), to deal with problems related to the criteria. Below follows an explanation for each of the four criteria and how they have been dealt with.
Construct validity - data collection

Construct validity refers to the quality of conceptualization, or operationalization of the relevant concept, which entails preventing that subjective judgements of the investigator are used when collecting data (Gibbert, Ruigrok, and Wicki, 2008; Yin, 1994). Several tactics can be used to deal with this problem: using multiple sources of evidence (triangulation), establishing a chain of evidence, having the case study report drafts being reviewed by key informants (Yin, 1994; Gibbert, Ruigrok, and Wicki, 2008). In this study construct validity have been achieved by:

- gathering data from multiple sources (interviews, documents, etc.)
- creating a chain of evidence by maintaining the case study database
- having the case report reviewed by important collaborators and informants

Internal validity - data analysis

As the thesis can be argued to be a hybrid of exploratory and explanatory according to Yin (1994) it must ensure internal validity, that is deriving a casual relationship between variables and results. In a case study especially three methods can be applied for ensuring internal validity: formulating a research framework, theory triangulation and pattern matching (Gibbert, Ruigrok, and Wicki, 2008). Theory triangulation essentially means verifying findings by adopting multiple perspectives, which was achieved by applying various theoretical perspectives in the analysis. Furthermore pattern matching have been used to some extent, by comparing findings to general reasons for startup failure, even though these studies do not cover the exact same domain as this thesis. Finally, studied theory have been synthesized in a constructed framework, which have guided data collection and analysis.

External validity - research design

Also known as generalizability, external validity refers to the problem of knowing whether a study’s findings are relevant beyond the immediate case study (Yin, 1994). Neither a single, nor (most) multiple case studies will allow for statistical generalization, as the sample size is too small (Gibbert, Ruigrok, and Wicki, 2008). However, whereas quantitative research is interested with statistical generalization, a case study is interested in analytical generalization - that is striving to generalize a particular set of results to some broader theory (Yin, 1994). Then the theory which helped identified cases for this study, can help identify future cases to which the results are generalizable. According to Eisenhardt (1989) analytical generalization can be achieved by conducting a cross-case analysis involving 4-10 of such cases. Since this study involves five different cases it could potentially reach some analytical generalization. However, in order to be certain the outcomes of this study should
be compared to more cases in future research.

Reliability - data collection
This last criteria refers to objective to ensure that any following investigator should be able to reproduce a study described by an earlier investigator and arrive at the same findings and conclusions (Yin, 1994). Typically reliability is interpreted in a different way in an interpretivist study, than in a positivist study - where perfect replication is of high importance (Collis and Hussey, 2013). Yin (1994) address that this fact made external reviewers question the reliability of the case study’s early days. To remedy this, he proposes that the investigator make use of a case study protocol, a case study database and in general approach the research with transparency, so that an auditor would be able to reproduce the study. In this study, a case study database, with interview transcripts, archival data, and other available documents was established. Furthermore, to ensure transparency interview templates are disclosed and motivations regarding selection of cases and used methods are provided. One issue with the study’s reliability is that interviews have been pseudo anonymized for reasons discussed previously. However, a future study on the same topic should aim to identify other cases - to strengthen the internal validity of the findings from this thesis - thus, it should not pose a serious problem.

4.6 Research ethics

Ethics refers to moral values and principles that form the basis of a code of conduct and research ethics is concerned with with the manner in which research is conducted and how the results or findings are reported (Collis and Hussey, 2013). Various organizations provide guidelines on how to conduct research in an ethical manner. Since this have been conducted at KTH, a technological university in Sweden, the thesis have followed the general rules stipulated by the Swedish Research Council (2017):

1. You shall tell the truth about your research.
2. You shall consciously review and report the basic premises of your studies.
3. You shall openly account for your methods and results.
4. You shall openly account for your commercial interests and other associations.
5. You shall not make unauthorised use of the research results of others.
6. You shall keep your research organised, for example through documentation and filing.
7. You shall strive to conduct your research without doing harm to people, animals or
the environment.

8. You shall be fair in your judgement of others’ research.

These rules have been addressed by:

1. Always telling the truth to the best of the author’s knowledge and ability.
2. Openly disclose the propsitions and assumtations on which the research is based on.
3. To the best of the author’s ability, describe how the research have been conducted (through this chapter) and what the results were (through chapters 5 and 6).
4. Revealing the author’s cooperation with DIGG and Hack for Sweden, as well as here disclosing that the author have recieve no compensation for the work.
5. Referencing re-used material to the primary source.
6. Research have been properly organized in a digital case database, as discussed in section 4.5.
7. During the research the identify of informants have been pseudo-anonymzed, for reasons discussed in section 4.3. Furthermore, any participation in the thesis have been voluntary and consent have been granted from informants to use the material collected during interviews. For audio recordings of the interviews, consent has also been granted on beforehand. The research is deemed to do no harm to people, or animals otherwise. In concern for the environment the thesis have seldomly been printed in paper.
8. Other researchers and practitioners work have been judged fairly, to the best of the author’s knowledge and ability.
5 Case description

This chapter introduces the cases studied in the thesis and the context surrounding them. It begins with a description of the publicly funded open hackathon Hack for Sweden. While section 2.2 described the general context that surrounds any actor in Swedish open data ecosystem, Hack for Sweden is the specific context of the studied cases. Then, background information is given for each case, the idea for the project, who the creators were, project history including milestones & obstacles and finally motivations for continue, or discontinue the project.

5.1 Context - Hack for Sweden

Hack for Sweden is an annual open hackathon, collaboratively organized by several public sector bodies, where anyone is invited to participate in solving societal challenges by using open data and building Open Data Applications. Starting in 2014, the first Hack for Sweden involved 13 public sector bodies, attracted 75 participants in 21 teams and went on for about 30 hours (Hack for Sweden, 2014a). In 2018, the event had grown to include 30 public sector bodies, 220 participants and took place over an entire weekend (Hack for Sweden, 2018a). Over the years winners have been appointed by a jury in several categories, e.g. best visualization, best societal value, etc. and a grand title: the Hack for Sweden Award. Some of these categories have remained over the years and some have been unique to one year of the hackathon, see figure 9 for a summary of winners over the years.
Figure 9: Hack for Sweden winners in each category over the years, with the studied cases are marked in bold.

Short-term profits

According to interviewee PS5, few of the winning projects are active today, which is further confirmed by an investigation of the projects online presence, where many code repositories on GitHub are inactive and links to prototypes are broken. This seems to have been anticipated, as concerns were raised about the issue already in an evaluation of the first year for Hack for Sweden (Hack for Sweden, 2014b). The evaluation discussed the problem of what is commonly called the "valley of death", that is the gap between an idea for innovation and its commercial adoption. The author had learned, from other public open innovation contests, that it is difficult to encourage further development after the competition is over. Reasoning that if Hack for Sweden aspires to realize the potential of the winning ideas, they ought to figure out what Hack for Sweden can do to facilitate for the developers to focus on long term development of their open data applications. A few improvements were suggested:

- Further involvement of innovation specialists from public sector bodies
- Inviting venture capitalists to the event
- "Catalytic procurement" - Transforming the event to a special form of public procurement process
- Coaching projects in how to pitch an idea to investors
Some improvement might have been realized, but in the following years Hack for Sweden focused more on growing the platform and the evaluations focused on factors such as media coverage, participants experience of the hackathon and so on (Hack for Sweden, 2015; Hack for Sweden, 2016a). After 2017 it was again stressed that there ought to be an action plan for post-hack development of the winning projects (Hack for Sweden, 2017a). It seems like the prediction from the first year turned out to be true: without further support from Hack for Sweden or other organizations, the winners are unlikely to continue developing their projects. Therefore, the requirements for collecting a prize was changed in 2018.

In the first years of Hack for Sweden, mainly the winner of Hack for Sweden Award was rewarded for its contribution. The prize in this category was an opportunity to go on a field trip, in 2014 to Berlin (Hackforsweden, 2014), & in 2015 Silicon Valley (Hack for Sweden, 2015), and present their project at a conference. Winners of the other categories were granted a reward in the form of a device, such as a smart watch, or an Arduino starter kit (Hack for Sweden, 2015). In 2018 the prize was changed to remove the short-term benefits of winning and replacing them with the following: the winner of winner of any category was granted a reward of 40 000 SEK and an opportunity to collaborate in an incubator program, if one could present a viable realization plan of the project (Hack for Sweden, 2018a). The incubator program comprised spending some time at a co-working space, coaching and participation in Hack for Sweden’s appearance at Almedalsveckan (an annual political fair at Almedalen, Sweden). Also, Hack for Sweden produced a promotion video for each of the winning teams and uploaded them to their Youtube-channel.

**Participant demography**
Each year, meta-data about the participants have been collected, which is summarized in table 3. Unsurprisingly, as men are over-represented in the IT-sector, the majority of the participating hackers over the years have been men. While this is unfortunate due to different reasons, it should have no effect on the outcome of the research question under study. What the surveys have discovered more are that most participants are either employed IT-professionals or students. While contestants from start-ups exist, they are in minority.

**Future plans**
In the last two years, Hack for Sweden have grown considerably, from 172 participants in 2017, to 220 participants in 2018, to 420 participants in this year’s Hack for Sweden (Sweden - Opening ceremony, 2019). In 2019 one chose to use the same prize arrangements, with some smaller changes in the prize sum for each category. Though the change, of removing short-term prizes and replace these with more long-term oriented prizes, have not been evaluated, Hack for Sweden aims to further change its concept in the future. Currently one aims to transform the concept of Hack for Sweden, from being a event occurring once a year, to develop into ”Hack for Sweden 365” - described as a publicly funded innovation
Table 3: Participant demography

<table>
<thead>
<tr>
<th>Year</th>
<th>Participants</th>
<th>Male</th>
<th>Female</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>75</td>
<td>85%</td>
<td>15%</td>
<td>Mostly IT-professionals</td>
</tr>
<tr>
<td>2015</td>
<td>89</td>
<td>75%</td>
<td>25%</td>
<td>Mostly students</td>
</tr>
<tr>
<td>2016</td>
<td>71</td>
<td>74%</td>
<td>26%</td>
<td>-</td>
</tr>
<tr>
<td>2017</td>
<td>172</td>
<td>80%</td>
<td>20%</td>
<td>About 40% students</td>
</tr>
<tr>
<td>2018</td>
<td>220</td>
<td>?</td>
<td>?</td>
<td>-</td>
</tr>
</tbody>
</table>

platform that is active all year (Hack for Sweden, 2018a). The stipulated reasons for the transformation are:

- It has proven difficult to create challenges which participants can act on
- The participant demographics is too homogeneous
- Solutions are not realized, but stop at prototype stage

Though this transformation have yet to take place, its possible impacts will be discussed in later chapters.

5.2 Cases

Following subsections gives a brief explanation of the studied cases. For each investigated open data application, the following information is provided:

- General information about project
- Project history and decisions
- Understandings, opinions and thoughts
5.2.1 ODA - Cykelranking

Cykelranking was the winner of the category of "Best social good" in Hack for Sweden 2016 (Hack for Sweden, 2016b), but quit developing soon after the end of the competition. Motivated by the social and environmental benefits of choosing to bicycle over going by car, or public transport, the open data application (from now on referenced as ODA) idea was to develop a service for ranking Swedish municipalities, in terms of bicycle-friendliness (Interview MS1). The ODA consisted of a web application where users were presented with the most- and the least bicycle-friendly municipalities in Sweden, using open data from the two public sector bodies Trafikverket and Transportstyrelsen. Users could also search for a specific municipality, e.g Göteborg, and was then presented with a map, visualizing bicycle roads and historical accidents in the area - see figure 10. The value proposed by the ODA was to provide users in form of citizens, municipalities, or other interested actors, with information that would be informative and possibly improve bicycle friendliness (Interview MS1).

Figure 10: Map view in Cykelranking, showing bicycle roads and information about historical accidents in the chosen municipality, in this case Göteborg

Source: Hack for Sweden, 2016b

Creators

Cykelranking was created and developed by three experienced IT-professionals from a large Swedish tech-consultancy company. The creators were colleagues and entered the competition motivated by curiosity, seeing what one could do with open data and solve
real social problems (Interview MS1).

**Project history**
The developers built Cykelranking from scratch during the hackathon. They used internal templates for rapid prototyping, so one could argue that the team received some help from colleagues. After the hackathon Cykelranking was approached by representatives from Trafikverket and Transportstyrelsen, who thought the ODA was interesting and initiated discussions (Interview MS1). The representatives from the two public sector bodies saw the application as a leading example for what one could do with their data and wanted them to continue the development. However, the developers being already employed consultants were not motivated by developing the service pro bono and as the two public sector bodies allegedly were not interested in financing the project, negotiations ceased (Interview MS1).

**Reasons to discontinue the project**
During the contest the creators of Cykelranking did not think about in what way the service could be monetized. Due to the focus being on socially beneficial information, the developers reasoned that it would be difficult to develop the service as some kind of software as a solution, charging a fee directly from the user. According to Interview MS1 the most sustainable way of financing the ODA would have been through a partnership with a public sector body, or other interested organization. After the competition the developers reasoned that, if no external party would be interested in financing further development, it would be more beneficial spending their time at their employer.

### 5.2.2 ODA - WarnBox

WarnBox won Hack for Sweden 2016 in two categories: the jury’s & the people’s prize (Hack for Sweden, 2016b), but quit the project soon after the end of the competition. WarnBox was an idea to improve the way citizens receive emergency population warnings (Interview MS3). In Sweden this is called ”Viktigt Meddelande till Allmänheten” (important public announcement) and currently consists of a siren ”Hesa Fredrik”, which call on people to turn on their TV, or radio to receive more information about the danger. The creators of WarnBox thought the system had flaws and WarnBox meant to improve it by broadcasting more comprehensible and granular announcements via a small device - similar to a smoke detector (Interview MS3).

The ODA consisted of a small computer, called Raspberry Pi, which fetched information about warnings from MSB (Myndigheten för Samhällsskydd och Beredskap) and SMHI (Sveriges meteorologiska och hydrologiska institut), via their open data API:s (Interview MS3). In case of an emergency, WarnBox used a text-to-speech (voice synthesis) API, to
read out the messages out loud. Using geolocalization, WarnBox could broadcast more granular warnings for the exact location (Interview MS3). Another feature was that the device could read out messages in several languages, so that also non Swedish speaking citizens could receive warnings. The ODA meant to provide value for citizens, as well as authorities. According to Interview MS3, fewer and fewer people own a traditional TV, or radio - this assumption is confirmed by Regeringen (2018) - and in case of an emergency, citizens readiness is assumed to be low. The creators of WarnBox reasoned that having a modern way to communicate warnings and emergencies would be socially beneficial.

Creators
WarnBox was developed by four IT-professionals from a smaller consultancy firm. They viewed the competition as an opportunity to stress-test their abilities and as a teambuilding activity.

Project history
During the Hackathon, most of the time was spent on figuring out what one could do with the open data from the public sector bodies. Once they had figured out the idea, approximately 3 hours was spent on coding the solution (Interview MS3). After the hackathon, the creators of WarnBox were approached by MSB (Myndigheten för samhällsskydd och beredskap / the Swedish Civil Contingencies Agency) who was interested in the idea. MSB wanted to showcase the idea as a leading example, so the developers were invited to a field trip at MSB’s offices, however the negotiations ceased after the visit (Interview MS3). Allegedly the creators of WarnBox were given loose leads to contacts at some municipalities, who would be interested in the idea. However, the creators, being already employed, were not motivated to continue the project without further engagement from the public sector bodies (Interview MS3).

Reasons to discontinue the project
The creators of WarnBox were employed consultants, they reasoned that if the return on investment for focusing on WarnBox is not higher, than their consultancy work they, would not be motivated to continue further development (Interview MS3). According to Interview MS3, what could have motivated them to continue the development of WarnBox is either an accelerator program (how to work with public authorities, who to talk with, etc.), or clear interest from MSB or other interested organization.
5.2.3 ODA - Projekt Skog

Projekt Skog, or "Project Forest", won the "Hack for Sweden Award" in 2017 (Hack for Sweden, 2017b), but is currently inactive. The project was an initiative to easily identify areas of forest with a high “nature value”, that is a value for rating the forest in terms of biodiversity (Interview MS4). Using a machine learning model the application was able to predict the nature value of a forest based on features such as key biotopes, soil moisture and degree of logging. The ODA used open data from Artportalen, Skogsstyrelsen, SLU (Sveriges Lantbruksuniversitet) and consisted of an API, serving requests to the machine learning model, that a mobile or web application could query to process further, or visualize on a map - see figure 11 for an architectural illustration. The ODA could be used for a commercial, or informative purpose. Due to the ideological preferences of the creator, the former was not an interesting context. The latter holds value for anyone interested in knowing the value of a forest with the purpose to protect it, or similar (Interview MS4). Such organizations include, but are not limited to: Regional authorities, Skogsstyrelsen (the authority for forests and environment), or other interested organization.

Figure 11: Illustration of high level architecture of Projekt Skog

*Source: Hack for Sweden, 2017b*

**Creators**

Projekt Skog was created by a single IT professional, an independent consultant with a personal interest in forest protection.
Project history
During Hack for Sweden, the creator built a prototype which rewarded him with the award and gave him the opportunity to present the project at Forum Öppna Data (Interview MS4), an event organized by Vinnova, focusing on highlighting what is current in the open data sphere. After the hackathon, representatives from Hack for Sweden connected the creator with interested actors, which snowballed into connecting him with Sveriges Lantbruksuniversitet, Skogsstyrelsen and the county government in Jönköping. These organizations showed interest for the project and especially Skogsdatalabbet, a data laboratory at Sveriges Lantbruksuniversitet, offered him resources - such as database space and networking opportunities (Interview MS4). However, none of these seemed to be able to finance the project. Later in the autumn of 2017, the creator independently continued to work on the project. He built a prototype of the mobile application, which meant to be used for field studies in forest areas, and continued to improve the machine learning model. Eventually, as the project did not generated any income to the creator, it became difficult to maintain the project and development ceased (Interview MS4).

Reasons to discontinue the project
Due to limited time and resources, the creator spent less and less time on the project and eventually paused development. In order to continue development, interviewee MS4 argues that the ODA would need to be incorporated into a larger project, e.g a development program at Skogsstyrelsen, which would give the ODA context and be able to finance development.

5.2.4 ODA - Biologg

Biologg won Hack for Sweden 2018, in the category of ”best visualization” (Hack for Sweden, 2018c) and the project is still active today. The idea of Biologg is gamification of nature’s beauty, combining learning and fun, while contributing useful data back to society (Interview MS2). The ODA is best described as “Pokémon Go for nature”, or in other words: it is a mobile game where the goal is to explore nature, by actually getting out in the local nature. The user is rewarded with points for taking pictures of different animals and plants and guessing the correct name of the species - see figure 12. In an early stage of the project, correct answers of the species in submitted pictures are crowdsourced through the community. In the future there are plans to utilize image recognition to detect species automatically. The ODA uses open data

Figure 12: Example view of logging a species in Biologg
Source: Biologg, 2019
from Artportalen, which features data from Naturvårdsverket and SLU, and also pictures from Wikipedia and Google Images (Interview MS2). Some features are:

- Logging of animals & plants by taking pictures and assigning the right species
- Crowd sourcing right answers for species
- Search for a specific species

Biologg aims to provide value to citizens by helping them exploring nature in a fun way (Interview MS2). This also promotes the general health of the population, as spending time in nature is considered to improve physical and mental health. The element of learning could be valuable to other actors as well. Schools, for example, could use the service to encourage students to learn in a more fun way.

Creators
Biologg was initially developed by three persons. Two of them co-founded & ran a small application development studio together and the third was paired together with the other two during the competition. After the competition the third member left the project (Interview MS2). Today Biologg is driven by the two co-founders of the small development studio, whose focus is games and applications that have clear sustainability focus (Overstellar, 2019).

Project history
The two co-founders had thought on beforehand about what kind of ODA they wanted to develop and during the hackathon a prototype was developed (Interview MS2). By winning the category for best visualization and presenting a viable realization plan for the project, the creators were rewarded with 40 000 SEK and an incubator program. After the hackathon the developers contacted Artportalen to continue their research for the project and it turned out that similar ideas had been thought of before, but so far nobody had realized them. Conveniently a new species-API was to be released later in 2018, so Biologg was going to be one of the first users of it. In the summer of 2018 Biologg participated in Hack for Sweden’s appearance at Almedalsveckan, an annual Swedish politician fair, where they were given the opportunity to present their project and connect with other people in the open data ecosystem (Interview MS2). Biologg continued with the development of the prototype and finished user testing on a small user base in September 2018 (Biologg, 2018). Alpha testing of a MVP (Minimum Viable Product) was commenced in March 2019 (Interview MS2) and a first release of the MVP is expected in spring 2019.
Parallel to their independent work with the project, the creators of Biologg could utilize the incubator program. However, according to Interview MS2, the program was not really a program and its contents were coupled with uncertainty. First, there was confusion around the co-working space: when, where and how the premises was to be used. Second, there was ambiguity in the communication with the coaches. Biologg had three sessions where they received coaching in business model development and similar, but the sessions did not follow a plan and some follow-ups actions decided in the meetings never happened. In addition to the co-working space and coaching, Hack for Sweden also made a promotion video for Biologg and released it in late June 2018, on their Hack for Sweden’s YouTube-channel. Currently (2 April 2019) the promotion video has been seen 293 times (Hack for Sweden, 2018b).

**Reasons to continue the project**

So far development has been funded by the creators themselves, except for the 40 000 SEK that was included in the prize for winning Hack for Sweden. Biologg has initiated discussions about partnerships with, among others, a local county government, but has yet to create a stable source of income. The reason to why the creators have continued development is their personal interest in the project. The project is aligned with their company’s focus and the hope of success motivates a negative cash flow.

### 5.2.5 ODA - Match Yourself

In Hack for Sweden 2018 the project Match Yourself won the grand prize, the so called "Hack for Sweden award" (Hack for Sweden, 2018c). The creators of the ODA went on to develop the solution for a couple months after the hackathon, but eventually quit development (Interview MS7). The solution comprised a new way to find suitable jobs for people seeking employment, combining text analysis tools and personality tests. More specifically the solution revolved around the Big Five personality traits model\(^4\). Job advertisement data from Arbetsförmedlingen (the Swedish Public Employment Service) was collected and through a text analysis procedure, applying the Big Five personality traits model, the jobs were mapped into a five-dimensional vector space. A potential job seeker could then take the test and get her or his results mapped into the same model. In such manner one could predict jobs that would be most similar to the job seeker, in terms of personal traits.

The ODA was developed to function as a small web service, served through an API,

\(^4\)A personality test incrementally developed by psychologists over the ages. The test applies factor analysis on some respondent data to map the respondent to a five-dimensional space: Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism
which could then be integrated in Arbetsförmedlingen’s solution stack, rather than to be a full-stack service. According to interviewee MS7 this would be valuable for both Arbetsförmedlingen, since they allegedly have a hard time finding suitable employment for people and job seekers, as they can utilize a job recommendation engine tailored to their personality traits.

**Creators**
Match Yourself was created by four young IT-professionals, with particular interest in artificial intelligence, psychology and software development. The creators met through their interest in AI and saw Hack for Sweden as an opportunity to try solving societal problems and code together - ”We did not have the intention to start a company together” (Interview MS7).

**Project history**
The motivation for developing a solution targeting Arbetsförmedlingen was twofold. First, during the stage of ideation the creators looked at the open data available to them and found that many of the datasets and APIs were substandard, having descriptions and commands written in Swedish (considered a bad habit within IT), or lacking in some other way. Arbetsförmedlingen’s API was ”the least bad alternative”. Second, the creators saw an opportunity in Arbetsförmedlingen as they thought it had the general problem of finding suitable jobs for people.

After the hackathon the creators were confused over what exactly they had won (Interview MS7). As previously mentioned, in 2018 the prize for winning any category in Hack for Sweden was a reward of 40 000 SEK and an incubator program, if the creators could present a viable realization plan of the solution. In practice the creators were told that the prize sum was to be granted if the team could present a prototype at Hack for Sweden’s appearance at Almedalsveckan in the summer. The incubator program included a co-working space, which the creators used for developing the prototype and coaching, which according to interviewee MS7 consisted of one meeting with a Hack for Sweden representative. The creators got a contact at Arbetsförmedlingen, who showed interest in the project but could not fund development. Approximately, the creators spent 20 days, parallel to their regular jobs, developing the prototype for Almedalsveckan and afterwards the project was discontinued.

**Reasons to discontinue the project**
According to interviewee MS7, the team behind Match Yourself had the technical skills to implement the ODA and had ideas on how to monetize the service as some kind of software as a solution, targeting other recruitment platforms. However, as previously mentioned the creators had other occupations and did not approach Hack for Sweden with the intent to start a company. Had Arbetsförmedlingen shown interest in funding and running the ODA they could have continued development, otherwise they thought their time was more well
spent at their current employers (Interview MS7)
6 Findings and analysis

In an attempt to find answers to the research questions under study, this chapter presents empirical findings from the studied cases and resulting analysis, drawing from findings and previous research. The chapter begins with section 6.1 outlining similarities and differences between the studied cases in order to answer the first research question. Section 6.2 summarizes collected data about the projects and a breakdown of the opinions of the informants: what happened after the competition and why they chose to continue or discontinue the project - to see if any patterns emerge. Then in section 6.3 the projects are analyzed using the ODA-vBM framework, to understand what value the ODAs creates for whom and who is expected to compensate whom for this - which will reveal if there are gaps in the projects fundamental design. Finally, in section 6.4, findings from these two perspectives is compared to conventional reasons for business failure - to see if the identified reasons for failure corresponds with previous research.

6.1 Characteristics of an open data application

Section 2.2 explained how several type of actors co-operate in an ecosystem-like fashion to realize the potential in open data. While any citizen could access the data directly from the publisher, the broad majority of citizens lack the motivation or skill to make use of open data (Hellberg and Hedström, 2015). In the end, to realize the potential of open data, it therefore needs to be an actor which wraps the data in some kind of user friendly service (Kuk and Davies, 2011). Such an actor was also defined in section 2.2. Lindman, Kinnari, and Rossi (2016) identified some business roles that this actor would fulfill, but the model was insufficient for the Swedish case. Therefore the concept of an open data application, defined by C.-C. Yu (2016), was applied in the Open Data Ecosystem-model (see figure 3) to encapsulate some business roles in Lindman, Kinnari, and Rossi (2016)'s model.

However, besides the definition by C.-C. Yu (2016) (see page 14) and the business roles provided by Lindman, Kinnari, and Rossi (2014), there is not much detail on what actually constitutes an open data application. This claim is supported by section 1.2, where it was revealed that researchers and practitioners yet have to find out what constitutes a state-of-the-art open data service - able to develop in a sustainable way (Temiz and Brown, 2017; Kuk and Davies, 2011; Lindman, Kinnari, and Rossi, 2014). Hence, there are no descriptions on what constitutes a "state-of-the-art" open data application, nor what a "typical" open data application could look like. To amend this smaller research gap, common attributes are drawn from the studied cases and build understanding for how they servitize open data.
The typical open data application
In all of the studied cases, creators have begun with raw data from an open data publisher and built a product for some type of end-user (Interview MS1, MS2, MS3, MS4, MS7). None used data that had been preprocessed or transformed by an intermediary service provider. Thus, the cases took upon them all of the business roles described by Lindman, Kinnari, and Rossi (2016): data extraction & transformation, analysis and user experience provision. By using the open data ecosystem model, presented in section 2.2, the role which best fit the cases would be the open data application. Looking at the type of service they provide, who they provide it for and who is a suitable customer, there are similarities and some differences.

Table 4: Breakdown of cases based on type of service, targeted user and targeted customer

<table>
<thead>
<tr>
<th></th>
<th>Type of service</th>
<th>Targeted user</th>
<th>Targeted customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cykelranking</td>
<td>Web app</td>
<td>Indiviudals</td>
<td>PSB</td>
</tr>
<tr>
<td>WarnBox</td>
<td>Product as a Service</td>
<td>Indiviudals</td>
<td>PSB / Consumer</td>
</tr>
<tr>
<td>Projekt Skog</td>
<td>API / Mobile app</td>
<td>PSB</td>
<td>PSB</td>
</tr>
<tr>
<td>Biologg</td>
<td>Mobile app</td>
<td>Indiviudals</td>
<td>PSB / Schools / Consumer</td>
</tr>
<tr>
<td>Match Yourself</td>
<td>API / Integrated web-service</td>
<td>Indiviudals</td>
<td>PSB</td>
</tr>
</tbody>
</table>

As illustrated in table 4, in most of the cases the open data application offer its services in the form of some kind of mobile-, or web application. The applications provide informative visualizations, easy access and analysis of public open data and helpful services built on top of it. WarnBox stands out as the only studied ODA that uses some custom hardware to deliver its services. While Match Yourself intended to integrate their services within Arbetsförmedlingen’s services directly, the intended user would be a job seeker (Interview MS7). Only one ODA, Projekt Skog, targeted institutional users at a public sector body - where the intended user would be able to use predictions from a trained machine learning model in order to make qualified decisions about forest protection (Interview MS4). Finally, two of the cases either could imagine, or had plans to, bill the users of the ODA for the services. Yet, all of them favored creating revenue via public sector bodies, and/or in one case schools.

This bias towards a public sponsor raise the question of why ODAs consider the public sector as their main customer. Possible explanations for why this is so are discussed in
When Open Data Applications become non-private goods

Remember that the market will be inefficient in providing any goods that are non-private (Krugman and Wells, 2013). With the help of the World Wide Web and efficient server-technology the marginal cost for letting one more user access some digital asset on the internet is very low, close to zero. Therefore open data applications, or rather software services, share the attribute that they are essentially non-rival in consumption. However, since it is possible to prevent people from using software services through access controls, they are in fact excludable. This classifies ODAs and software services as artificially scarce goods, rather than public goods. Though, from experience one may have noticed that there are some software services that many are interested in paying a premium for (e.g. on-demand movies & music, software for productivity, etc.) and some which people are less, or not at all, interested in paying for (e.g. news, social media, informative websites, etc.). Consequently, the latter type remains open to all users and is oftentimes funded by advertisement, partnership and in some cases they simply are at loss for the producer. This non-exclusivity causes them to be classified as public goods.

So what motivates a person to pay for a software service, making exclusiveness viable? It could be argued that though person X’s usage of a digital asset does not, in practice, prevent person Y from using the same asset, both X and Y are willing to pay a premium for the service, if the premium does not exceed their individual use value of the service. A website about berry picking may be valuable to anyone interested in the subject, but in the end of the day, people may not consider it valuable enough to pay for, or maybe they find that any free news is better than a qualitative reportage with a paywall.

Following this line of reasoning, the classification of an ODA as public or artificially scarce (and ultimately who is willing to pay for its’ services) is reduced to a question whether the ODA creates value for individuals, or society. The services of an ODA can be made exclusive if the creators deem the services can provide use value, to each individual, that is higher than a certain premium (which need to be high enough to cover expenses). If so the goods will be classified as artificially scarce, which causes inefficiently low consumption, but motivates production. Otherwise the good is classified as public and can neither be efficiently produced, nor consumed, by the market.

6.2 Problems with ODA creation from the informants’ perspective

In a first attempt to find answers to why many open data applications discontinue and what is to be done about it, one may look directly at the opinions and answers provided by the
informants. First the opinions of the ODA creators themselves and then representatives from public sector.

6.2.1 From the perspective of ODA creators

<table>
<thead>
<tr>
<th>ODA</th>
<th>Project History</th>
<th>Why active/inactive</th>
<th>Incitaments to continue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cykelranking</td>
<td>- Interest from Trafikverket/transportstyrelsen</td>
<td>- Developers other jobs</td>
<td>- More push from PSB</td>
</tr>
<tr>
<td>2016 (Inactive)</td>
<td>- No follow up</td>
<td>- No sustained initiative from PSB</td>
<td>- PSB able to fund development</td>
</tr>
<tr>
<td>WarnBox</td>
<td>Interest from MSB</td>
<td>- Developers other jobs</td>
<td>- More push from PSB</td>
</tr>
<tr>
<td>2016 (Inactive)</td>
<td>- Tour on MSB</td>
<td>- No sustained initiatives from MSB</td>
<td>- Clear action plan</td>
</tr>
<tr>
<td>Projekt Skog</td>
<td>- Interest from Skogsstyrelsen, SLU, etc.</td>
<td>- Developer have limited time and resources</td>
<td>- Embed ODA in bigger project at PSB</td>
</tr>
<tr>
<td>2017 (Inactive)</td>
<td>- PSB not able to fund project</td>
<td>- No sustained initiative from PSB</td>
<td>- PSB able to fund project</td>
</tr>
<tr>
<td>Biologg</td>
<td>Incubator program:</td>
<td>- Personal interest in showcasing app → Motivated to develop ODA without external funding</td>
<td>- Find sustainable revenue model</td>
</tr>
<tr>
<td>2018 (Active)</td>
<td>- co-working space</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- coaching</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Marketing?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Match Yourself</td>
<td>- Interest from Arbetsförmedlingen</td>
<td>- Developers other jobs</td>
<td>- Motivation from PSB</td>
</tr>
<tr>
<td>2018 (Inactive)</td>
<td>- Developed prototype</td>
<td>- No sustained initiative from PSB</td>
<td>- PSB able to fund development</td>
</tr>
<tr>
<td></td>
<td>- No follow up</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 13: Summarized background information about the studied ODAs. The creators opinion on why they continued/discontinued their ODA and what would motivate them to continue further.

When questioned about reasons to discontinue and the biggest challenges to continue development, informants did not mention obstacles or challenges related to technology, or the product itself. Instead, how to fund the project is the unanimously considered to be the biggest obstacle for continued development (Interview MS1, MS2, MS3, MS4, MS7). Looking at the opinions of the ODA creators, summarized in figure 13, especially three opinions seem to be shared among the creators of inactive projects: lack of motivation, low perceived return on investment and lack of interest in the project from public sector bodies.

Lack of personal motivation
First, creators of the ODAs which discontinued already had an occupation which did not depend on, or even conflicted with, the success of the project. Some creators attended
Hack for Sweden as a group of colleagues for a team building activity, or a group of friend to practice software development skills while trying to solve societal problems (Interview MS1, MS3, MS7). Thus, they were not personally invested in the project. This can be contrasted with the creators of the sole active ODA, Biologg, who run a small startup together and consequently are more invested in the project, as its success will contribute to their startup’s success.

**Low perceived return on investment**
Second, while having any other occupation than working in a startup does not exclude the creator to focus on a side project, the creator will not pursue development of the ODA (other than as a hobby) if the value (use and exchange value) created by it does not exceed the value created by spending time at the employer. Rephrased: a person will not continue her ODA, unless the perceived return on investment of the project is larger than their current occupation. In some cases, such Cykelranking and WarnBox, the perceived return on investment of the project was low enough to quit development right after the competition. Since, they could spend their time on lucrative projects, they were not interested in spending time on a project for free. In other cases personal interest motivated spending some time for free on the project, but eventually it was not enough. The creators of Biologg were not the only ones who had a personal interest in their project. Looking at the case of Projekt Skog, the creator had a strong personal interest in developing the application, as it aligned with his interest in forest protection (MS4). However, as time went by and the project did not attract funding, his interest for forest protection could not match the personal costs inflicted upon him - or in other words: the perceived return on investment for the project was too low.

**Lack of interest from public sector bodies**
Third, despite the previous two reasons combined, the creators of all ODAs studied in this thesis could imagine themselves continuing development of their projects - if they could receive external funding. An opinion shared among the projects that have discontinued is that at some point, in order for development to continue, a targeted public sector body should show interest in the project and eventually be able to finance development (Interview MS1, MS3, MS4, MS7). The reasoning behind this is that when developing the projects, some creators did not think about building a commercial product (Interview MS1, MS3) and some even explicitly did not want to develop the project for commercial purposes (Interview MS4). Instead, what they did was to think about what societal opportunities could be solved with existing open data and built projects aligned with that goal. So, most of the open data applications were services that targeted users in the form of citizens, rather than private customers, and they often had a one or several PSBs in mind:

- Cykelranking - Trafikverket/Transportstyrelsen/county governments
Post-hackathon, the targeted public sector body was often excited about the application that targeted their domain and encouraged creators to continue development. However, in most of the studied cases the enthusiasm and support from PSBs extended to gratitude and a field trip. In one of the cases a PSB offered resources in the form of a database (Interview MS4), but no financial support. So, from the perspective of the ODA creators it seemed like the PSBs was not very interested in their solutions.

6.2.2 From the perspective of public sector

As mentioned several times previously in this thesis, the rational for creating business based on open data is creating value, for individuals, organizations and society. (Kuk and Davies, 2011) showed that this value creation process is ultimately performed by some service creator, a so called hacker (arguably an interpretation of Schumpeter’s entrepreneur). Hence, the public sector have an interest in identifying and solving problems related to the creation of these services. Interviews with various actors in the Swedish open data ecosystem from public sector (Interview PS4, PS5, MS5, MS6), revealed that public sector is well aware of the problems ODA projects face after initial prototype stage - whether they were developed at a hackathon or elsewhere, as well as some other problems which obstacles the value creation based on open data. Down below, three problems are presented.

Founders are not willing to start a business
The first problem is that founders of ODAs, created in hackathons or elsewhere, are not ready to start a business (Interview PS5). They are often currently employed at some IT-corporation, or students with a couple of years of studies ahead of them. This view is also supported by the participant demographics of Hack for Sweden over the years - presented in the previous chapter (see table 3). While these ODA creators are skilled, they currently have a steady occupation which makes the startup life less appealing. Therefore, many of the ODAs created in Hack for Sweden have stopped at prototype stage, due to founders lack of interest in continuing development of the project without further incitaments.

Public sector have restricted options to fund ODAs
The second problem, which was brought up in several interviews (Interview PS4, PS5, MS5, MS6), is that while the public sector would be interested in funding an open data
application in some cases, it is not always possible. This problem is in itself caused by three factors: scarcity of resources, ODAs missing a problem owner and ODAs not being developed to solve a concrete problem.

First, it may seem obvious, but it still should be emphasized: government budget is a zero-sum game and as a consequently investments must be well motivated (Interview MS6).

Second, even though one could think of the state government as one unit with shared interests, in reality it comprise several smaller units with their own interests. This has consequences as in each of these units the spending of government money is regulated by public procurement laws (Interview PS1), a letter of appropriation (regleringsbrev) from the government (Regeringen, 2016), etc. Thus, even though units would like to cooperate in a common interest, in order to motivate public funding the investment must target the needs of one of these units specifically. However, many open data applications do not target the needs of a specific public sector body or public stakeholder, which makes it difficult for a PSB to motivate an investment (Interview PS4, PS5, MS5). Another way to phrase this is that the ODAs are missing a ”problem owner”. To exemplify, consider for a second an ODA which creates value for citizens, or business, in a way that makes it helpful in some public sector body’s administration. Since the ODA creates value for the PSB, it lies within the interest of the PSB to fund the ODAs continued development. However, since the spending of government money is regulated by public procurement laws, if the ODA does not target the needs of the PSB more specifically, the PSB is restricted in its options to fund the ODA. From the perspective of an entrepreneur these laws may seem strict, but according to interviewee MS5, public sector bodies are actually quite flexible in their procurement options, at least from a legal standpoint. The problem from the perspective of public sector is still that the ODAs do not solve their specific needs, which introduces the third part of the problem.

The third part of the problem is that ODAs are often created from an opportunity of what one could do with existing open data, rather than solving a specific problem of a PSB. In order to make it easier for citizens to directly target problems of the public sector, some public sector representatives would like to change the approach for fostering this citizen innovation (Interview PS5, MS5, MS6). One approach is to switch from the event-based hackathons, to challenge-based platforms (Interview PS5). Two examples of such platforms are ”challengesgov.se”, created by Tillväxtverket (Interview PS5) and ”Hack for Sweden 365”, introduced in the previous chapter. The idea is that public sector bodies will create challenges that they are in need of solving. Citizens, or ”small and medium-sized enterprises” (Interview PS5), are then able to submit solutions to the challenges directly via a digital platform. This can be contrasted to hackathons, where solutions are often developed towards ”society” and not a specific PSB as main benefiting stakeholder. The intention is that these challenge-based solutions will be easier to adapt and in the end
funded, by the public sector.

**Open data is just a means to an end**
The third problem, or reflection, is more general and questions the intrinsic value of open data. According to interviewee MS6 the discussion of value creation based purely on open data is too narrow and one should remember that open data is but one part of the larger *data landscape*. This topic will be discussed further in chapter 7, but for the sake of an nuanced analysis it’s important to have a critical perspective on open data itself. Obviously open data has its benefits in terms of economic growth and democracy, which has been discussed by researchers and practitioners before (Tammisto and Lindman, 2012; Zeleti, Ojo, and Curry, 2014; European Commission, 2018), but it also has its downsides. Informants have reported that many datasets opened by public sector bodies are of low quality (Interview PS3, MS6, MS7); they are missing samples, stored in inaccessible formats, have no or bad documentation, or they are not very valuable to begin with. Furthermore they are often missing service level agreements (Interview MS6), which puts ODA creators in a difficult position when their most important resource are not guaranteed to them. These and other reasons, questions whether one should talk about such things as ”open data applications” at all.

### 6.3 Analysis with the adapted ODA-vBM model

This section presents a selection of the findings from the ODA-vBM framework analysis of the cases. For a full illustration of the produced business models, see appendix B. Since the lifespan of the projects span from a couple of days, to a year, the business models vary in their extensiveness. Focus lies on the public beneficiaries and executive organization stakeholder categories, as these describe what essential value the open data application creates for whom; and in some cases, where they are relevant, also the service chain participants and society & nation categories are included. Finally identified gaps in the models are presented, which will be discussed in the following chapter.

#### 6.3.1 Cykelranking

**Public beneficiaries**
In the case of Cykelranking the public beneficiaries group constitutes of individual users, as well as potential institutional users in the form of municipalities, media companies, or other interested organizations. Value created for this group includes: encouraged use of bicycles as a method to commute, increased knowledge about bicycle friendliness in local
areas and easy overview of public open data on historical bicycle accidents. This value is created by the ODA through: ranking of municipalities in terms of bicycle friendliness, provided search functionality for specific municipalities and visualization of bicycle roads & and historical accidents on a map. Needed resources in order to use the ODA are a mobile device and an internet connection. As there was no plan to bill the users for the service (Interview MS1) the derived costs for the stakeholder group are again: the cost of acquiring a mobile device and billing for internet connection.

Executive organisations
If Cykelranking had been realized, the intention according to interviewee MS1 was that the founders would take a more passive role as developers maintainers of the application, but some public sector body would have owned the service. The public sector body would thus take on the operative tasks of running the ODA, while the original creators would take on the role as developers. For the developers, value is created in the form of billable hours for maintaining the ODA and since they no longer own the ODA, no costs - except time spent on the project - are inflicted on them. It is uncertain what explicit value is created for the ODA owner, whether it would be Trafikverket, Transportstyrelsen, or any other public sector body. Initially, it seems like Cykelranking does not address a specific problem that lies within the mandate of any PSB. However, there have been cases historically where for example Trafikverket have contracted consultants to produce one-time visualizations (Trivector, 2018), similar to what Cykelranking could offer on-demand, implying that there indeed is a need for the solution provided by Cykelranking.

Service chain participants
ODA stopped at prototype stage and hypothetical discussion not really relevant.

Society and Nation
For society and Sweden as a nation Cykelranking is deemed to be valuable, since encouraged use of bicycles as a means of transportation could result in reduced carbon emissions, traffic jam and potentially have positive health effects on the population.

Summary
In the current state of this business model, the underlying problem seem to be that Cykelranking has no clear stakeholder which ”own” a problem that the service provides a solution for. Individual users and media channels would probably be interested in using the service, but it is uncertain whether they would be interested in paying for the service. Municipalities or PSBs on the other hand could finance the solution since it seems to benefit its citizens, however although historical cases exist they don’t explicitly (or at least doesn’t realize that they) have a problem with visualizing bicycle roads and accidents.
6.3.2 WarnBox

Public beneficiaries
In the case of WarnBox public beneficiaries would be citizens as end users. For this stakeholder category value comes in the form of a crisis alarm, able to broadcast messages more comprehensible than an alarm signal. The messages can also be more granular as the user does not need to remember the difference between a air raid warning, gas leakage or a fire in the local area. Furthermore the user’s readiness in case of an emergency is increased since WarnBox could potentially eliminate the "cry wolf"-factor of the current PSA system. Needed resources would obviously be a WarnBox, the hardware reading the messages and an internet connection for the box to pick up broadcasted announcements. For inflicted costs one could compare to how people currently acquires smoke alarms, landlords are responsible for rental properties and apartment & house owners are responsible for acquiring their own devices.

Executive organisations
As with Cykelranking, the creators of WarnBox would like to have seen more engagement from a PSB in order to continue their work, but the PSB would not necessarily have needed to taken executive control and could have remained a service chain participant (Interview MS3). Regardless who had taken the role of executive organization and control operations, the executive organization would have needed to develop or outsource the development of the WarnBox hardware. Furthermore the executive organization would have needed to develop and maintain the ODA systems and services around and so on. This would have inflicted some relatively large upfront costs, compared to the other cases which are strictly software-oriented, as well as operations expenditures for maintaining the ODA over time. Needed resources are the open data provided by MSB and SMHI, as well as revenue streams to fund development. Revenue could be created from potential partnerships with with county governments, landlords and consumers willing to purchase the WarnBox services to increase emergency readiness.

Service chain participants
Had the creators of WarnBox maintained executive control they would have needed to form a partnership with MSB who provides the emergency announcement API. For MSB, value is created as their broadcasted messages need to be received by some party in order to inform citizens about a catastrophe. Further partnerships could have been created with county governments. Interviewee MS3 argues that counties with nuclear plants would be an interesting case, but a similar argument can be made for any county with an interest in increasing emergency readiness among its citizens. In return the partners could have payed a partnership fee, or help establish contracts with landlords in the local area.
**Society and nation**
For Sweden and local societies within, value is created as citizens emergency readiness increases. Sweden have been spared from warfare within its borders for centuries, but must be prepared in case of a crisis. Furthermore as have been discussed, the ODA could help spreading information about other less severe types of dangers.

**Summary**
The ODA-vBM analysis reveals that the ODA have potential for sustainable development. However, for a long period of time it would not create revenue for the executive organization, if developed independently without the help from public sector. The project require relatively large upfront costs for developing hardware and infrastructure that is secure and stable. The discontinuation of the project cannot really be explained by the ODA-vBM analysis.

**6.3.3 Projekt Skog**

**Public beneficiaries**
Users of Projekt Skog would primary be institutional users at PSBs with a mandate to maintain forest welfare, but according to interviewee MS4 other NGOs could be interested as well. Together these are the actors in the public beneficiaries category. Value is created in the form of an increased ability to quickly identify forest areas with high nature values with the help of a predictive machine learning model. Embedding the model in an API and providing a user friendly mobile application to query the API, needed resources would simply be a device with an internet connection and the costs are network charges for using it.

**Executive organisations**
Before discontinuing the creator still was the only actor developing and maintaining the ODA. Objectives in order to do so include: development of the machine learning model, API and a mobile application and maintaining of these. The ODA used resources such as the open data API from Artportalen, but received no revenue. Inflicted costs are again the operations expenditures for creating the ODA, as well as charges from cloud providers to serve the ODA.

**Service chain participants**
In order for the project to continue the developer had want to integrate the ODA into some large project at a PSB, such as SLU, Skogsstyrelsen, or Naturvårdsverket (Interview MS4). Whether the PSB had taken the role of executive or intermediary is left out of discussion, for analysis sake it is defined as a service chain participant. Value created includes reduced
cost for monitoring forest environments and enhanced ability to identify forest with high nature values. In order for the ODA to develop sustainably, the partnering PSB would have need to pay a partnership fee to the executive organization, which is covered by a potential government budget for forest protection.

**Society and nation**
Regarding value created for Sweden, the ODA provides increased knowledge on forest welfare. Important areas can be protected from harmful deforestation which in consequently protects the welfare of important animal and plant species.

**Summary**
In the current state of this business model there is a gap in that the ODA creates no revenue for the executive organization. The ODA has potential to create value for actors in the public beneficiaries group, in the form of governmental organizations and NGOs, as well as the category of society & nation in general, as forest welfare is a matter of national interest. Thus, some public sector body should be interested in the service and be able to fund development. The explaining factor for why these partnerships did not occur lies outside of the context the ODA-vBM analysis.

### 6.3.4 Biologg

**Public beneficiaries**
Users in the form of individual users and potentially pupils represent the public beneficiaries of Biologg. By providing a leisure activity in a popular format the ODA creates value for the public beneficiaries in the form of encouraged learning about nature in a fun way. It also provides easy access to open data about plant- and animal-life through a search functionality. Finally it facilitates social contribution by having users collect data about forest welfare, that can be used in research and by public sector. Individual users and students will play the game through the mobile application, consequently needed resources to use it is a mobile phone and an internet connection. Currently there are no plans to bill individual users for the service and in the case of a partnership with schools, the school and not pupils will probably be billed for the service. Thus, the costs for public beneficiaries to use the service are simply the cost of acquiring a mobile device and billing for internet connection.

**Executive organisations**
The two creators of Biologg is executively run the ODA. To order to do so they must develop and maintain the mobile app and supporting systems & services, increase brand awareness and customer usage. These operations inflicts costs, but currently the ODA generates no
revenue; however some planned partnerships could potentially change this in the future. The ODA relies on open data from Artportalen, which is funded by Naturvårdsverket, as well as different cloud services.

Service chain participants
As a currently active ODA Biologg has a number of current and planned service chain participants: Artportalen as open data provider, oppnadata.se, which is the open data portal serving as an intermediary, as well as county governments and schools as potential partnership actors. The most probable partnership would be one with one, or several, county governments (Interview MS2). For this type of actor value is created, as Biologg may provide the county government with up-to-date data on local plant and animal welfare, which can be used to make data-driven decisions. In exchange the partner would compensate Biologg for the data-partnership.

As a sidenote: all ODAs in studied in this thesis relies on a public open data publisher, which is an interesting dependency, differentiating ODAs from other types of software services. A potential vulnerability with this is that PSBs rely on government funding, allocated by politicians, in order to run their operations. Recently ArtDatabanken, which run Artportalen, was affected by this fact, when the absence of a Swedish government in 2018 caused the conservative block to enforce a premature budget for 2019. The budget, was hastily designed and among others, Natuvårdverket’s budget was reduced, endangering Artportalen’s open data API (SLU, 2019). This situation can be resolved through future budgets, but serves as an interesting example how ODAs depend on political differences in ways that other companies do not.

Society and nation
Similar to how Cykelranking create positive externalities for the Swedish population, Biologg encourages citizens to go out and explore nature which could have positive health effects. Furthermore, should county governments make use of the data, collected by users, to increase forest welfare this has obvious positive consequences for Sweden.

Summary
From the ODA-vBM analysis of Biologg one may conclude that the ODA has potential to create sustainable value, but in order to so there is one gap that must be addressed - the lack of recurring revenue streams to the executive organization. The end-users (public beneficiaries) are not paying customers; however there are a couple of stakeholders in the service chain participant category which the ODA could create value for and would potentially be interested in partnering with the executive organization. In order for the ODA to continue develop in a sustainable way, some partnership must be finalized.
6.3.5 Match Yourself

**Public beneficiaries**
Job seekers are the users of Match Yourself representing the public beneficiaries stakeholder category. Value is created as the ODA could improve the experience of applying for jobs and increasing the probability of finding a job that suits the applicant. Integrated into Arbetsförmedlingen’s, or other similar actor’s, services the ODA requires simply a device with an intranet connection.

**Executive organizations**
The creators of Match Yourself developed the ODA on their own, but would only continue development if they could integrate the ODA into Arbetsförmedlingen’s solution stack (Interview MS7). For the sake of analysis the creators are defined as the executive organization. Objectives include developing and maintaining the matchmaking algorithm as well as the supporting systems around it - which inflicts operation expenditures, but currently no revenue is created. Finally, the ODA relies on open data from Arbetsförmedlingen.

**Service chain participants**
Arbetsförmedlingen is defined as potential partnership to Match Yourself. The ODA create value for the PSB in form of automated personality tests of job applicants, benefitting Arbetsförmedlingen’s mission by providing a personalized matchmaking service. In exchange Arbetsförmedlingen would provide a partnership fee (or potentially take over development themselves and buy the solution from the creators). The resources at hand is a government budget and their own data assets.

**Society and nation**
The ODA has potential to boost economical growth, should the ODA able to decrease unemployment rate. Furthermore Sweden could benefit from a healthier population, if ODA is able to provide jobs people are happier with.

**Summary**
The ODA-vBM analysis of Match Yourself reveals another project with potential, but with loose ends. One can imagine how this kind of service will be a core part in Arbetsförmedlingen’s technical infrastructure in the future, creating value by not only showcasing jobs, but also suggesting them based on personal characteristics. If the solution actually performed it could reduce times to find a job and overall improving the experience of seeking employment - factors with a potentially big societal impact. The identified gap is, again, lack of recurring revenue to the executive organization. Explanations to why benefited stakeholder groups did not formed partnerships is not provided by the ODA-vBM analysis.
6.4 Analysis using business failure theory

In this section findings from the previous two sections are compared to documented reasons to why business, especially startups, fail. Again, to “fail” in this context simply means to cancel business and the purpose of the analysis is to find out whether the reasons for failure in the studied cases are in line with previous research, or not. The analysis of the cases mainly revolves around two of the three identified problem themes: the product and the entrepreneur. The third theme, the process, is mostly left out of analysis, since the short life span of the projects makes the theme redundant. Figure 14 illustrates a summary of the analysis.

<table>
<thead>
<tr>
<th>Problem/Solution fit</th>
<th>Product/Market fit</th>
<th>Entrepreneurs</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cykelranking</strong></td>
<td>Solution does not target a explicitly defined problem of consumers or a PSB, but historical cases speaks for the need of the solution</td>
<td>N/A - No development</td>
<td>Unpassionate entrepreneurs</td>
</tr>
<tr>
<td><strong>WamBox</strong></td>
<td>Identified a problem for which it provides a solution. ODA-vBM analysis suggests it could work; some Product/Market fit testing would be needed in order to confirm.</td>
<td>N/A - No development</td>
<td>Unpassionate entrepreneurs</td>
</tr>
<tr>
<td><strong>Projekt Skog</strong></td>
<td>Addressing an existing problem with a viable solution</td>
<td>Could not find who the solution is valuable for</td>
<td>Single entrepreneur, limited resources</td>
</tr>
<tr>
<td><strong>Match Yourself</strong></td>
<td>Solution does not address an explicit problem, but does target a explicit problem area (matching jobs) and is an interesting experimental opportunity.</td>
<td>N/A - No development</td>
<td>Unpassionate entrepreneurs</td>
</tr>
<tr>
<td><strong>Biovag</strong></td>
<td>The ODA targets a defined problem/solution fit, leisure activities with innovative technologies. Whether the market exists for the product remains to see.</td>
<td>MVP and user testing/validation in progress. Business model testing (Individual users, partnerships, etc.)</td>
<td>Passionate entrepreneurs, multiple talents, maybe missing a clear business person</td>
</tr>
</tbody>
</table>

Figure 14: Matrix of possible explanations for why a ODA failed or not. A green box represents a positive verdict in the category, yellow is neutral and a red box is a possible explanation for failure

6.4.1 Cykelranking

Beginning with the case of Cykelranking there is one obvious reason which speaks for the failure of the ODA. According to Giardino, Wang, and Abrahamsson (2014) a passionate entrepreneur is important in order to tackle obstacles that arise during the development of the project. The creators of Cykelranking were a group of employed IT-professionals,
who created the ODA as a team building activity and for putting their skills to a test. While competent, the creators were not very interested in starting a company and when they hit a roadblock - namely that the targeted PSBs were not interested in funding the project - they quit development. For the sake of analysis we also look at the second theme. While the ODA-vBM analysis showed that Cykelranking is missing an explicit owner of the problem the ODA is solving, the same analysis presented evidence for that at least one PSB have historically been in need of the services provided by the ODA. The analysis also displayed an array of actors who the ODA create value for, thus it seems to exist potential for sustainable development. Since failure to identify who creates value for whom is a critical factor for venture failure (Nair and Blomquist, 2019), would the creators of Cykelranking had chosen to continue the project, they would had needed to explicitly define whose problem they are solving - and what the problem actually is.

6.4.2 WarnBox

The creators of WarnBox share characteristics with Cykelranking’s: a group of colleagues, entering Hack for Sweden for creating the ODA as a team building activity. As presented in section 6.2 they also share the same lack of personal motivation to drive the project forward when faced with an obstacle. The ODA-vBM analysis in section 6.3 showed that the there should exist stakeholders who are interested in the ODA, which deems continued development viable. Since the solution was not developed further, it remains to see whether one could find suitable product/market fit from the solution. All in all, the most probable explanation to WarnBox’s failure is, according to conventional knowledge about startup failure, the entrepreneurs’ lack of passion.

6.4.3 Projekt Skog

Continuing with the case of Projekt Skog one cannot accuse the creator for lacking passion for the project. As briefly discussed in section 6.2 and described in section 5.2.3 the creator had a personal interest in forest protection and developed the ODA for a while without external funding. Of course one could always argue that there is a lack of passion should the entrepreneur chose to quit the project at any point in time, but then again this form of reasoning is not very helpful in analysis. A more probable reason for business failure can be found within the product theme. Projekt Skog has the problem that it is most valuable for a stakeholder group not considered in most business models: Swedish forests and animals. From this one can derive that it creates value for society, which in turn is represented by public sector bodies with a mandate to protect and improve the state of
Swedish forest welfare. The ODA-vBM analysis revealed that Projekt Skog indeed have potential to create value for PSBs, or other organizations with interest in forest protection, but that no partnership had been closed. A possible explanation for this is that it is uncertain exactly who is responsible for for forest welfare and thus it is uncertain exactly which PSB have budgeted funds for the cause. Two possible PSBs are Skogsstyrelsen and Naturvårdsverket. However, according to both interviewees MS2 and MS4, there seem to be a conflict of interest at these PSBs, where interests in forest protection are opposed by forest owners and loggers. Finally one could mention that according to Marmer et al. (2012) when a startup is run by a single entrepreneur, rather than by a couple of them, probability of failure is increased. It is possible that had the creator had a partner, they could have ran the ODA for a little longer until a long-term partnership had been found.

6.4.4 Match Yourself

The first problem and reason for failure, in the case of Match Yourself, is again that the creators are not interested in building a startup. The team building the ODA consisted of a couple of friends, highly competent, all interested in AI and how it can be used to solve societal challenges (Interview MS7). The second problem is that though they built the ODA for targeting the PSB Arbetsförmedlingen directly, the PSB was not interested in the service. Does this display a problem with the product/market fit? The short answer is yes, since Arbetsförmedlingen did not acquire the product. A more nuanced explanation, which is provided by the ODA-vBM analysis, is that though this solution solves a piece of the puzzle - that is Arbetsförmedlingen’s problem of finding employment for citizens - this kind of solution is ahead of its time. The solution solves a problem that is not maybe not yet defined within Arbetsförmedlingen, but it is still a viable problem/solution fit.

6.4.5 Biologg

Since Biologg have not failed the case is analyzed differently; instead of identifying what reasons there were for failure, it will focus on potential threats that may cause failure in the future. Beginning with the entrepreneurial theme, the case looks strong. The two creators are passionate, personally invested in the project and complement each others’ skills. The team could be complemented with more business characteristics, but on the other hand taking in more people this stage could potentially be disadvantageous - which is discussed later on. Regarding the product, Biologg seem to have identified a viable problem/solution fit. Using modern techniques they target a new area of mobile games, the location based ones, which became popular with the famous Pokémon Go. However, Biologg has yet to
find its product/market fit, since the ODA has not identified a stakeholder willing to pay for the product. Failure to do so could mean failure for the company, as the creators must begin receive compensation for their value creation process. Finally one may look at the process theme. As mentioned earlier, it could be potentially disadvantageous to hire people at this stage and if not absolute necessary, they should not do so. The reasoning behind this is that a startup should only spend resources on activities necessary for the current stage of development, in order to avoid premature scaling (Marmer et al., 2012).
7 Discussion

The purpose of this thesis is to study five ODA initiatives, created during the publicly funded open hackathon Hack for Sweden, to identify reasons why ODAs discontinue and how these ventures can be supported to increase their longevity. Research gaps in previous research were identified, and from these, three research questions and one macro question were formulated. This chapter aims to answer the research questions by discussing findings from the five studied cases, drawing from analysis and previous research.

7.1 Characteristics of an Open Data Application

This section discusses and presents answers to the first research question:

What are common characteristics for open data applications?

Findings suggest that open data applications cover several of the business roles described by Lindman, Kinnari, and Rossi (2016): data extraction, transformation, and analysis, as well as user experience. This is expected, since the market for open data services is a new one and there are not enough actors to provide niche services. As the market matures, one could expect to see businesses focusing on one of the business roles, e.g., extracting and analyzing open data from publishers for other user experience providers to use. Furthermore, the results showed that most open data applications deliver their services either through a full-stack application (web or mobile). In some cases, such as Projekt Skog and Match Yourself, the core of the project is a statistical model that can be served via an API. However, querying and interpreting the response from the APIs requires specialized competence in programming and web technologies, thus the creators are required to wrap the models in a user-friendly interface to teach stakeholders about the usefulness of the ODA.

The results also showed that the majority of the ODAs are built with individual users in mind, but the intended customer is a public sector body. This raises the question: why do most of the ODAs consider the public sector as their main customer? A possible answer is that the ODAs were all created during Hack for Sweden, where a lot of public sector representatives are present; potentially this biased creators to build solutions which public sector bodies would be interested in. Further research needs to be done to determine whether this applies to ODAs created outside the context of public hackathons. Another possible explanation is that many open data applications share certain characteristics, which makes them difficult to monetize through consumers. Analysis found that open data applications can sometime
be classified as public goods, effectively depending on whether the ODA cannot motivate a premium to be paid by individual users. Assuming the ODA creators act in own self-interest, they would bill the user if they knew that the ODA was valuable enough to the user, but evidently many of the cases did not. This does not mean that the ODAs are not valuable at all, but that *to each individual the marginal benefit is lower than marginal social benefit*. This is a characteristic of a public good, as described by Krugman and Wells (2013) and accordingly the good must be provided as such. Thus, the ODA creators are left with the choices of funding their good with donations, advertisement, or government funding (as forced exclusiveness has already been deemed infeasible in those cases) and in the studied cases, they turned to the public sector. From these discussions it is concluded that open data applications have a couple of common characteristics. First, they perform all of the operative tasks: extraction, transformation and analysis of data, as well as working with user experience. Second, they often provide their deliver their services through a web- or mobile application. In some cases the core of the ODA is a statistical or computational model, served via an API, but nevertheless for a non-technical person to make use of the ODA, it must be wrapped with a user interface. Third, open data applications often create societal value, which finally implies that under some circumstances they classify as public goods, thus cannot be efficiently be provided by the market.

### 7.2 Why Open Data Applications fail

Before discussing the findings I would like to stress some important points. Starting and running a business is difficult. In fact, it is so difficult that researchers tend to agree that most business fail within the first couple of years (Giardino, Wang, and Abrahamsson, 2014; Marmer et al., 2012; Feinleib, 2011). Thus failure is a natural part of business and should be embraced, as advocated by some (Blank, 2011). That being said, this thesis is interested in expanding the knowledge about why certain business fail and it aims to identify *reasons* to why this happens, other than "entrepreneurship is difficult".

Continuing on, this section discuss and presents answers to the second research question:

*Why do many open data application initiatives discontinue early in development?*

The five examined cases have been analyzed using business model theory and common reasons for why business- and startups fail. The ODA creators have been able to tell their stories about the projects and informants from the public sector have provided supplementary information. Here I discuss the findings and resulting analysis of why these open data applications failed, or not. The discussion is summarized in figure 15.
Beginning with the analysis of common failure themes for startups, there was especially one theme the discontinued cases shared, the entrepreneurial theme. Findings showed it is not that the ODA creators are missing entrepreneurial characteristics, as described by Nair and Blomquist (2019) and Feinleib (2011); to the author they all seem technically competent, knowledgeable about the field of open data, and have a business mindset. It is more that they are not interested in taking time from their current occupation to start a new venture filled with uncertainty. Though it may seem obvious, lack of passion/motivation to develop the ODA - when the enterprise is coupled with uncertainty - can therefore be seen as an critical factor for ODA failure, as described by Giardino, Wang, and Abrahamsen (2014). However, the answer to the research question is not that simple. First, there is at least one case clearly contradicting the rule (Projekt Skog). Second, the creators’ passion for their projects is not a static binary variable, but continuously fluctuating depending on the context. The analysis of ODA creators’ opinions found that the creators perceived the return on investment from the projects to be low, which can be derived from a shared concern over how to fund the projects. Also, since all cases have identified a viable problem/solution fit, there seem to be other reasons for why many of the ODAs discontinued.
Continuing with the constructed value centric business models for the ODAs, analysis revealed that all of the cases had promising proposal for value creation, but no paying customers - which is an obvious gap and problem\(^5\). Section 7.1 laid out how some ODAs may be categorized as public goods and thus have a problem of generating revenue from individual users. This explains the lack of revenue streams from the public beneficiaries group. However, in all cases the ODA-vBM analysis showed that there exist actors from other stakeholder groups, which the ODA potentially could create value for. Many of these actors were public sector bodies which in one way or another could benefit from the services of a studied ODA. Why these partnerships never happened is left unexplained by the ODA-vBM analysis, but can be answered from another perspective.

Looking at the answers of public sector informants, there seems to be a problem with how to fund the ODAs. In some cases the ODAs are missing a explicit problem owner within the public sector organization and when they do have one, the ODA still do not meet the specific needs of the problem owner. While these problems present obstacles for a cooperation between the ODAs and public sector, considering the process through which the ODAs have been created the obstacles are not surprising. The applications developed in a hackathon can be viewed as some type of spontaneous citizen innovation, which target some societal problem formulated as a challenge in the hackathon. They are thus not the result of a public procurement process, where a specific PSB define their needs and requirements on the application. Here there seems to be a discrepancy in the process of developing applications for societal problems; on the one hand public actors would like to involve citizens in the innovation process, but on the other hand they cannot make use of the applications created in the process. A possible solution to this problem was presented in section 6.2.2, which will be further discussed in the upcoming section regarding RQ3.

Combining the various perspective, one may conclude that the problem of many open data applications failing is - just as previous research have shown for other types of business failure (Bruno, Leidecker, and Harder, 1987) - a multidimensional problem. Regarding creators of the ODAs, especially motivation to start a business and being able to identify for whom and how the ODA is creating value are critical factors in order to avoid failure. Regarding the public sector as a customer for the ODA, finding ways to acquire a spontaneously created application seems to be a big obstacle in order to avoid ODA failure.

\(^5\)It is not unusual for startups to lose money for several years of development, for example Spotify recently reported its first quarter with positive operating income, net income, and free cash flow - after more than a decade of operations (Spotify, 2019). This does not mean that employers at Spotify have not received salaries for a decade - at some point a startup must begin creating value for their employed ones. However, in the current state the business models reveals a total lack of revenue streams. So, in contrast to Spotify the ODAs will never break even on their services.
7.3 Supporting the creation of Open Data Applications

This section discusses and presents answers to the third research question:

*How can the public sector and open hackathons support the creation and development of open data applications?*

Initiatives from the Swedish public sector, such as Hack for Sweden and similar, are part of a bigger vision to advance data-driven innovation and digitalization in Sweden (Hack for Sweden, 2018a). More specifically, Hack for Sweden aims to engage private- and public sector, as well as academia, to interact and collaborate in citizen-driven innovation, which may benefit the nation (Hack for Sweden, 2019b). As have been shown in this thesis, initiatives such as Hack for Sweden make a good effort to spark innovation, but evidently do not succeed in creating long-term value for society (in terms of producing open data applications that develop sustainably). The hackathon does produce some ODAs that are able to support themselves, e.g. Biologg. However, most produced cases seem to fail, since the market is unable to efficiently supply and demand the types of goods that these cases provide. If the goal of Hack for Sweden and similar initiatives is to produce only open data applications that may survive on their own, this result is satisfactory, since business failure is the natural result of market selection mechanisms and few startups succeed (Giardino, Wang, and Abrahamsson, 2014; Marmer et al., 2012; Feinleib, 2011). However, if the goal is to also produce ODAs, which otherwise would not be produced by the market, yet creates value for the public sector or society in general, further measures need to be taken.

Essentially, two parties must meet: spontaneous citizen innovation projects and the needs’ of public sector bodies. The new platform-based way of fostering citizen innovation presented in 6.2.2 solves the two main problems of funding ODAs: each challenge have an explicit problem owner and the challenges are tailored to the problem owner’s specific needs. However, this new channel for innovation raises other issues. First, how is this process - of formulating and arranging a challenge for citizens, or business, to solve - different from the standard public procurement process? Second, how will the public sector then tap into the spontaneous citizen innovation that is being produced during hackathons, or elsewhere? One of the perks of a hackathon is that the organizing actor(s) will receive solutions that one maybe had not thought of otherwise. Moving to challenges implies the organizer must on beforehand specify the problem to be solved and what requirements a solution should meet, which is a tedious process and difficult if one do not know what to ask for. However, these questions are topics for further research.

Regardless of process for collecting citizen innovation, hackathon or innovation platform, the important issue to solve is how to work with the ideas after initial prototype phase. At
this stage the solution will at best solve some of the demands of the problem owner. Therefore, when an ODA project have won the hackathon/challenge and the problem/solution fit have been found, the problem owner must work with the ODA creator(s) to iterate a viable product/market fit. The ODA creators cannot be expected to do this work without guarantees, therefore I propose one of two arrangements: either the problem owner may acquire the ODA prototype and take over development themselves, or fund development while creators remain the executive organization and act on a contract for the problem owner. To choose between the two one must consider questions such as:

- Does the problem owner have a competent IT-department able and willing to take over development?
- Will the ODA reach its full potential without the initial creators?

and so on. Acquiring the ODA prototype may result in an straightforward procurement process, as the procured price for the prototype will be lower than for the cost of further development. However, the decoupling of the initial visionaries and creators of the ODA may lead to a sub-optimal application and the costs for internal development may exceed the opportunity cost for contracting external development. Contracting the creators to continue development of their ODA at the problem owner’s premises will increase the probability of the ODA reaching its full potential. It is still important that the problem owner have its own project owner, which is enough competent and knowledgeable to guide the contracted creators in the problem owner’s domain. How the contract is to be arranged may seem complex, however as argued by interviewee MS5, Swedish public sector bodies have quite flexible procurement alternatives. One example of such a flexible procurement procedure, suggested by interviewees MS5 and PS5, is the ”Innovationspartnerskap” (innovation partnership), where the public sector body procure both development and acquisition of the good (Upphandlingsmyndigheten, 2019).

On a final note, I would like to point out that there might exist a problem in the top level of public sector, hindering public sector bodies from collaborating with ODA creators. Section 6.2.2 discussed how a public sector body’s spending is, in addition to public procurement laws, governed by the state government through letters of appropriation and similar. A letter of appropriation contains information on what funds a PSB disposes, as well as terms and demands for reporting how the funds are used (Regeringen, 2016). Investing in an open data application could be seen as a kind of investment in innovation, i.e an investment with high risk and one should not expect to find support for such investments in the letter of appropriation. If so, there exist a problem with governance of the PSBs and would then be need to be solved at the level of Swedish government offices or directly by the government. Further research on the topic would be needed to be confirm the problem, but it is left here as a consideration.
Overall one may conclude that the Swedish public sector, with initiatives such as Hack for Sweden and similar, is doing well in supporting the creation of open data applications. The field of open data service creation is a relatively new one and many practitioners learn of the field for the first time when they come in contact with Hack for Sweden. Thus, it is realistic to claim that, without the effort from actors within the public sector, most of these open data applications would never had been created. With that being said, further measures must be taken to ensure that these open data applications actually contribute to society over time.
8 Conclusion

The purpose of this thesis was to study five ODA initiatives, created during the publicly funded open hackathon Hack for Sweden, to identify reasons to why ODAs discontinue and how these ventures can be supported to increase their longevity. This chapter aims to summarize the research, conclude findings and answers to the studied research questions, explain theoretical and practical implications of the research and present topics for further research.

8.1 Summarizing the research

This thesis departed from a number of identified gaps in previous research. Researchers had found that the integral actor for creating value from open data is a entrepreneur/hacker who builds services around it for non-technical people to use (Kuk and Davies, 2011; Lindman, Kinnari, and Rossi, 2014) and C.-C. Yu (2016) had defined this entity as an open data application. However, there was not much detail on what characterizes these ODAs. Furthermore, researchers had identified that most ODAs do not survive beyond prototype stage (Kuk and Davies, 2011; Temiz and Brown, 2017) and there was a gap in explaining why that is. Finally, researchers had found that simply releasing data will not cause hackers/entrepreneurs to build open data applications, due to the lack of incitaments (Kuk and Davies, 2011; Hellberg and Hedström, 2015). This spurred the need to investigate how public sector and hackathons can further support the development of ODAs. From these gaps, three research questions were formulated:

- RQ1: What are common characteristics for open data applications?
- RQ2: Why do many open data application initiatives discontinue early in development?
- RQ3: How can the public sector and open hackathons support the creation and development of open data applications?

The nature of the RQs deemed a case study would be the most suitable research approach (Yin, 1994). More specifically a multiple case study was chosen, to be able to generalize findings and contrast the perspectives of active and inactive cases. Five cases were studied, which is a satisfactory amount to begin generalizing findings in an analytical sense (Eisenhardt, 1989), but to strengthen the external validity of the results more cases need to be studied in the future. Furthermore, one drawback with the choice of cases was that only one of the cases had remained active. This made it harder to distinguish what differ-
ences there may be between a successful ODA-case and a discontinued one. Also, the sole active case had only been in business for about a year during the time of this thesis, which makes it difficult to tell what factors contribute to sustained development in the long-term. However, since the study focused on why many ODAs discontinue, this set of cases was more favorable than the opposite would have been (4 active and 1 inactive). Moreover, the study focuses on why many ODAs discontinue early in development, so while it had been interesting to study more mature projects in the future, the limitation of immature cases should not have affected findings in this thesis.

For data collection, interviews, documents & archival data and to some extent observation, were used. ODA-creators of the cases were interviewed, as well as representatives from the public sector. This helped avoiding bias and keeping a critical approach to both sides, as data from several perspectives was gathered. However, one key point that needs be addressed is that informants from the public sector never discussed any specific case, but their opinions and views on cases of open data applications in general. Thus, when describing the relation between a case an the targeted public sector body (e.g Cykelranking - Trafikverket, Match Yourself - Arbetsförmedlingen), the situation is described from the ODA creators’ point of view and not the PSB’s. This limitation would be interesting to address in a future study as well, studying a case from both the creators’ and the specific PSB’s perspectives.

Findings were drawn by directly summarizing informants opinions about the studied problems, as well as applying analysis from a business model perspective and business failure theory perspective. The concept of value and the process of value creation from innovations made discussions more stringent. These are otherwise quite abstract concepts and as a core part of this thesis is trying to understand what value is created by who, for whom it is absolutely necessary to concretely define them. A possible flaw with the analysis was that it have been carried out by a single researcher, i.e me. This may have affected the outcomes of the thesis in a number of ways, for example as a single researcher I am more vulnerable to confirmation- and anchoring bias, as when there are two or more researchers, at least those researchers’ biases are averaged out. To address this flaw, the thesis have been reviewed by informants, supervisors and peers. Hopefully this have mitigated any level of impact my bias may have had on analysis, or findings.

On a final remark I present the two limitations. First, this thesis was conducted during the set time period between January and May 2019. Extending the period of research would have enabled more cases to be studied as well as going back and collect data from the affected PSBs in each case. Second, geographical constraints put restrictions on some meetings and interviews as they hade to be done digitally, instead of face-to-face.
8.2 Concluding answers to research questions

With the limitations discussed in the previous section in mind, this section will now conclude the main findings of the thesis.

The thesis shows that the studied cases fit the description of open data applications, as described by C.-C. Yu (2016), as well as several of the business roles described by Lindman, Kinnari, and Rossi (2016). In many ways they are similar to any other type of data driven software business and may be treated as such. However, the research shows that open data applications do have some characteristics that makes them different from ordinary software applications. First, the ODAs share a dependency on the data publisher, oftentimes a public sector body, which makes them vulnerable when the publishers’ operations are threatened by political conflicts. Second, many ODAs provide a type of goods that benefit society, but - because of certain market mechanics - self-interested users will not be interested in paying for these goods.

This thesis also shows that there are a number of reasons contributing towards the success or failure of an open data application. First and foremost the entrepreneur(s) behind the ODA must be willing to start a business, or at least develop it beside another main occupation. This motivation will depend on the prospect of being able to get some kind of return on investment, from time spent on development, and can be encouraged by actions from interested stakeholders. Second, in line with previous research (Altman, 1983; Nair and Blomquist, 2019; Giardino, Wang, and Abrahamsson, 2014), the entrepreneur(s) must identify and specify how the ODA creates value and for whom. This is known as identifying a problem/solution- and product/market fit, which can be modeled through the ODA-vBM framework - by C.-C. Yu (2016). Third, should the ODA target society, or the public sector as main benefiting stakeholder, chances are that the services of the ODA are public goods and will then need support in order to develop in the long-term.

Finally, the research shows that the public sector, with initiatives such as Hack for Sweden, is already doing well in supporting the creation of open data applications, but further measures must be taken in order for the created ODAs to survive and create value for society in the long-term. Concerning the problems of the hackathon as an innovation creation procedure, some public actors suggest to (and in some cases have already started to) replace them with challenge-based platforms. These platforms deal with some of the problems addressed in this thesis, such as assigning a clear problem owner to the ODA, but still leaves some other questions unanswered, such as how problem owner and ODA creators should work together to jointly develop the ODA.

To conclude, there seems to be a number of reasons contributing towards to long-term
development of an open data application. First, there must be one, or several entrepreneurs, willing to take a risk. Second, the entrepreneur(s) must identify a viable problem/solution fit and then a product/market fit. Trying to validate a product that does not solve any particular problem for a market, is condemned to fail. Finally, in the cases where the open data application target a public, or societal, stakeholder the two must cooperate in the development of the ODA.

8.3 Implications

This section discuss what implications the thesis may have for academics and practitioners. The implications for practitioners may be seen as my recommendations on how to solve some of the obstacles that lies in the way for value creation from open data.

**Academic implications**
This thesis departed from several research gaps, which through the research all have been addressed. To begin with, the research expands on the field of open data services and common characteristics for open data applications, drawing from studied cases. Also, the results of the conducted research extend the knowledge about reasons to why many open data services discontinue, which has been called upon by previous research (Temiz and Brown, 2017; Lindman, Kinnari, and Rossi, 2016; Kuk and Davies, 2011). Furthermore, the thesis expands on how the public sector and hackathons may further support long-term value creation from open data. Additionally, the thesis contributes to research by introducing the Open Data Ecosystem model, which clarifies relationships and the flow of resources between various actor within the open data ecosystem.

**Implications for practitioners**
The research may serve as advice for both prospective open data entrepreneurs and actors within the public sector. For entrepreneurs seeking to innovate, in the new market of open data services, this thesis contributes with information about the market and how to avoid failure. For public actors, the thesis presents a set of problems and solutions for fostering open data innovation.

Moving forward, Hack for Sweden, DIGG and other public actors should consider what are the explicit goals for hackathons, or challenge platforms how to measure success. For example, Hack for Sweden have grown considerable the last years, in terms of amount of participating hackers and collaborators, but the amount of projects continuing after the hackathon is over seemingly remain low. The growth of the event surely helps spreading knowledge and promote the use of open data in general, but long-term value creation for society will require different actions, than spreading general knowledge about open data.
It could be that the goal of Hack for Sweden simply is to promote the creation of open data services and that long-term value creation is left for the challenge-platforms, or by individual entrepreneurs. If so is the case, growing participant numbers is merely positive, but anyone interested in long-term value creation, based on open data, must set other goals and address the problems discussed in this thesis.

8.4 Future research

This thesis have proposed answers to several questions regarding service creation based on open data, but there is still much research to be done.

To begin with, further research need to be done on reasons for success, or failure, of open data applications. This thesis presents five cases that serves as a good basis, but increasing the number of studied cases would increase the external validity of the findings. Secondly, a theory developed in this thesis is that ODAs will oftentimes provide a product that classify as public goods. Further research need to be done if this applies to open data applications in general or if it is mostly prevalent when the ODA have been created in a context close to public sector bodies. Third, the research raises questions regarding what obstacles exists for generating citizen innovation, as well as how to fund it. Further research need to be done on what kind of channels are the most effective for generating citizen innovation and if what governance issues might preventing PSBs from investing in innovative projects.

Some suggestions for future research topics are:

- What types of services and datasets can open data applications target to increase their independence from public support?
- Do open data applications, created outside the context of public hackathons, provide public goods as well?
- What are the benefits and drawbacks of channeling citizen innovation via challenge platforms, compared to hackathons?
- How does governance of public sector bodies affect the possibility of investments in open data applications?
References


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Kuk, George and Tim Davies (2011). “The roles of agency and artifacts in assembling open data complementarities”. In:


Miles, Matthew B and A Michael Huberman (1994). Qualitative data analysis: An expanded sourcebook. sage.


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Appendices

Appendix A  Interview templates

A.1  Interview template pre-2018

Interviewee  Date & Time  Title/Position

Introduction
1. Who are you?
   - Age
   - Education
   - Experience with open data or software in general
   - Background to participate in Hack for Sweden

2. What does your company/ODA do?

3. What value does this create and for whom?
   - Users
   - Society & Nation
   - You as developers

4. What data/system/services is needed for the ODA?

5. In what way is/could this ODA been monetized?

Post-Hack Development
6. What happened after H4S?

7. Did H4S in any way encourage for further development?

8.A. If no further development
8.A.1 Why did you choose not to continue develop the project?
8.A.2 What could have motivated you to continue develop the project?

8.B. If further development
8.B.1 What motivated you to continue with the project?

8.B.2 Did you cooperate with H4S in some way?

**General about Development**

9. What do you see is the biggest challenge for continued development?

- Business?
- Technical? - Own tech or open data landscape
- Legal?

10. What do you think is most important for successfully building a sustainable service based on open data?

**Other thoughts**

Besides what has been brought up so far, what are your thoughts about OD, ODAs, etc.?

**A.2 Interview template post-2018**

As the 2018 version of Hack for Sweden offered an incubator program as part of the prize the questions to winners in 2018 was slightly modified. The second version of the interview template was almost the same as the previous version, except for the following questions:

7. How did you decide to/not to continue developing the project?

8.B. If further development
8.B.1 How did the cooperation between you and incubator look like after H4S?

- co-working space
- development plan
- tech/business coaching?

8.B.2 How did you experience the cooperation?
A.3 Interview template - Public Sector

Interviewee Date & Time Title/Position

1. How do you work with Open Data?

2. How have Hack for Sweden continued working with the ODAs after the hackathon is over?

3. Do you know whether any of the projects are still active?
   - If so, how are they doing?

4. What do you think are the biggest problem for ODAs, created during Hack for Sweden, to continue develop?

5. What do you consider the biggest obstacle for long term value creation from open data?

Asked to informants later on:
6. Many of the ODA founders consider funding the largest obstacle for continued development, what do you think about that?

7. Do you see a problem with large corporations could benefit the most of open data?
<table>
<thead>
<tr>
<th>Stakeholders - Roles</th>
<th>Values created through objectives</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public beneficiaries - Individual users</td>
<td>Enhancing learning by providing a leisure activity which enables learning about local nature in a fun way; Being able to access open public sector data easily by providing search and visualization of animal and plant species; Facilitating public participation (in gathering data) and engagement by logging species in app</td>
<td>Internet connection, mobile device</td>
<td>Fee for internet connection, Free access for individual users</td>
</tr>
<tr>
<td>Executive org. - Overstellar - ODA creators</td>
<td>Business value, business development and good-will by creating and maintaining the mobile app, creating revenue and profit, increase brand awareness, increase customer usage</td>
<td>Open Data from Arportalen/SU; Initial funding from HFS; Revenue: None, potential revenue from partnerships</td>
<td>Development of ODA-app, website and systems, Operation expenditures and cloud services</td>
</tr>
<tr>
<td>(Potential) Service chain participant - County governments as partnership</td>
<td>Promote animal and forest welfare by making data driven decisions based on collected data; Promote civil engagement and efficiency gains in data collection by allowing citizens contribute directly to national datasets</td>
<td>Government budget, business assets</td>
<td>Partnership fee for gathering data</td>
</tr>
<tr>
<td>(Potential) Service chain participant - Schools</td>
<td>Promote learning, knowledge seeking and promoting student health by providing an interactive learning tool that promotes spending time in nature</td>
<td>School budget,</td>
<td>Fee for using the services</td>
</tr>
<tr>
<td>Service chain participant - Government (Arportalen, SU) as OD provider and oppnadata.se as portal</td>
<td>Fostering re-use of public sector information by promoting OD reuse, keeping OD repository and API up to date; Offering opportunity for citizen and agency engagement (collecting data, etc); Enabling monitoring of forest and species health, Efficiency gains in data collection, Sustainability</td>
<td>Open Government Data, Government budget, Business assets</td>
<td>OD repository and API maintenance, OD portal maintenance, Operations expenditures</td>
</tr>
<tr>
<td>Service chain participant - Cloud and other system providers</td>
<td>Business value - promote usage of technical assets</td>
<td>Revenue from Biologg</td>
<td>Cost for cloud services usage</td>
</tr>
<tr>
<td>Society &amp; Nation</td>
<td>Promoting learning and discovering of local nature, promoting health and animal/forest welfare, boosting economic growth</td>
<td></td>
<td>ICT adoption, infrastructure cost</td>
</tr>
</tbody>
</table>
### Match Yourself

<table>
<thead>
<tr>
<th>Stakeholders - Roles</th>
<th>Values created through objectives</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public beneficiaries - Individual users</td>
<td>Improving experience of seeking employment by providing a personalized job recommendation engine</td>
<td>Internet connection; mobile device or computer</td>
<td>Fee for internet connection</td>
</tr>
<tr>
<td>Executive org - Match Yourself - ODA creators</td>
<td>Business value by: Developing and maintaining test analysis model, API and other ODA services</td>
<td>Open data from: Arbetsförmedlingen; Revenue: None, potential revenue from partnership</td>
<td>Development of ODA-model, API and systems, Operation expenditures and cloud services</td>
</tr>
<tr>
<td>(Potential) Service chain participant - Arbetsförmedlingen</td>
<td>Benefitting Arbetsförmedlingen mission by providing a personalized matchmaking service to job applicants; Decreasing manual work with automated personality test</td>
<td>Government budget; Current systems and infrastructure for providing employment to applicants</td>
<td>Partnership fee</td>
</tr>
<tr>
<td>Service chain participant - Government (Arbetsförmedlingen) as OD provider and oppna.data.se as portal</td>
<td>See ODA-vBM analysis for Biologg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Society &amp; Nation</td>
<td>Boosting economical growth if ODA able to decrease unemployment rate; Healthier population if ODA able to provide jobs people are more comfortable with</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Figure 17: ODA-vBM of Match Yourself**

### Projekt Skog

<table>
<thead>
<tr>
<th>Stakeholders - Roles</th>
<th>Values created through objectives</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public beneficiaries - Users (Institutional or NGO)</td>
<td>Enhances ability to quickly identify areas of forest, with high nature value, by using a predictive machine learning model</td>
<td>Mobile app, Internet connection</td>
<td>Internet usage cost</td>
</tr>
<tr>
<td>Executive org - Projekt Skog - ODA creators</td>
<td>Business value and personal interest by developing and maintaining machine learning model, API and other ODA services</td>
<td>Open data from: Arportalen, SLU; Potential data space at SLU; Revenue: None, potential revenue from partnership</td>
<td>Development of ODA-model, API and systems, Operation expenditures and cloud services</td>
</tr>
<tr>
<td>Service chain participant - Partnership with PSB (e.g. SLU) or county government</td>
<td>Enhances ability to quickly identify areas of forest, with high nature value, by using a predictive machine learning model; Reducing cost of monitoring local forest areas, by using the service instead of manual labor</td>
<td>Government budget, business assets</td>
<td>Partnership fee</td>
</tr>
<tr>
<td>Service chain participant - Government (Arportalen, SLU) as OD provider and oppna.data.se as portal</td>
<td>See ODA-vBM analysis for Biologg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Society &amp; Nation</td>
<td>Increased knowledge about status on forest welfare; Able to take actions against harmful deforestation; Increased forest &amp; animal welfare</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 18: ODA-vBM of Projekt Skog**

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<table>
<thead>
<tr>
<th>Cykelranking</th>
<th>Values created through objectives</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public beneficiaries - Users (Private, Media, Municipalities)</td>
<td>Encourage increased use of bicycles as a method of commute by increasing knowledge about bicycle friendliness in municipalities and providing search functionality for a specific municipality; Easy overview of public data on bicycle roads and historical accidents by visualizing open data on map</td>
<td>Internet connection, mobile device</td>
<td>Fee for internet connection, Free access for individual users</td>
</tr>
<tr>
<td>Executive org. - Cykelranking - ODA creators</td>
<td>Business value by creating and maintaining the mobile app, creating revenue and profit, increase brand awareness, increase customer usage</td>
<td>Open data from Trafikverket, Trafikförvaltningen; Revenue: None, potential revenue from partnership</td>
<td>Development of web-app and systems, Operation expenditures and cloud services</td>
</tr>
<tr>
<td>(Potential) Service chain participant - Partnership with Public sector body</td>
<td>Increased awareness of bicycle friendliness in municipalities and where problem areas exist by the provided ranking system and visualization of bicycle roads and historical accidents</td>
<td>Government budget</td>
<td>Partnership fee</td>
</tr>
<tr>
<td>Service chain participant - Government (Trafikverket, Transportstyrelsen) as OD provider and oppnadata.se as portal</td>
<td></td>
<td>See ODA-vBM analysis for Biologg</td>
<td></td>
</tr>
<tr>
<td>Society &amp; Nation</td>
<td>Encourage increased use of bicycles as a method of commute &amp; knowledge of potentially dangerous areas in municipalities, promoting health of citizens, reduced carbon emissions and boosting economic growth</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 19: ODA-vBM of Cykelranking

<table>
<thead>
<tr>
<th>WarnBox</th>
<th>Values created through objectives</th>
<th>Resources</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public beneficiaries - Users</td>
<td>Provides a comprehensible crisis alarm by having a personal broadcaster that may read localized and granular PSAs; Enhances citizens catastrophe readiness by reducing the &quot;cry wolf&quot;-factor of current PSA system; Democratizes PSAs by providing alerts in several languages</td>
<td>WarnBox hardware and service, Internet connection</td>
<td>Fee for internet, Potentially: one time fee for WarnBox, or subscription fee for the service</td>
</tr>
<tr>
<td>Executive org. - Cykelranking - ODA creators</td>
<td>Business value by developing or outsource the development of WarnBox hardware; creating and maintaining the ODA-system, creating revenue and profit, increase brand awareness, increase customer usage</td>
<td>Open data from MSB, SMHI; Revenue: None, potential revenue from partnership</td>
<td>Development of ODA-environment and systems, Operation expenditures and cloud services</td>
</tr>
<tr>
<td>(Potential) Service chain participant - Partnership with county government</td>
<td>Enhanced crisis awareness and readiness among citizen by improving PSA comprehensibility, reach and granularity of crisis messages</td>
<td>Government budget</td>
<td>Partnership fee</td>
</tr>
<tr>
<td>Service chain participant - Government (SMHI, MSB) as OD provider and oppnadata.se as portal</td>
<td></td>
<td>See ODA-vBM analysis for Biologg</td>
<td></td>
</tr>
<tr>
<td>Society &amp; Nation</td>
<td>Enhanced PSA reachability, Able to broadcast more granular messages, increased awareness,</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 20: ODA-vBM of WarnBox

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