STAVANGER SMART CITY

STAVANGER SMART CITY INITIATIVE: THE UTILIZATION OF OPEN DATA ENFORCES INNOVATION

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STAVANGER SMART CITY INITIATIVE: THE UTILIZATION OF OPEN DATA ENFORCES INNOVATION

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Abstract

Many governments and municipalities are implementing smart solutions to their cities. Open data is a term used to describe sets of information published in a portal to be publicly available and free to utilize, reuse, and distribute. Many data sets are collected and published in the open data portal. However, the benefits contained in the open data are still facing the challenges to reap open its full potential. Therefore, with the implementation of open data, Stavanger municipality is expecting an increase in public participation of the smart city initiative.

However, the utilization of open data is as a topic of research is still nascent with little research having been conducted to date. Open data as a smart city initiative has limited research established in Norway. The author of this thesis has organized and conducted an explanatory case study with in-depth semi-structured interviews. The thesis implements this method in order to examine how open data enforces innovation. Hence, it mainly discusses the exploitation of open data that can enforce innovation discussed in the supply and demand for open data. The supply and demand entail the management of open data and how to entice public participation and what factors should be emphasized to unlock the potential of open data for innovation. Moreover, the positive and negative aspects of implementing open data partake in this discussion. These entail theme such as the challenges risen from the application of smart city and also the betterment which the public can benefit from open data as the implementation of a smart city in Stavanger Municipality.

Keyword: Open Data, Initiative, public participation, innovation.

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Preface

This thesis is written as the final requirement to finish the degree of Master of Business Administration at the University of Stavanger. The research is carried out using a qualitative approach and is written by Rizkika Widya Tarandeli during the spring semester of 2019, which constitutes 30 ECTs.

The thesis aims to reveal the benefit of utilizing the open data provided by Stavanger Municipality in the process of implementing the smart city project. The open data from the city of Stavanger has many potentials, yet they are still difficult to fulfill. This thesis has been challenging and time-consuming, although, the experiences gained in the completion of the thesis have given me comprehensive knowledge I believe will benefit me in the future.

I want to extend my utmost gratitude toward my supervisors, Professor Jan Frick, and Hilde Ness Sandvold, for allowing me to undertake this topic. I am indebted for the continuous guidance throughout the entire process and for providing me with critical and constructive feedback for my thesis.

Many thanks are also due to my families and friends for letting me experience the incredible journey of a master's degree filled with their constant support, discussions as well as sincere kindness I can barely return. Thanks are also greatly addressed to the municipality of Stavanger for the information and guidance. The thesis would not have been possible to finish without their contributions and support.

Last but not least, I would like to thank my husband, Vetle Volden-Freberg, who is always there for me, for bringing the greatest love, encouragement, and support in my life. In addition to providing advices and comments with regard to the writing for the whole thesis.

Stavanger, June 2019

Rizkika Widya Tarandeli

Concepts

Big Data: Unstructured large sets of data

Data set: A collection of sets of information

Digitalization: The conversion of data from analog into a digital form

Digitization: The act of digitizing processes

Data visualization: The effort to increase the significance of data by placing it in a visual context

Data exploitation: The effort to increase the potential value or benefit of data for the utilization purpose

Public Data: The collection of data that is available to the general public but not necessarily open.

Data: Information or recordings electronically stored that includes documents, contracts, transcripts, and recording of events.

API: a set of functions and procedures allowing the creation of applications that access the features or data of an operating system, application, or other service.

CHAPTER I

1. Introduction

This chapter presents the motivation for the choice of research and research questions. Also, it provides the reader with a detailed description of the purpose of this thesis as well as the thesis overview to see how the thesis is constructed.

1.1 Motivation

1.1.1 Technology forms the concept of smart city and open data

Keeping up with the trends of new technology, governments from around the world find as many as possible ways to improve the living standards of their citizens. The concept of a smart city is introduced as it is perceived as an effort to smart solutions. Many scholars have discussed the definition of a smart city. The term has various definitions and is different from a people's and technological perspective. (Al Nuaimi, Al Neyadi, Mohamed, & Al-Jaroodi, 2015). However, the smart city is nothing new, and it is a concept evolved from already existing concepts such as eco-city, digital city and wireless city combined (Van Den Bergh, Viaene, & Scholl, 2016). In order to alleviate the implementation of the smart city, one of the ways is adopting open data applications. Open data is defined as a set of data that is standardized and in a particular format (Khan, Uddin, & Gupta, 2014). The use of open data aims for the development and sustainability of smart cities in general.

The phenomenon of data that grows exponentially is nothing new. A wide range of data is collected and generated more than ever before, and the growth of evolving technologies further supports this. Data has potential in Norway as a country of transparency. The government collects and establishes the data so that the public make use of it. Open data is the transparency of the data which builds on the three concepts: the right for everybody, the data that people need, and data that people can use (Open Data Barometer, 2018).

1.1.2 Literacy rate level supporting data literacy of Norway

Norway is a country which has a high level of literacy rate. A Nordic-dominated ranking reported that Norway was placed second after Finland for the best literacy rate in the world (The Local, 2016). The figure below shows the Norwegian literacy rate between 2008 and 2014. The adult literacy rate defines the percentage of Norwegian citizens above the age of 15 who

can read, calculate, and write short simple statements with a certain level of comprehensiveness (Knoema, 2014). The present data shows that Norway has successfully increased the adult literacy rate to 100% (Burton, 2018).

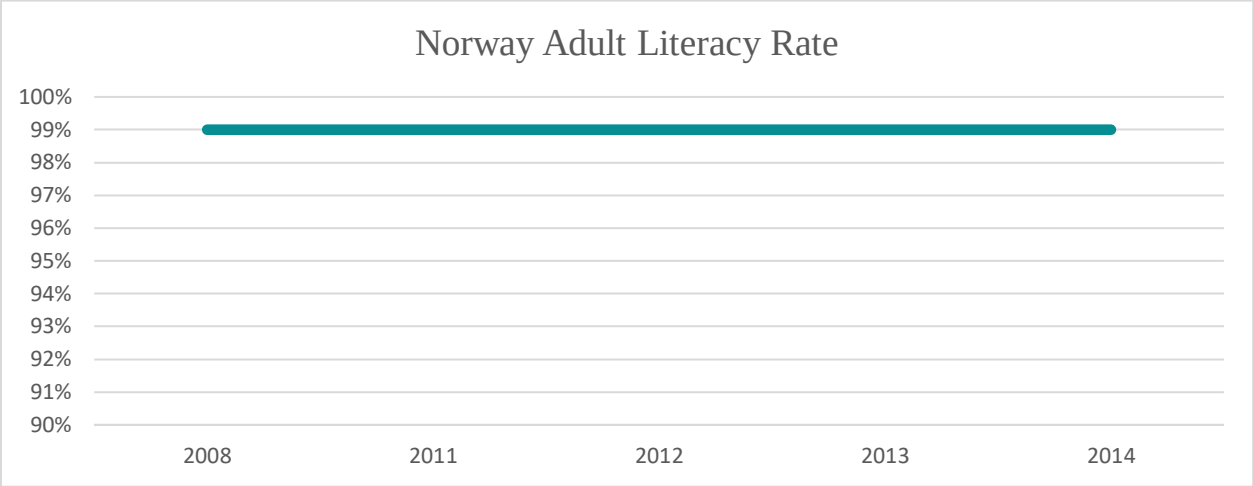

Chart 1.1 – Norway adult literacy rate as the essential ability to understand data literacy

Source: (Knoema, 2014)

There happen to be two misconceptions about literacy. Literacy, in general, and data literacy are two different concepts. Data literacy is commonly defined as the ability to comprehend, utilize, and perform analysis effectively on a collection of facts and statistics to construct decisions (Mandinach & Gummer, 2013). However, data literacy is another type of skill that not every individual possesses. Besides, the level of literacy can support the data literacy which both are equally critical in a world that is increasingly powered by data (The Data Literacy Index, 2018)

There are multiple factors that people need to understand to support the data literacy such as data generation, collection, and storage, what data looks to scientists and analysts, statistics intuition, model building, and the ethics of data (Bowne-Anderson, 2018). The level of data literacy in a country is then expected to boost the utilization of open data. Norway as a country which has a high proficiency level of literacy, numeracy, and problem-solving should start to promote and bring awareness of using the open data. Which is soon expected to bring the opportunities and potentially establish new enterprises in Norway. The availability of open data in combination with the high proficiency level of data literacy might increase the potential in creating new businesses. This is resulting from the fact that open data acts as a foundation of innovation that supports the decision-making process, which in turn will increase the employment rate.

The table below shows the age spectrum of Norwegian citizens with the proficiency level of literacy in 2012. The data is retrieved from the official national statistics website *ssb.no*. Albeit the proficiency level of literacy is high, it does not guarantee that an individual possesses the ability to read and analyze the data, however, there is a potential from the citizens' data literacy.

Proficiency of Level	Age	2012	
		Literacy	
		Percentage	Standard error
	16-65 years		
Less than level 1		3	0.3
Level 1		9.3	0.6
Level 2		30.2	0.8
Level 3		41.6	0.8
Level 4-5		13.7	0.6
	16-24 years		
Less than level 1		2.1	0.6
Level 1		10.7	1.2
Level 2		0.3	1.8
Level 3		42.3	2
Level 4-5		10.1	1.3
	25-34 years		
Less than level 1		4.1	0.7
Level 1		6.6	1.3
Level 2		20.4	1.7
Level 3		44.6	2.3
Level 4-5		20.8	1.8
	35-44 years		
Less than level 1		3.2	0.6
Level 1		6.4	1
Level 2		22.6	1.4
Level 3		45.9	1.7
Level 4-5		19.8	1.2
	45-54 years		
Less than level 1		2.7	0.6
Level 1		7.4	1.2
Level 2		33.5	1.7
Level 3		41.8	1.8
Level 4-5		11.5	1
	55 years and older		
Less than level 1		2.8	0.5
Level 1		15.8	1.6
Level 2		41.4	2.3
Level 3		33.1	1.9
Level 4-5		5.4	0.8

Table 1.1 – The proficiency level of literacy based on the age spectrum

Source: (Statistik Sentralbyrå, 2012)

1.1.3 A decline in the Norwegian oil and gas industry decreasing the employment rate

A steep decline in oil price harms the Norwegian economy, especially in Stavanger as the capital of the oil and gas industry. The impact became severe since Norway has depended on the oil industry as a motor of the economy for decades. Employment statistics in Norway as of July 2016, shows that approximately 37.000 jobs in oil and gas field have been slashed out since 2014 (NRK, 2016).

A report, as of January 2019, shows great promise as 4 out of 10 managers in the oil industry will open up the opportunity to hire more employees in the near future (Andersen, 2019). Norway must, more than ever, realize that the country needs a breakthrough shift concerning the economy driver.

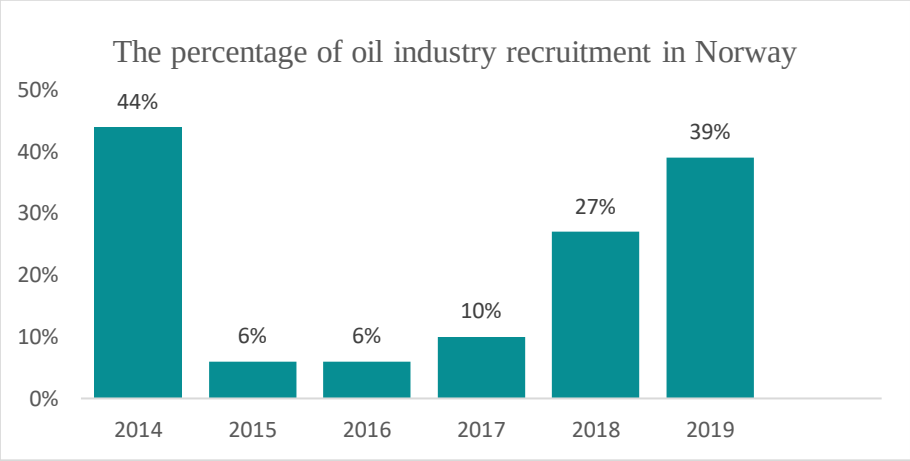

Chart 1.2 – The oil industry reports an increase in recruitment in 2019

Source: (Andersen, 2019)

Most EU/EEA member states increased the weight of the ICT sector for the total employment over 2007-2014, including Norway, that shares 2.84% (Science Research and Innovation Performance of the EU, 2018). Hence, Norway must be able to find new business opportunities to keep the economy exciting for the future.

1.1.4 Norway's position in the entrepreneurial and innovation index

The global innovation index reported that Norway is rank 19 out of 126 countries in terms of innovation (Global Innovation Index, 2018). From a global perspective, it signifies that Norway has significant potential for innovation performance. Due to this potential, the open data can serve as an instrument to support the innovation more from the citizens and the country as a

whole. In addition, Norway can build more opportunities to create new businesses, and like the domino effect, it will create job opportunities and decrease the Norwegian unemployment index.

Norway placed the lowest performance for the innovation compared to the rest of Nordic countries. However, Norway is considered to have a moderate position among the other European countries

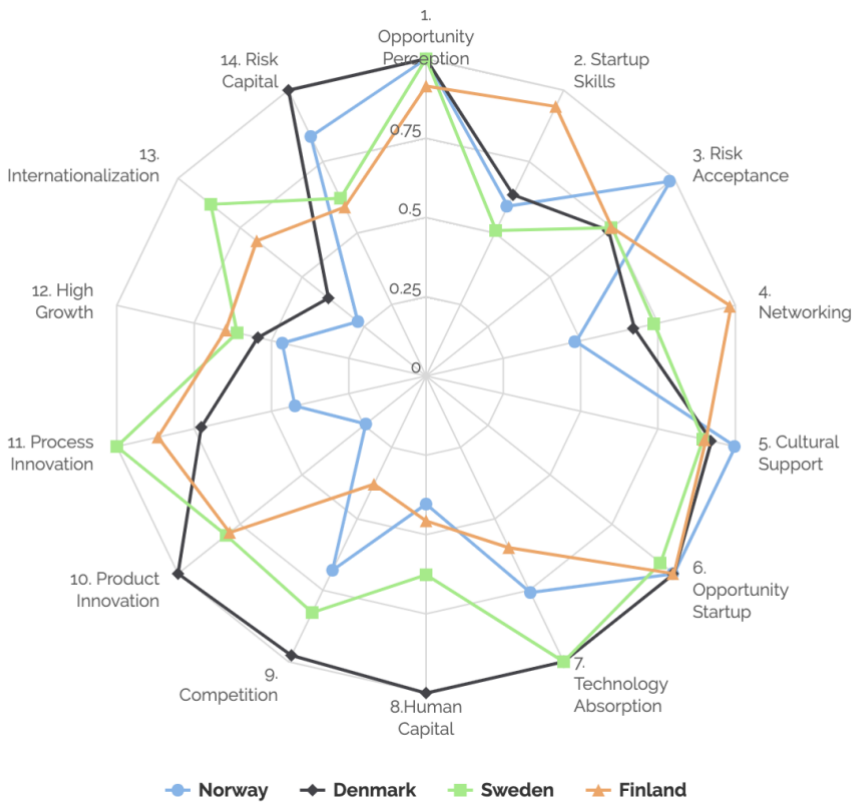

Chart 1.3 – Norway's innovation performance is lower than other Nordic countries

Source: The GEDI tool adopted from (Nordic Innovation, 2016)

Many believe that Nordic countries are the best place to run a business. This statement supports the report by Forbes that Norway and Nordic countries, in general, offer the ease of doing business according to criteria. The criteria list involve credit policy, construction permit, trading with borders, dealing the contracts, business environment, and taxes (Chhabra, 2016). Hence, Norway is ready to be a business agent from the facts mentioned above related to the entrepreneurial and innovation index. Therefore, in this research, we will discuss the open data as an instrument to support and trigger Norway to create an exciting environment to build new business opportunities.

1.1.5 Background choice of research

Stavanger municipality holds and collects data across several categories. As a city that put forward transparency, Stavanger compiles a wide array of data into one data pool for public consumption. These data are made freely available as the initiative in contributing to the smart city concept. Albeit publicly accessible, it does not guarantee that the data will be utilized by stakeholders even if they regard the data as a valuable set for their perusal. This is the challenge the government must tackle to make open data function as intended. Besides, open data can also be treated as a proxy for democracy that ties the government closer to the citizen (Lakomaa & Kallberg, 2013).

A considerable number of people are familiar with advanced technology. The revolution of technology increases the potential of a smart city to work well. The smart city initiatives such as open data will work if the civil society possesses the ability to keep up with required skills the technological advances demands. The critical skillset involves data literacy and ability to make use of the technology. Furthermore, this ability can support the real impact of open data. (Lakomaa & Kallberg, 2013) reported that public access to open data has a direct impact on future entrepreneur's perception of the ability to execute their business plans. Therefore, the exploitation of open data to be used by the public can explain as to why the use of open data can be a catalyst of innovation.

Based on the aforementioned factors in the subchapters above, we find that Norway has the potential to increase its innovation and new enterprises that can give rise to the job opportunity. Norway is one of the eight countries as the founding governments that pursue the open data along with seven other countries such as Indonesia, Brazil, Mexico, South Africa, United Kingdom, The United States of America, and The Philippines. Indirectly, Stavanger contributes to innovation as one of the biggest cities in Norway. A decline in oil price has a drawback impact on the Norwegian economy, especially in Stavanger. For decades, Stavanger's economy has been relying on the oil and gas sector as its economic driver. Thus, Stavanger, more than ever, must be able to find new business opportunities to protect their economy in the future. The effect caused by the creation of more jobs will lower the unemployment rate. Further, this will have an additional side-effect that will enable employers to participate in the economy, which will create the need for even more jobs.

For the reasons mentioned above, we want to elevate the study on the exploitation of open data to the smart city initiative. The main focus is on how the use of open data can enforce innovation and new business opportunities. We started off by formulating the research questions with the motivations and facts we assessed. After the questions have been determined, we continued with defining the proper research strategy. We conduct our research through the interview from the users who have experience with using the Stavanger open data portal. Prior to determining the answers, we simultaneously evaluated the current situations of open data initiatives from Stavanger municipality. We further used our findings from interviews to obtain the answers of our underlying research question regarding the way to increase public involvement for utilizing open data and the factors for emphasizing the potential of open data to enable innovation.

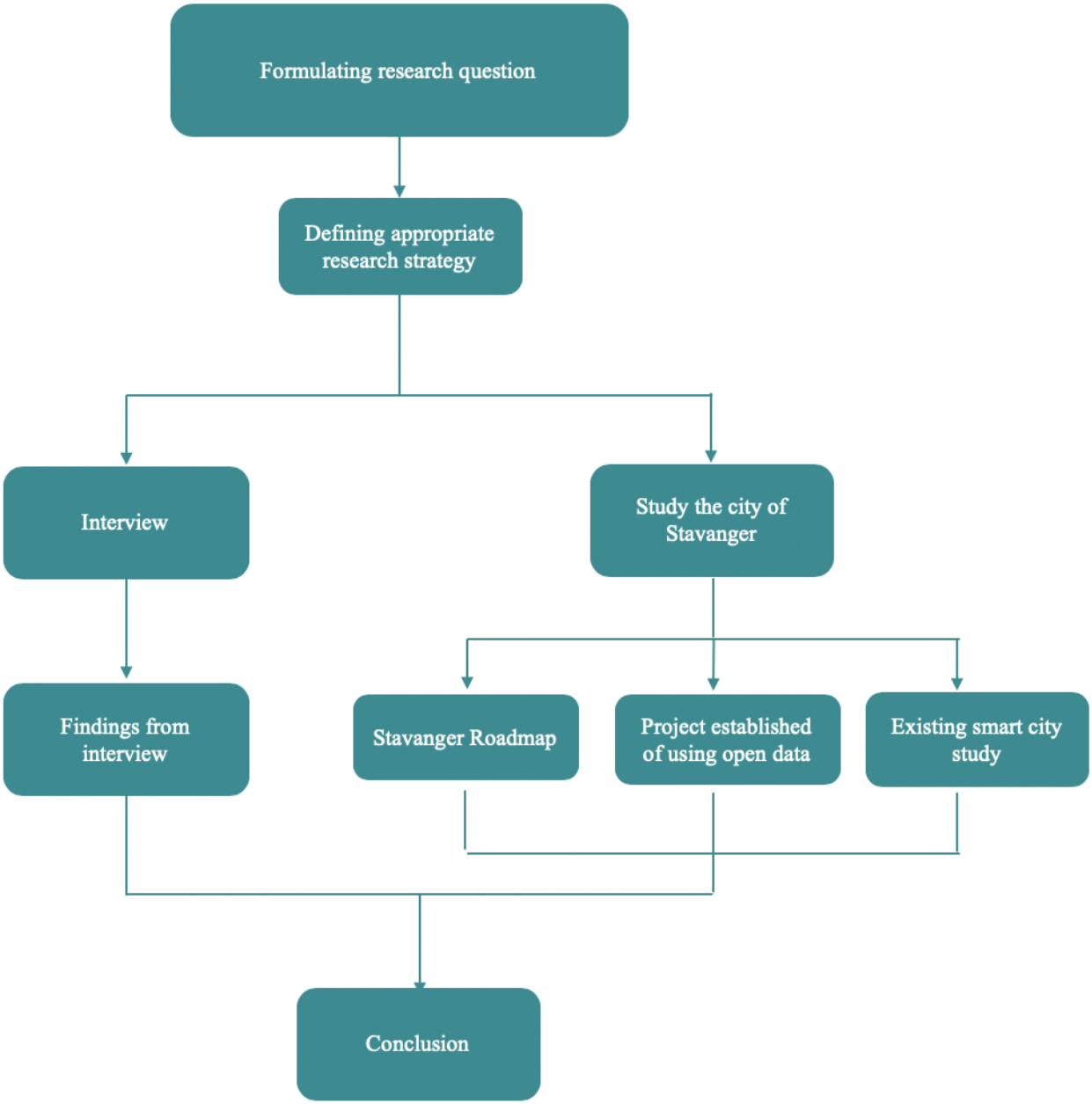

Figure 1.1 – The overall thesis steps that constitutes a scheme

Source: Own author

1.2 Research questions

The purpose of this thesis is to give a general overview on how the utilization of open data can trigger the public involvement to support the smart city project, and how the open data can be the foundation of innovation. We formulate the overall research question as follows:

How does the use of open data enforce innovation?

To further answer this overall research question, we further define the following underlying research questions:

RQ1: How to entice public involvement in utilizing the open data?

RQ2: What should be emphasized in the coming years to unlock the potential of open data to enforce the innovation?

1.3 Limitations

Considering the limited time, resources, and feasibility for this thesis, selections have been made to narrow down the scope. Based on the focus exploitation of open data in the application of a smart city, data will be collected through interviews from users which are the public, that includes academics, communities, the civil society that use open data. Civil society constitutes citizens that are linked and shared by common interest and activity. It refers to organization spectrums: community groups, non-governmental organization, labor union, faith-based organization, not-for-profit basis, professional associations, and foundations (Jezard, 2018). The interviews for the public will be according to the smart city initiative, and the use of open data. The aim is to analyze the current effectiveness of open data, increasing the usage of open data, and the factors to unlock the potential of open data to enforce the innovation.

The users represent a group selection based on an age range from 16 to 54 years of age as the generation that has the advanced proficiency level of literacy in Norway (*see table displayed in 1.1.2*). The ability to have a high proficiency level of literacy can generate the potential ability to data literacy. Throughout the objectives of Stavanger smart city, we limit the scope into the exploitation of open data, and we examine how the utilization of open data can increase its likelihood as a foundation of innovation to create new businesses.

1.4 Thesis overview

The thesis is structured into seven chapters:

Chapter 1 – Introduction is separated into the following sections: 1.1 is the section that presents motivation as to why the theme has become the background choice of research. Section 1.2 provides research questions. Followed by 1.3 introduces the limitations conducted in this thesis. Finally, section 1.4 gives a detailed overview of the thesis.

Chapter 2 – Case description describes further information about the roadmap of Stavanger Smart City, Stavanger Smart City's ambition to exploit the use of open data and the project established by Stavanger municipality regarding open data and the existing smart city established by other cities.

Chapter 3 – Theoretical background provides relevant literature and theoretical concepts that support this thesis.

Chapter 4 – Methodology presents the choice of method for this thesis. Moreover, in this chapter, we justify why the utilization of the method provides insight to answer the identified research questions.

Chapter 5 – Analysis consists of an in-depth discussion and analysis of the discoveries from the explanatory study with respect to our success criteria. Finally, the chapter presents a discussion concerning the findings and the relevant issues of our research questions.

Chapter 6 – Validation of the study evaluates the methodology and the overall quality of the study as well as the trustworthiness of a research which is divided by the validity and reliability.

Chapter 7 – Conclusion presents final remarks which conclude the result and findings of our study, and this chapter also gives direction towards future research.

CHAPTER II

2. Case description

This chapter provides the fundamental reason as to why Stavanger municipality comes up with the smart city and open data initiatives. Further, we present the municipality's current running project efforts for the smart city initiative, revolving the use of open data.

2.1 The road map of Stavanger smart city

Stavanger municipality has pointed out the desire to develop and improve the public sector in their projects. As technologies are exponentially growing worldwide, Stavanger municipality realizes that the city needs to improve the living standards and facilitate an easier life. However, the growth of the technology to be applied in the city is somehow not linear according to the ambition. There happen to be a gap in between the perception and the reality regarding the issues. Issues generated as the agglomeration of people become centralized towards the city. The city becomes the more prominent in terms of size and population density. Predictions say that by 2050, approximately seventy percent of the world population will reside in the cities (Jiong, Gubbi, Marusic, & Palaniswami, 2014).

Growing urbanization is expected to create new challenges. Stavanger municipality is finding avenues to improve the public sector and reshaping social life in the city of Stavanger. However, these concerns are challenged by private sectors that can provide similar services for citizens in general. Many concepts are attempted to be implemented, including the smart city concept. A smart city is a broad concept which includes physical infrastructure, human and social factors (Galán-García, Aguilera-Venegas, & Rodríguez-Cielos, 2014). Therefore, the needs of the city for smarter and efficient solutions are implemented in the concept of smart city.

Throughout these objectives, Stavanger Municipality expects to motivate the stakeholders to participate and share the responsibilities with the hope of making Stavanger smarter. The stakeholders include the citizen, governments, private industries and commerce, civitas academia, and the public in general. Moreover, the Stavanger smart city initiative identified three criteria which became key drivers to make project efforts classified as a smart city; technology, cooperation, and citizen involvement.

The purpose of the smart city initiative is described in the roadmap by Stavanger municipality in *figure 2* below.

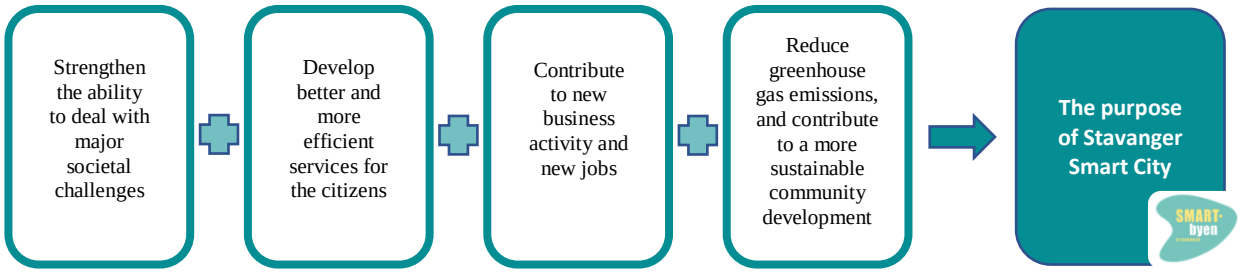

Figure 2.1 – The purpose of Stavanger Smart City

Source: (Stavanger Smartby, 2016)

Technology is needed as the avenue for creating economic, social, and environmental improvements. The enormous growth in technology resulted in the efficiency and effectiveness of activities as it becomes the driver of more and more innovation. The more innovation, the more economic potential can be retrieved from it.

Furthermore, technology is a vehicle for the development of a smart city which has an impact on the communities living within smart cities. Cooperation becomes a fundamental area due to the needs of interaction between local authorities, industry and commerce, organizations, and citizens in general. These integrated interactions are necessary for the achievements of Stavanger Smart City objectives.

Citizen involvement has an essential position in terms of supporting the implementation of a smart city. As the main subject of the project, a smart city is built according to the needs of the citizen's escalating standards of living and an easier life. Thus, a citizen is expected to participate in creating innovation and decision-making for the city proactively. Without the contribution of the Stavanger citizen, the objectives of Stavanger smart city seem to be challenging to achieve. Further, the development of Information Communication and Technology (ICT) have successfully altered the way people are interacting with each other. The existence of social media and web 4.0 open the two-way communication between governments and the citizen. Consequently, the participation and involvement of the citizen will be increased with the employment of ICT to support the application of the smart city initiative.

Stavanger smart city chooses five focus area that becomes the priority and the main contributors to smart city Stavanger. These focus areas include health and welfare, education and

knowledge, energy climate and environment, urban art, and governance and democracy. The proportion of demographic people living in Norway, in general, shows the imbalances. The population pyramid of age structure predicts that for the coming years, the portion that constitutes the unproductive age will rise significantly in comparison to the productive age. This comparison includes the proportion of elderly living in Stavanger (SSB, 2019a). Hence, Stavanger needs to, more than ever, develop new solutions along with the implementation of technology as a response to this matter. With the focus on health and welfare, Stavanger answered the needs of the citizen by calling for collaboration in establishing smart healthcare which needs cooperation from education institutions, research and innovation communities, and competent supplier industry.

Education and knowledge are perceived to be an investment. It supports the fact that through education, the future of Stavanger will be built based on the current of the education system. Stavanger attempts to introduce the concept of a smart city to the early stage of education. By implementing the technology and modern teaching methods, the future generation can further develop the smart city and its initiatives. Stavanger expects to shape a competent and heterogenous workforce in the future. This workforce will further reinforce the creativity and innovation of Stavanger civil society and the citizen in general. Collaboration networks between stakeholders in the effort of implementing the smart city concept is the crucial part. Besides, a smart city that is supported by the use of technology can benefit from improving the quality to achieve the objectives of a smart city. Stavanger smart city focuses on how the city can be a climate neutral city. The smart city initiative aims to let the city be a platform for the citizen, commerce, and industry and stakeholders to contribute and preserve the energy, climate, and environment. Therefore, the purpose of strengthening Stavanger's position to be the capital of energy is possible to achieve.

Stavanger is not only concerned about the infrastructure but also the usage of the public space for urban art by also involving digital technology as the way to express the art. This way, Stavanger municipality expects that the city becomes more attractive in terms of architecture, creativity, and innovation that involves technology. Stavanger has the purpose of engaging the citizen in the participation for great governance and democracy, employing technology to build an efficient and convenient way to increase the citizen's contribution.

2.2 Stavanger smart city initiative to exploit open data usage

Every single day, Stavanger municipality performs services to its citizens. Much data is collected and shared in the municipality's data lake. The municipality organizes this data collection in several data categories which, makes Stavanger the most significant contributor in providing data sets in Norway as of June 2019.

Municipality*	Total Data sets*
Bærum	2
Fjell	3
Gjesdal	16
Larvik	2
Randaberg	2
Stavanger	168
Trondheim	2
Ålesund	3

**As of June 2019*

Table 2.1 – Stavanger collects the highest data sets among other municipalities

Source: (Stavanger Smartby, 2016)

Norway is one of the eight countries as the founding governments that pursue the open data along with seven other countries such as Indonesia, Brazil, Mexico, South Africa, United Kingdom, United States of America, and The Philippines. A country that initiates the use of open data usually derivate the initiatives from a national level to a smaller scope. This case is also implemented in Stavanger as the local level that implements the importance of smart city initiatives.

The open data portal of Stavanger municipality contains more than 160 data sets (Stavanger Smartby, 2016). Most of the data collected from many regions come from the Stavanger region. The open data portal contains rapidly changing data in many areas such as environment, school, health, and art. Here are some data sets theme example obtained from the portal:

- Requirement profile
- Kindergartens
- Basic school education
- Municipal health
- Social service
- Water base
- Fee rates
- Church foundation
- Transport
- Fire and accident protection

- Waste and refuse
- Introduction scheme
- Property tax
- Nature management and outdoor life
- Employment in municipality
- Child welfare
- Culture foundation

The data sets above are from Statistic Stavanger, but the most are stable data on the website. The data sets other than these are not structural and annual. However, it contains some sensor data which are not easily understood by the local community.

The figure below illustrates the position of countries according to the opening of their data sets. In the illustration, countries are split into three distinct categories, namely beginners, followers, and trendsetters. Each country is in one of these categories according to the following factors; data comprehensiveness with high-value information, data availability and portal usability (Rijmenam, 2015).

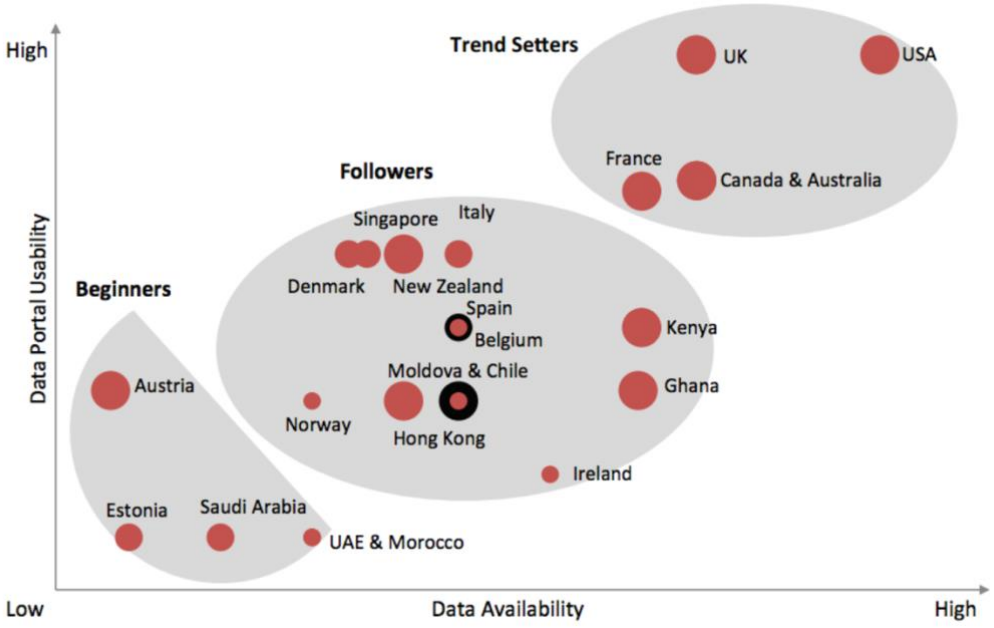

Figure 2.2 – Norway is clustered in the moderate position for open data

Source: (Rijmenam, 2015)

2.3 Project efforts established in Stavanger smart city

The table below explains the pilot projects established by smart city Stavanger, which are currently running and still being evaluated. These projects mostly revolve around utilizing the open data.

Triangulum	Triangulum is a lighthouse project with aims to integrate energy, mobility, and ICT in new solutions that will help tackle societal challenges, contribute to increased sustainability, through an eco-friendly urban development, reduction of Carbon dioxide, green energy and energy efficiency improvement.
GeoViz - Pilot	GeoViz uses VR technology for the development of a 3D viewer for urban development plans.
Digitization of Parking	The aim is to digitize parking activities according to the vehicle's registration number. A parking activity includes all types of parking, such as parking lots, parking garages, and residential area parking.
Automatic measurement of the ratio of fullness in buried waste containers	To increase the efficiency of transporting waste from waste containers, this project employs a machine to measure the ratio of fullness and automatically notify truck drivers using the in-vehicle computer to follow a scheduled route according to the registered emptying requirements.
Varsle om Feil (Notification of Errors)	A website that allows the citizen to report om errors or deviations related to several services the municipality provides, e.g., water and drainage, buildings, sanitation, to name a few.
City Planner	Provides a new platform for citizen dialog concerning urban development plans in 3D, which facilitates understanding and lowers the threshold for input to urban development plans.
Open Data	A project that provides the transparency data from the government for citizens perusal, which is expected to increase citizen involvement, industrial and commercial development.
Smart City Room	A smart working and meeting space for sharing knowledge, this is used as a platform to increase the citizen involvement to support the smart city project.
Sensor Control for weeds	This project focusses on fleet and sensor control.

Table 2.2 – Projects established by Stavanger Smart City.

Source: (Stavanger Smartby, 2016)

CHAPTER III

3. Theoretical Background

It is necessary to gain a profound understanding of a smart city and open data in order to understand the outline above fully. Thus, we present the relevant literature and theories by defining and explaining various essential terms as well as creating a theoretical basis and framework.

3.1 The concept of smart city initiatives

A smart city is defined as a city well performing in a forward-looking way in economy, people, governance, mobility, environment, and living, built on the smart combination of endowments and activities of self-decisive, independent, and aware citizens (Chourabi et al., 2012). The emerging concept of a smart city cannot be separated from the urbanization process that is related to developments in many areas such as economic, social and environmental protection (Arroub, Zahi, Sabir, & Sadik, 2016). Rapidly increasing urbanization creates new challenges on many levels. The new infrastructure for the government as it requires more attention and extensive management, the new solutions for the environment, and the effective and efficient project implementation for the city. These support the formation of the smart city concept. Nevertheless, the smart city initiatives have risen as the product of urbanization, i.e., cities that are continually developing along with the growth of ICT. Urban development performance depends on technical infrastructure, the availability, and quality of knowledge, communication and social infrastructure (Pollalis, 2006)

The concept of a smart city as a topic has gained interest among many scholars and the public in general. The past few years, the smart city initiative has permeated along with technology and the needs for public involvement in parallel as an avenue to address the growing urbanism. Below is a display set of data in a graph form indicating the growth of the smart city topic. The data is taken from *Google Trends* to illustrate smart city's presence in public consciousness for the past few years worldwide.

We can identify from the illustration below that the topic of smart city has risen since 2014. The query of the smart city's topic retrieved from Google search engine steadily grew and reached a peak in 2015.

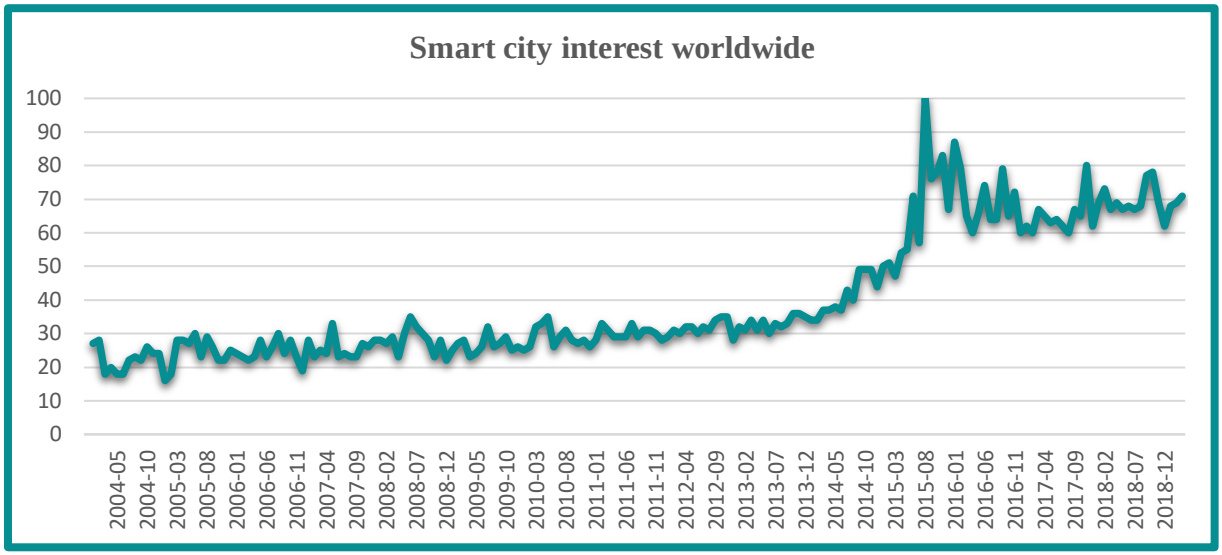

Figure 3.1 – The interest of smart city worldwide topic browsed through search engines
Source: Google Trends

A city is required to interrelate, economic, social, and environmental dimensions with each other in order to keep the city in balance and create benefits for all stakeholders (de Jong, Joss, Schraven, Zhan, & Weijnen, 2015). For a city to be considered 'smart', it must also implement vital components that enable the centralization of data. These components can be on several formats; it can be in the form of a simple website, a more complex and context-aware mobile application or take the form of specialized hardware (Rotuna, Cîrnu, Smada, & Gheorghiță, 2017).

While each municipality identifies needs for smart solutions, they compete to make their cities as smart as possible. However, the participation for the activities the smart city initiatives are promoting is voluntary. A different municipality has its objectives towards conducting the smart city initiative. Therefore, each municipality has a different definition of the smart city initiative and its elements.

3.1.1 The paradigms of smart city

There is a need for collaboration which includes every stakeholder for the success of a smart city, such as government, the involvement of citizens, and the growth of technology. The concept of smart city encompasses a lot of dimensions, (Arroub et al., 2016) mentioned there are six dimensions cooperated within the smart city paradigm such as smart economy, smart environment, smart governance, smart mobility, smart living, and smart people.

The economy is one of the engines of smart city initiatives. It becomes a degree measurement of city competitiveness, whether the city has the potential and capacity to manage the smart city according to its economy availability. The economy component of the smart city initiative is conducted in a smart economy concept. The economy concept encompasses many subcategories such as innovation, trademarks, entrepreneurship, flexibility, and productivity of the labor market, and the integration in the national and global market (Chourabi et al., 2012). There happen to be several characteristics defining the smart economy, according to researchers. These characteristics are; innovative, digital, competitive, green and socially responsible. Innovation refers to the ideas of increasing the opportunity and minimize cost. Digital defines the utilization of ICT in the economy. Competitive requires the community or people to be open, knowledgeable, and innovative to obtain profits to have a good quality of life. Green focuses on sustainability by reducing energy usage while socially responsible seeks to promote the welfare of individuals (Arroub et al., 2016).

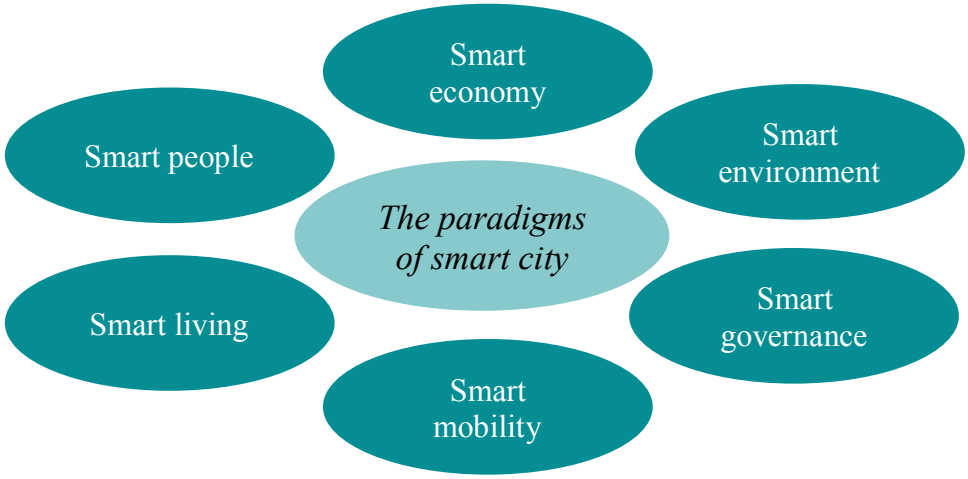

Figure 3.2 – Illustrate the smart city paradigms across category
Source: (Arroub et al., 2016)

Smart Governance requires all stakeholders to collaborate and participate in order to achieve the projects and including objectives of smart cities in general. The government must show the avidity to run the smart city initiatives, which further obliges transparency from the government to earn the trust of the citizens. The challenges concerning the initiatives are inadequate technology and stakeholder's participation. It becomes the critical factors to determine whether the project succeeds or fails. It is related to major issues such as the ability to cooperate among

stakeholders, leadership support, alliances structure, and work under different jurisdictions (Scholl et al., 2009)

The smart city concept is forward-looking in responding to its existence towards the environment. The aim is to magnify the sustainability, protection, preservation of the environment, and its infrastructure. The city that is voluntarily implementing the concept of a smart environment should deliberately consider the usage of energy resources.

The people dimension is a major driver in smart city initiatives. A smart city needs smart people that are; knowledgeable, educated, creative, and have a willingness to learn. Nonetheless, this dimension can be complicated. Besides possessing the points to increase the smart city success criteria, people can also be a factor that demolishes the project and damages the environment. Hence, the city needs people and a community that is not only possessing the knowledge but also the awareness of the sustainability of the environment.

Smart mobility is very closely associated with urban transport and infrastructure. The development of transportation modes in the city area yields to the alteration of lifestyle and mobility practices of individuals. The revolution of lifestyle triggers the needs for transportation alternatives. The modern citizen gives more expectations upon the government as their mobilities are high. Thus, diversified transportations are built to meet the needs for mobility.

The citizens adjust their way of living through technology. Citizens seeks a convenient way along with the growth of the technology. More and more people worldwide connect through their devices. People nowadays are familiar with the technology as it offers a cheaper, an easier, and faster way of communicating and accomplishing tasks. These observations constitute the paradigm referred to as smart living. The rapid development of technology and the changing lifestyle stimulate the needs for automation to boost the quality of life of the citizen in a smart city.

3.1.2 The challenges of smart city

There are many explanations as to why the implementation of the smart city concept in a city brings great promise. However, there are drawbacks and challenges of implementing it. The table below shows the challenges of implementing smart city across dimensions such as economy, governance, people, environment, mobility, and living.

Economy	Infrastructure deficit, limited urban/based industries, economic decrease, unbalanced geographical development, ICT infrastructures deficit, economic decline, sustainable local economies, mono-sector economies, and shrinking cities
Governance	Shortage in access to tech, low urban institutional capabilities, instability in governance, urban youth problems, the gap between govt and governed, territorial cohesion, flexible governance, and formal/informal government.
People	Urban poverty and inequality, low educational level, threats to cultural identity, unemployment, innovation, social cohesion, aging population, and cybersecurity.
Environment	Climate change effects, scarcity of resources, water scarcity, rapid growth, pollution, urban sprawl, climate change effects, energy saving, environmental issues, and urban ecosystems under pressure.
Mobility	Pollution, lack of public transport, high infrastructure deficit, non-car mobility, multimodal public transport system, traffic congestion, inclusive mobility, and sustainable mobility.
Living	Relatively affordable housing, health problems, safety and security, emergency management, urban violence, and insecurity.

Table 3.1 – Smart city challenges across dimensions

Source : (ASCIMER Project, 2015)

3.2 Open data

This section explains various definitions of open data and the importance of implementing open data. Moreover, this chapter clarifies the barriers as well as the benefits of open data.

3.2.1 Open data: definitions

There are many ways to define open data. Many scholars identify the definition of open data on a different perspective depending on their focus of research. Consequently, we consider different definitions before determining the closest definition that suits this thesis.

Data, by definition, is the procedure by which analysis utilize the tools of mathematics and statistical testing applied to business-relevant historically in order to identify relationships, patterns, or affiliations among variables (Holmes, 2003). Open data is naturally given available so that public can use and utilize it as needed. Data does obviously belong to the public. Government plays the role to be the bridge to collect, hold, and publish for the use of the public who has the right to this data and information. In addition, open data allows citizen, businesses, and government to cooperatively shape the city to be more efficient and livable which resemble the objective of Smart city (Alaimo, 2017).

Open data refers to the established information in standard formats that are interoperable and open. This aims to ease its access so that the public can reuse for variety purposes. Open data consists of several data sets across category in a portal and is expected to encourage and increase the number of citizen participation for the city and the audacity goal is to improve the economic purposes (Al-Mutawa & Al-Aama, 2017). Data should provide the free flow across location, border, and within a data space. The flow and access of data are restrained by the rules of localization or many other barriers such as technical and legal. If the valuable data is expected to growth and jobs, then the data should be utilized and used. But it is not enough without the discoverability, availability, and the analysis (Berends, Carrara, Vollers, Fechner, & Kleemann, 2017).

Each government around the world compete to be as transparent as possible by disclosing their data in the portal for public. Many governments determine their definitions to further explain open data and their ambitions towards the utilization of open data. Besides transparency, enticing the participation of stakeholders and increasing the government efficiency are the premise that well described the definition of open data. Nevertheless, a common definition to define open data is the disclosing of government data in a reusable format that can strengthen citizen engagement and yield new innovative businesses (Huijboom & van den Broek, 2011). We analyzed that this statement defines the audacious goal of open data. Therefore, this is the closest definition that best suits for this thesis.

The definitions above share similarities yet also differences. They resemble to support defining the best definition to support this research. However, none of the definitions above show the aim of implementing open data and the benefit of utilizing it. A novel definition based on the

utilization is critical to confirm the evident purpose. However, there is still limitation to proof the evidence impact due to these strategies of open data are relatively new.

3.2.2 Open data: stakeholders

The open data stakeholder refers to an individual, organization, community, or group of people that share an interest related to the concern, which is in this case, engagement with open data. The attention of engaging with open data expands various categories, although the boundary between lines of stakeholders is not always clear. However, we categorize the stakeholders into several categories. The government, businesses, and the public are the key players of open data stakeholders. The government covers various levels such as national, regional, or local level. The industry or business open data stakeholders include start-ups, entrepreneurs, developers, investors, academics, civil society, engineers, scientific institutions, and politicians (Graves & Hendler, 2013). However, some additional stakeholders that are equally important for open data are the media and journalists.

The government is identified as an intermediary stakeholder in the open data ecosystem. In the simple demand and supply chain of the open data ecosystem, the government had only been known for only being a data provider. However, the government shifted the role to a broader perspective. The government is also the consumer of the data that contributes to the demand for data. The government recently embraced the reformation of the digital infrastructure, policy provisions to form the implementation and impact of open data activities, and the Institutional optimization arrangements (Davies, Walker, Rubinstein, & Perini, 2019). The government has three main roles in the open data ecosystem, which are enabling value creation, managing risks, as well as engaging stakeholders and users (Chui, Farrell, & Jackson, 2014). The government can activate the value creation by being transparent in promoting the decision-making process, its results, and creating a way to stimulate the development of nascent product and services.

Although, the group of stakeholders that benefit the most is the common public, the majority of the citizens that are not directly using open data. The public consumes the data in the form of application, a visualization, or a report (Graves & Hendler, 2013). They play the role as the end-user that utilize the innovative creations out of open data. On the supply side, there lie the businesses that alter the open data and modify it according to the public's demands. Businesses across categories such as start-ups, Small Medium Enterprises, developers, academics, as well as civil society are competing to create innovative products or services out of open data. The

outcomes are obtained with several motivations. The purpose varies from alleviating the life of the citizen or even profit oriented goal.

Journalists and media are playing an essential extended role in the open data ecosystem. Journalism is the way to form the data into a more interactive method that can persuade readers. The media is the platform of journalists to attract readers by transforming statistical data into stories and visualizations (Davies et al., 2019). This aims to engage the public in an interactive way to be aware of open data. Stakeholders of open data can analyze and identify the gaps and choosing the proper improvement strategies. The ability to analyze each role from stakeholders will empower and activate the collaboration.

3.2.3 Open data: purpose

The purpose and benefits of open data seem to be vague to distinguish. Since both have positive sides as to why many governments compete to implement and develop open data as transparent as possible. Open data has four purposes, such as empowering citizen, improving government, creating opportunity, and solving public issues (Vandenbroele, 2017). First and foremost, open data is expected to enhance the government throughout its transparency to avoid the act of corruption. The primary purposes include improving government throughout accountability and transparency of disclosed data (Zhang, Dawes, & Sarkis, 2005). Moreover, open data is the answer to enhancing and digitalizing public services and resource allocation. Open data also aims to empower citizen by facilitating them with services to make urban life more convenient.

Open data facilitates a new way of communication and accessing information. Furthermore, open data becomes media to new forms of social mobilization and informed decision making (Open Government Partnership, 2016). It is expected to increase collaboration between stakeholders further. The reason is as more people, along with the government, try to find solutions to get better services for the public. The civil society, such as a group of developers use open data by creating new business in digital services, application, and content. Then, public convert ideas and creativity into worthwhile solutions to daily problems (Danish Ministry of Science, 2010) The form of services can be more efficient transportation systems, smart applications, and the accessible and sufficient information for decision-making purposes (Al Nuaimi et al., 2015)

In terms of economic gain, open data stimulates public creativity as it aids to trigger innovation. Open data creates new opportunities for citizens, foster innovation, and promote economic growth and job creation (Open Government Partnership, 2016). The utilization of open data can be widely used by the public to build and develop applications such as parking, arrival time of public transportation, water temperature, weather forecasts, and many others. Open data tends to solve public problems as it is allowing stakeholders access to the problems' new forms of data-driven assessment (Open Government Partnership, 2016). For the efficiency process of policy-making, open data provides the policy makers sufficient data that is needed to better understand the problems and (Arzberger et al., 2006). Open data is a form of digitalized data stored in the portal, updated and maintained to ensure the sustainability of the data to prevent the protected data being lost.

There happened to be widespread purposes as to why users are engaged with open data. Open data is expected to increase the invention of new applications. However, there is a need to understand the motivations of users for using open data. It aims to easily analyze the roles, concerns, intentions, and motivations of users to map the needs for collaboration purpose. Davies in his study regarding the implication of utilizing open government data divided the use of open data into five categories. It entails the concept of data to fact, data to data, data to information, data to interface, and data to service (Davies, 2010).

- Data to fact entails the concept which each respondent specifies the facts they need in open data sets which support their engagement in planning (Davies, 2010)
- Data to information can be defined as the process to create a static representation out of data sets, which leads to visualization, info graph, blog posts, and written reports (Davies, 2010).
- Data to interface provides an interface to allow interactive access of large data sets. It serves and provides information that are customized according to users' demand and input (Davies, 2010)
- Data to data covers the activities that involve converting, manipulating, and transforming data in some way (Magalhaes & Roseira, 2017). These data sets will then be shared and created to ease the user experience.
- Data to service aims to build a service or product out of data sets. The data sets are applied to grow innovative ideas and creations to solve the issues.

3.2.4 Open data: life-cycle

The government has the purpose to open the data as their form of responsibility to the citizen. These data are made available and free for the public to utilize, share, and distribute. Beside transparency as the purpose to opening data, the government also has the purpose of creating the data to be publicly structured for convenience and foster innovation as a city's economic stimulus. The journey to establish the data themselves is impractical. Many challenges are coming the way. One way to capture challenges is by formulating a life-cycle model (Veenstra, Broek, Bastiaans, & Plas, 2013). The life-cycle is aimed to capture a certain type of phenomena or so-called describing and predict the next step in the development (Lane & Richardson, 2011).

There are requirements to have the data in the portal to be established and deployed. Government must make sure that the data publishes the information as expected. Many scholars have different opinions on categorizing data stages of the open data life-cycle. However, the silver lining of the procedure is somewhat similar. The formation of the life cycle is the idea to provide a standard process to ease the work of the government in collecting, establishing, promoting, and evaluating the data in the platform. The life cycle is an attempt to standardize the steps so that the stakeholders can and always evaluate and identify the steps which need more improvement. The main section of the life-cycle is divided into three, namely pre-processing, exploitation, and maintenance (Attard, Orlandi, Scerri, & Auer, 2015).

A study done by Al-Mutawa and Al-Aama further indicates the different stages in an avenue to extend the explanation in detail. The pre-processing contains the identification, preparation, and publication of the data prior to the establishment in the platform, exploitation covers the phase of the data utilization which covers increasing the value, promoting, reusing and evaluating (Al-Mutawa & Al-Aama, 2017). Lastly, maintenance aims to keep the data published become sustainable, which is the crucial part in each step of the process. These main sections are later on divided by phase and stages to explain about the process forming the life-cycle itself.

The initial process of pre-processing includes identification that consists of setting the strategy, creating data, and choosing the data to be published in the portal. In this identification phase, the government also considers the selection the type of data to establish which requires removing the confidential data such as private data or personal data and regards whether or not the potential established data is violating the law or code of conduct and ethics (Zuiderwijk & Janssen, 2014). The second phase is the preparation that includes setting the requirements and

harmonizing the data. This phase involves data preparation based on its conformity to publishing standard (Attard et al., 2015). Before publishing, the government needs to pay attention to the anonymity of the data that might identify an individual's personal information. The third phase in pre-processing includes the publication involving the discoverability of the data. Besides, the management of the data must be well structured into categories and register its metadata to ease the public in finding the data needed. The metadata consists of several aspects such as the description and the purpose of the data. Furthermore, it must have the licensing and the specification of maintenance, such as the date and the person in charge to maintain the data (Lapi, Tcholtchev, Bassbouss, Marienfeld, & Schieferdecker, 2012).

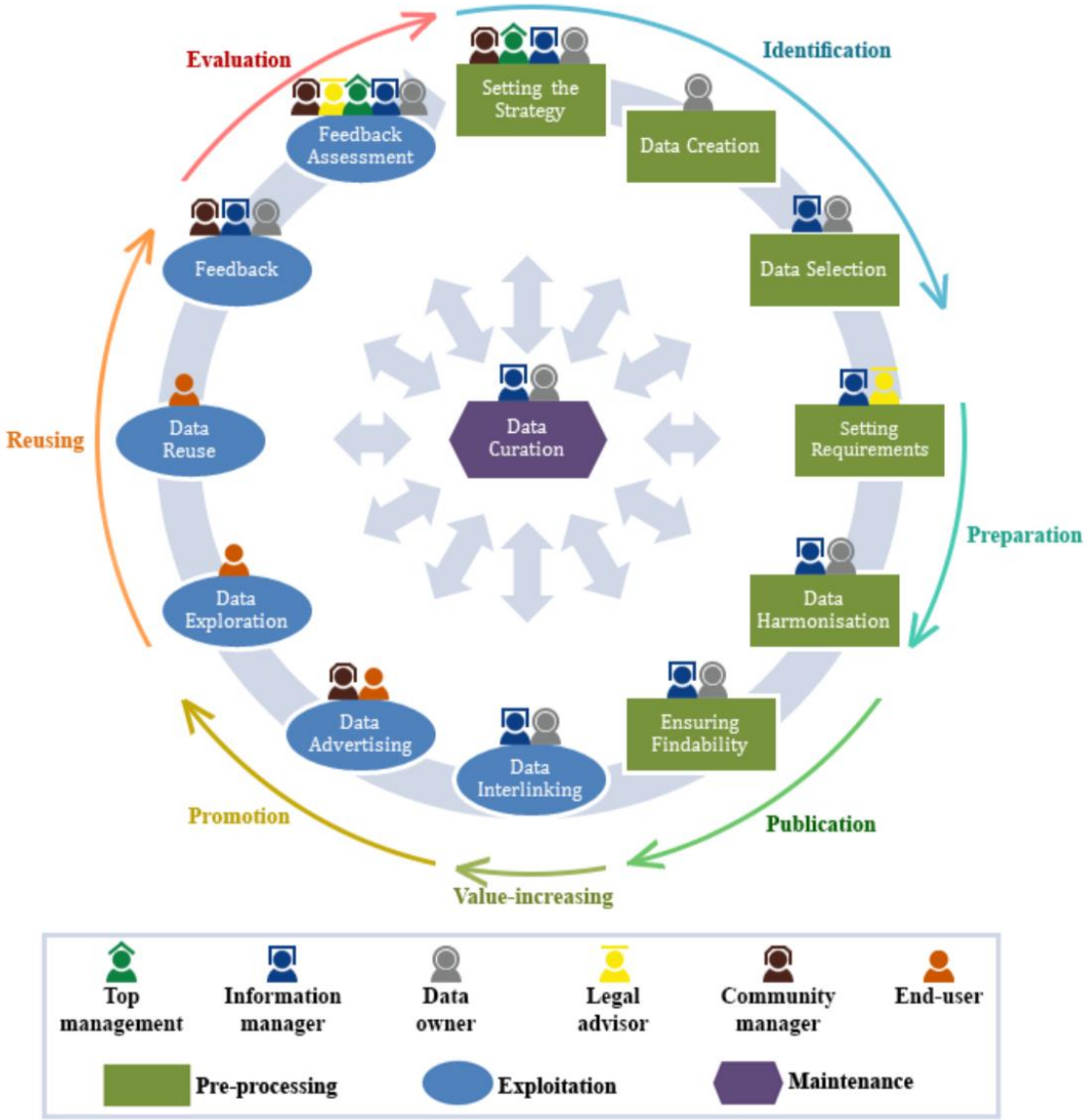

Figure 3.3 – Depicts the life-cycle of open data of how it is established in the portal
Source: (Al-Mutawa & Al-Aama, 2017)

The process of data exploitation aims to increase the utilization of the data. It is a crucial part to gouge the data to unleash the potential to enforce innovation for economic purpose. The avenue to do this exploitation is by increasing the value of the data itself. Several efforts are required, such as incorporating the data and revealing the relationship between each data and further giving the context for its interpretation (Attard et al., 2015). Moreover, the value of data will tend to increase if the platform is set in such a way the public is attracted to reuse and distribute. This means that this phase needs visualization, designing, and structuring the data. The next critical phase is data advertisement involving the act to promote and encourage the exploitation of open data. This phase requires attempts to actively raise the awareness of open data usage such as doing hackathons, business competitions out of open data, training, calling for collaboration, and many other efforts can involve.

User experience is examined through data exploration and the reuse of data. It can be trivial in a way the user utilize the feature given such as filtering, RSS, searching as an attempt to examine open data by visualizing and scrutinizing it (Al-Mutawa & Al-Aama, 2017). Data reuse involves the exploitation in an advance avenue of employing the data such as leading out the analysis, innovating based on open data and creating a fusion of disparate elements of open data. Therefore, the government needs to create a strategy to advance the platform and escalate stakeholders' participation to generate new data. This effort can be made by creating a convenient platform to reach such as applications. An advance portal will also enable the feature for open suggestion and feedback by the users from the experiences of retrieving the data in the portal. Additional open for request data set is an important feature to increase the use of open data. However, the likelihood of reusing the data is low. As a consequence, the government is obliged to keep monitoring the visitors and users to see the public interest and for internal evaluations to make sure that the end-users reuse the data.

The last section accommodates maintenance in each stage of open data life-cycle, which includes data curation. Data curation is pivotal due to its role to ensure the sustainability of established data. This signifies the number of processes, namely updating data and stale data, cleansing data, and metadata enrichment (Attard et al., 2015).

3.2.5 Open data: barriers

Before implementing the open data, it is wise to assess the barriers and the benefits enacted. There are several impediments for open data to be applied. Many scholars have their arguments

and perspectives with the boundaries of open data within the research. Politicians and governments act as actors that play the power to prevent open data from extracting its full potential (Peled, 2011). This problem addressed is mainly the technical whether or not the data sets published in the portal are valuable.

There are three barriers of data integration before the establishment of the public, such as the problem of inclusion, the problem of confusion, and the problem of diffusion (Peled, 2011). The problem of inclusion is related to the quality of the data on whether or not the data are negated or enclosed from the data sets. The incomplete data will lead to the defect of the quality of the data. This statement is seconded that the quality of data determines the usability of the data (Huijboom & van den Broek, 2011). The problem of confusion is related to difficulties to emend sparse data once the data sets are established in the portal. Lastly, the problem of diffusion refers to the unavailability of open data to offer a mechanism to time-versions data sets, to create historical integration points among combine data sets, or to let data to expire (Peled, 2011).

Barriers can be clustered into political, organizational, legal, technical, and financial, and also with regards to the awareness of the open data availability and (Berends et al., 2017). The barriers discussed starting from the data publishers as the upstream as well as reusers as the downstream. The discoverability of the data can become a significant obstacle to utilize the data as to the fact that the data availability is the gate to access and to bring the awareness of open data. However, several cases happened which the data is too complicated and too complex to find. It is because of the metadata that is poorly managed and limited search features on the data web (Berends et al., 2017).

Category	Barriers
Political	Lack of political will
	Lack of awareness from both politicians and lower level government
	The political structure of countries that adopt open data
Organizational	The management structure of open data tends to be ad hoc
	Negotiations and considerations
	Open data is not integrated in the existing operational processes
	Lack of skills
	Lack of coordination level between stakeholders
Legal	Unclear, unspecific or not even developed data sets
	Privacy constraints

	Appropriate license
Technical	Quality and the availability of Open Data
	Lack of standardization
	Poor discoverability of the data
Financial	The benefits of publishing Open Data for free are not always clearly documented
	Additional funding is needed
	Different funding models
Awareness	Low awareness due to an abstract issue of unclear benefits
	Less understanding of the value of open data
	Less training and less public engagement

Table 3.2 – Barriers of open data in categories hindering the exploitation of open data

Source: (Berends et al., 2017)

3.2.6 Open data: benefits

Many cities implement smart cities to exploit the benefits of the initiatives themselves. At the same time, many scholars have argued regarding the benefits and barriers of disclosing the data in the portal. The main point is evident despite differences. Open data has not just one but many benefits and opportunities that can be seized. However, there is still less clear evidence leading to proof of the impact of benefits that have been identified (Huijboom & van den Broek, 2011). These proofs of impact are limited since the open data as a smart city initiative is relatively new to explore. The impact involves a long-term realization, which is yet uncovered in recent years.

The table below shows the broad spectrum of benefits by implementing open data. Evaluating case basis can determine the evidence of benefits for utilizing the open data. The benefits could change over time along with the situation and condition involving in the respected time (Janssen, Charalabidis, & Zuiderwijk, 2012).

Category	Benefits
Political and Social	Improving transparency
	Democratic Accountability
	Increasing Participation and self-empowerment of the public (users)
	Creation of trust in government
	Equal access to data
	New governmental services for public
	Improvement of citizen services
	Improvement of policy-making processes
	Visibility for data providers
	Creation of new insights in the public sector

Economic gain	New innovative social services
	Stimulation of innovation
	Development of new product and services
	Creation of a new sector adding value to the economy
	Availability of information for investors and companies
Operational and technical	The ability to reuse data
	Optimization of administrative processes
	Improvement of public policies
	Access to external problem-solving capacity
	Fair decision-making by enabling comparison
	Easier access to data and discovery data
	Creation of new data based on combining and comparing data
	External validation and quality checks of data
	Sustainability of data
	The ability to merge, integrate, and mesh public and private data

Table 3.3 – Benefits of open data in a nutshell

Source : (Janssen et al., 2012)

Some of the benefits reaped are clustered into three perspectives that are benefit socially, benefit economically, and benefit environmentally (Al Nuaimi et al., 2015). The spectrum of social benefit is expanded into politics and social benefits (Janssen et al., 2012). Furthermore, the environmental benefit includes operational and technical benefits. The exploitation of open data can gather the collective intelligence of the public, which can generate better alternatives and make better decisions (Surowiecki, 2004). Besides, the government enacts the possibility to enable citizen initiatives and to indulge public aspiration by disclosing the data.

3.3 Open data charter's principles

Open data is naturally aimed to be used, reused, and distributed freely by the public. However, the legal and technical have to be taken into consideration to make the data available. The available data should represent the credibility, transparency, accountability. Hence, standardization is important to measure the quality of the data to seize the opportunity out of the open data. These principles are the form of open data standardization to assess the possibility of open data for fostering innovation.

There are six fundamental principles developed by the Open Data Charter to facilitate the utilization for the development of new innovative ideas generating economic benefits (Open Data Charter, 2015) :

- Open by default

- Timely and comprehensive
- Accessible and usable
- Comparable and interoperable
- For improved governance and citizen engagement
- For inclusive development and innovation

Open by default

Open by default is a widely used term as the principle to describe open data. Open by default can also be considered as a mandate to let the data open and available for the public to access and utilize. The government as the agent that collects and holds the data has the responsibility to make the data available so that it is accessible to the public. The government is obliged to inform the public frankly if there is a specific reason as to why the data cannot be made available in the portal. Open by default is the idea that the data is established as it does by default, belong to the public, for the public, and from the public in general.

Moreover, the openness of the data requires ground changes in the government structure to manage the culture of transparency for open data (Caldera, 2018). Open data is commonly set according to the certain formats agreed upon the establishment. The format is the idea to make the open data structured so that it will ease the use of open data. Furthermore, it allows the public to extract the optimized value from the information released in the open data.

Open by default is divided into two disclosure as an attempt to achieve the transparency, accountability, and credibility of open data. There are proactive disclosure and reactive disclosure or commonly known as the right to access. The difference between these disclosures is the stance of the government as public authorities with regard to making the data available to the public (Villoria, 2014). Reactive disclosure requires the public to request the data to the government, then the government will respond to the request by sharing and releasing the data. As opposed to reactive disclosure, the government will disclose the data publicly in the portal without considering the public request.

Timely and comprehensive

Data sets in the portal can be more than just value-worth raw data sets for the stakeholders. Open data needs to be designed in a comprehensive, accurate, timely-updated, and considerable format. A collection of standards for data sets is wise to be agreed upon to utilize the data sets. Open data can be more valuable if it is relevant for the users (Palmer, 2018). Therefore, open data in the portal will be more likely to be utilized if the government establishes as many data sets as possible. The information provided should be in its unmodified form. The government should religiously update the information in a comprehensive way to exploit its potential for success (Palmer, 2018).

Accessible and usable

Establishing data sets in the portal need a procedure (see 3.2.1 Open Data Life-Cycle). Many factors have to be taken into consideration when releasing the data in the data portal such as the type of the data, the category, privacy, and confidential concern, and the available data held by the government. The portal becomes the platform to access these data released, which acts as the ‘moment of truth’ for the user experience. Moment of truth is any interaction which a customer may form an impression towards the brand, product, or services (Interaction Design Foundation, 2019). The impression can be either positive or negative. Therefore, the government needs to design the user interface for the portal and ensure that the portal is easy to find, and the data is readable and accessible. The information that is provided in the portal should be free of charge and within a publicly usable format.

Comparable and interoperable

Data sets in the portal should open the possibility to compare within and across sectors, geographic locations, and in a timely manner (Open Data Charter, 2015). The data should provide the structure and standard format to support interoperability, traceability, and effectiveness to reuse (Open Data Charter, 2015). Interoperability is defined as the ability of systems and/or organizations to work together to process data from multiple sources without losing meaning (Hanssens, 2014).

The interoperability of the data aids to integrate the data to several purposes such as visualization, analysis, and other forms of representation according to the users. Interoperability helps the users to discover, explore, and comprehend the content and the overall structure of data sets in the portal (Global Partnership, 2017). Moreover, interoperability is the ability to compare data from different and several other sources to facilitate the creation of more contextual and holistic information for various purposes such as convenience, automated analysis, decision making, and accountability (Global Partnership, 2017).

For improved governance and citizen engagement

The form of accountability from the government activity is resumed and reflected throughout publishing data open and freely in the portal. Open data is an essential output to maintain long term credibility and increasing public trust. The release of open data is aimed to increase government efficiency and effectiveness, improve decision making, and enhance the provision of public programs and services (Open Data Charter, 2015). Open data serves as the platform of interaction between government and other stakeholders. The stakeholder entails public that uses open data such as civil society, academics, citizen, and other organization.

Governance is indirectly improved when it is transparent. Like a domino effect, the public, in general, will build trust gradually towards the government. Open data brings the idea that the government encourages the citizen to participate in transparent governance. To keep the public in the loop of information, open data is, in general, carrying two purposes such as education and monitoring. Education means creating a sphere in which public comprehends about the process of governance.

Furthermore, open data allows the public to find relevant insights which they can take at their standpoints as the avenue to engage the citizen (Vandenbroele, 2017). From the obligation to disclose the data, the government solicits the stakeholders to publicly monitor the government's action and the impact of its action throughout the open data. Albeit many factors may involve, disclosing the data in the portal is believed to foster citizen engagement to participate in good governance to tackle the urban issues (Vandenbroele, 2017).

For inclusive development and innovation

Open data is published in the portal with many intentions. Albeit the function to show credibility and accountability of government, open data is established with the idea of data exploitation. Open data is not only about escalating government performances but also facilitating innovation as there are stakeholders making money off the back of open data (Open Data Charter, 2015).

Open data is accessible for the public, which means the utilization of open data is not restricted. The nature of open data offers users extracting the opportunity to exercise freedom of creativity by transforming abstract data sets into innovative solutions for daily urban issues (Jetzek, 2012). Data sets can ultimately be transformed into useful applications. Besides, open data can also be amalgamated with other data sets to develop actionable information that is used to augment the urban environment (Alaimo, 2017). Furthermore, open data aids to foster greater interdepartmental collaboration for the government and driving innovation through sharing data with third parties (Ende, 2018)

Open data consists of several data sets in a portal. The information established depends on what category of data sets the government is willing to reveal. The data sets include the environment, aquaculture and agriculture, economy and finance, health, infrastructure, transportation, technology, society, and many others. Stakeholders that use open data can utilize these data sets to innovate in the purpose of solving urban problems and making the urban lives convenient. Stakeholders that use open data can uniquely combine data sets from open data to yield the expected output. When open data is used in the application to enhance the urban landscape by optimizing city operations, management, and services. Thus, open data can serve as a foundational concept to smart city development (Alaimo, 2017).

Open data works as a catalysator for the creation of new digital services and applications for public, extracting the economic potential, and evolving government services for future needs anticipation (Open Government Partnership, 2019). At last, open data push ahead of the economic development as it is not just about improving the performances of government, but also profit can be obtained out of it (Palmer, 2018). However, if most governments could not meet the basic open data principles in addition to the less policy and the insufficient data sets in terms of quality and breadth. In most cases, the intention to alter the life of the citizen for betterment will be less likely to be achievable (Open Data Barometer, 2018)

CHAPTER IV

4. Methodology

In this chapter, we will provide an outline of our selected method for this study. First, the research design is presented, followed by research method. Lastly, the quality of study consisting of the validity and reliability of this research will be discussed.

4.1 Research Design

This part of the chapter encompasses the path of research design we implemented. The process, the method approach, candidate selection, will be explained meticulously in this section.

4.1.1 Research Process

In this phase of the methodology, we create a general model illustrating the process and how we conduct our thesis. The first figure shows a general essential step for the research, which will then be illustrated thoroughly by the last figure.

Figure 4.1 – The general steps of this thesis research process

Source: Own Author

Preparation remarked our first step in the process of the research. It consists of planning and brainstorming work to ensure that the research goes to the correct and expected direction. The early stage was collecting the relevant and essential literature of previous studies associated with the theme. It is necessary to acknowledge the topic we selected thoroughly. Building the foundation from the literature, we set and formulated our research question and the questions to support answering our research question. The research question designates the purpose of the overall thesis that we would like to achieve.

In the phase of data collection, we chose the interview subjects based on the criteria defined. We further prepared and formulated our interview questions grouped in the value drivers according to the theoretical background. Interview guides were framed prior to the interview. The data then is collected by executing the interview. The final step of data collection is the interview transcription. Moreover, Further analysis is conducted as the completion of data is

already according to the expectation set. Then as the last step, the conclusion is defined according to the discussion of our findings.

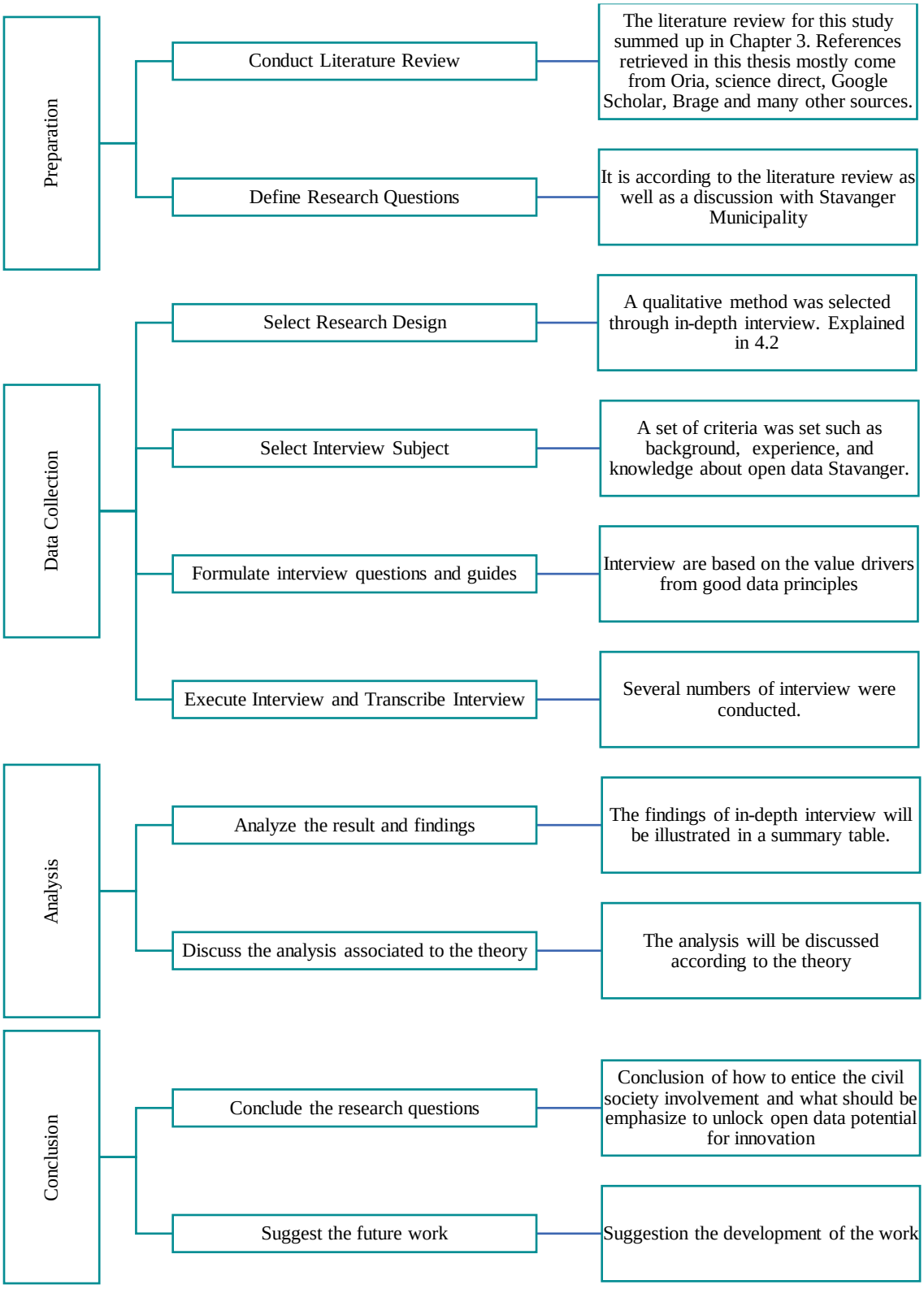

Figure 4.2 – The thorough chronological step of conducting the thesis

Source: Own Author

4.1.2 Qualitative Method

The method implemented to carry out this study is a qualitative method. Qualitative research seeks to collect, integrate, and present data from sources of evidence as part of the study (Yin, 2011). We opted for a qualitative method to be implemented because we strive for rich and meticulous answers. Besides, we also want to identify an intensive image of the issue and potential interactions towards our subjects of the interview. As opposed to quantitative, our study relies on in-depth knowledge and quality within the field chosen (Yin, 2014). Thus, a qualitative approach is fundamental. To support our chosen methodology, we implement our collected data by in-depth interviews along with the information from relevant literature. Qualitative approach as we selected gives benefit such as flexibility which is indispensable. It allows us to give spontaneity of following up questions form our interaction to the subject of the interview.

The smart city initiative and the usage of its open data are fairly new in Stavanger and Norway in general. We want to contribute with the prominent information about the smart city initiative that is open data. Moreover, we would like to reveal how the utilization of open data can enforce innovation and new business opportunities. Hence, our research design is according to the evaluation of the case leading to the exploratory approach. Exploratory research is an approach to investigate a problem which is not frankly defined. It aims to have a bigger picture and a better understanding of the existing problem (Bhat, 2019) There are benefits retrieved from relying the study on exploratory research design. It is effective in putting the groundwork that will lead to future studies. Furthermore, It can also save time due to this type of approach determines the kind of research at an early stage that is worth pursuing (Dudovskiy, 2018). Additionally, this method is carefully chosen as it complies with the criteria of reliability and validity.

4.1.2.1 Selection Process

A semi-structured interview is implemented in addition to conduct an in-depth interview. We believe this method provides sufficient and comprehensive answers to our research questions. We choose our candidate based on purposive sampling. Purposive sampling is a method to group the participants according to criteria that have been selected, which is relevant to a particular research question (Mack, Woodsong, Macqueen, Guest, & Namey, 2005). We carefully selected our potential participant according to their experience of using open data and their knowledge in creating research or business out of open data. This method is preferred due

to our purpose to make a systematic assessment of our participant that is the most relevant for the thesis.

We set our relevant criteria for interviewee sampling according to the knowledge and experience that can support answering and put additional insight for our topic and research questions. The interviewees were invited to give meticulous elaboration of their experience of using open data from Stavanger municipality, their purpose of using the open data and challenges they faced. Open data were reported used by several users across public which generally split between micro-enterprise and SME business in the private sector, local and national public sector institutions, and academic institutions with a minimal representation of voluntary sector workers (Davies, 2010). Building from this report, we emphasized our selection according to these categories indicating that the representatives can give valuable perception for this study based on their experience and knowledge of using open data.

We constructed our selected interviewee based on the requirements below.

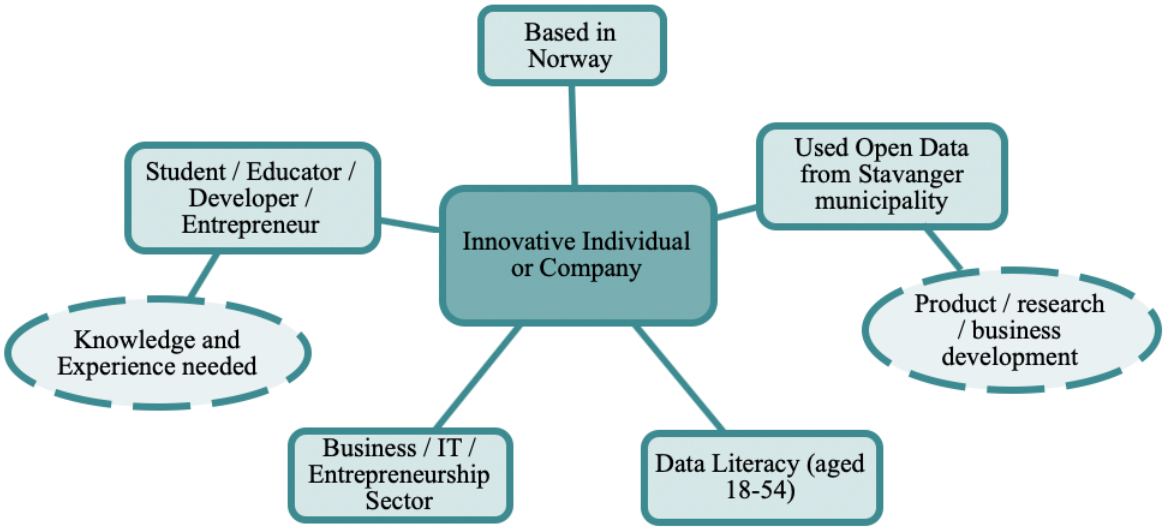

Figure 4.3 – Illustrate the criteria of interviewees for our interview selections

Source: own author

Age 18-54					
Business Student	StartUp	IT Consultant	App Developer	IT Student	Project Developer
1	1	1	1	1	1

Table 4.1 – Table of categories for selected interviewee

Source: Own Author

4.1.2.2 Implementation

The way we identify suitable people to be our interview participant was by doing the research to find the candidate. First, we set the selected category from the theory. We then find the relevant candidates by further assessment of the background experience and knowledge. We listed several possible candidates and contacted them by email. We explained our purpose, thesis topic, research questions, and asked whether they were willing to be our interview respondents. Lastly, if they accepted our interview request, we set the date either it is a physical meeting or online meeting. The decision of the meeting depends on the availability of the interviewee. We provide channels for the online meeting such as Skype, Facebook, Discord, etc.

4.1.2.3 The critics of qualitative method implementation

There is always advantages and disadvantages to choosing the methodology. Enforcing innovation out of open data required experience and knowledge from the relevant people. Besides, innovation is a concept that alters consistently along with the organic situation and condition. Innovation and new business opportunity relied upon open data also heavily depend on the variety of data in the portal. Therefore, it requires further insight and perspective as well as thorough information from the selected interviewee. In other words, it acts as a guide to wealth and profound data that leads to flexibility qualitative approach. Thus, we believe by implementing qualitative method will help us to seek further explanation as this method aids to answer the- what, how, and why of the research.

Albeit the advantages, several drawbacks challenge the implementation of the method. The first one is the tendency of finding relevant information from one's perspective that can support the created expectations in advance (Boeije, 2010). Reflecting on our method, we picked and listed down the potential interviewees according to our perception which is less representing our

sample. It implies that we chose our relevant candidate according to our perspective and considering the selection process based on our method.

The interviewees have a different level of experience and knowledge which reflects in answering the questions addressed to them. Despite its flexibility, we tried to follow the guide as much as possible to redirect us in terms of addressing questions within the topic. Some responses are thorough and more elaborative than others. It is also reflected by the personality of the interviewee whether or not they are comfortable during the interview. Some gave the concise and short answers and the rest were excited and talkative. Moreover, the condition such as personal situation and preparation during the interviews took place to become one of the contributing factors for the quality and length variation of the interview. However, we assume that we have achieved sufficient interviews to represent our data sample.

4.2 Research Method

Research method in this section mainly discusses what and how we collected our data, the sources to support additional information and about the guide to direct the interview we conducted.

4.3 Data Collection

We conducted our thesis with semi-structured interviews referring to the predetermined guidelines. Besides interview the authors seek for information from the representatives of Stavanger smart city that are in charge of open data.

4.3.1.1 Interviews Selection

We managed to conduct six interviews across the categories selected as our dispersed sample. The categories are according to the facts summarized in the report (*see 4.1.2.1 Selection Process*). Semi-structured interview acted as a compass to redirect the interview to be in the value drivers discussed and to allow the interviewee elaborating the critical topics to discuss further. We sent out the letter of consent for permission to record and transcribe the interviews. It aims to help the interviewer to examine the interview for validity assurance repetitively. Besides, we implement a referral method for the reference to find a new prospective respondent. We ask one candidate to recommend and suggest us to find a person that we can contact for an interview.

The table provided below illustrates the category chosen, the number of representatives for each category, location, and date of interview taken place, what experience each interviewee has with respect to open data, and the duration of interview itself.

No	Category of Interviewee	No. of Interviewee	Interview Location	Date	Open Data Experience	Duration of Interview (minutes)
1	Business Student	1	Stavanger	28-Mar-19	Project Research regarding the environment: Censor and Application	42
2	Start Up	1	Stavanger	03-Apr-19	Hackathon regarding the smart city solutions: Website	49
3	IT Consultant	1	Oslo	09-Apr-19	Hackathon regarding the smart city solutions: Website	28
4	App Developer	1	Stavanger	24-Apr-19	Hackathon regarding smart city solutions: Applications	51
5	IT Student	1	Stavanger	29-Apr-19	University project regarding smart city solutions: Application	41
6	Project Developer	1	Stavanger	03-May-19	Hackathon regarding smart city solutions: Application	23

Table 4.2 – The overview of selected interviews.

Source: Own Author

4.3.1.2 Interview Guide

The qualitative interview guide can be used as sources of questions to guarantee the relevant and critical topics are thoroughly covered. This list of interview questions contains a topic and sequence formed in a structured manner. The interview guide is designed with the value drivers as topic entailing predetermined questions that can be either general or simplified. However, a semi-structured interview allows us to add questions as the opportunity during the interview to seek clarity. More specifically, this guide is used to give direction for the interview and to remind the interviewers for the structure which allows for additional questions to support the topic. This aims to get a thorough and deep insight for the topic according to the interviewee's

experience and knowledge. The interview questions consist of both open-ended and close-ended questions. There are approximately seven to eight questions in each topic and there are six value drivers as the topic. This interview guide is attached in the appendix of this thesis.

4.3.1.3 Supporting Sources of Information

In addition to the semi-structured in-depth interviews, we have other sources of information used to support our analysis. We collected information in the form of file documents such as presentation slides, project handbook from Smart City Stavanger Municipality, and own analysis of the open data portal. We also compared municipality open data to national open data and side-to-side comparison to other open data portals from leading countries. Besides, we conducted an additional in-depth interview to several representatives of Stavanger municipality regarding open data, the procedures for collecting open data, activities we have conducted and the overall situation about open data project effort.

4.4 Data Analysis

The way we performed our data analysis is through data transcription. During the interview for data collection purpose, we wrote notes as well as recorded the interview process. The notes, on top of recordings, are intended to provide the fundamental points to help the process of coding the data. The audio recordings were collected under the permission of the interviewee. The instruments such as notes and audio recordings are important to see the overall statement from the respondents that explains what, how, and why to help answer our research questions. These processes were performed to aid the author for transcribing purpose. Preserving the anonymity, we do not provide any identity background of the interviewee in this thesis.

Coding is the process in grounded theory where data are turned into component parts and put the label upon (Bryman, 2012). We collected, transcribed, and compared our findings with the theory chosen in this thesis. The data are considered as potential indicators of concepts which are constantly compared (Bryman, 2012). The indicators which embodied the behavioral actions or events will then be evaluated comparatively, the analyst code and label these as indicators (A. L. Strauss, 1987). After the comparison is performed, the initial raw material data was followed by conceptualization. This coding process generates concepts which later can be grouped up and categorized (A. Strauss & Corbin, 1990).

The interpretation is easier to perform by adapting these analytical procedures. Although the key themes of value drivers have been decided, there still rises the needs to decode the raw material of data collected. The categories, which is presented in the findings section, embodies the key themes regarding open data principles to evaluate the quality of the current open data portal. The repetition process of coding yields several focus concepts such as enticing public participation and unlocking the potential of open data to enforce innovation.

CHAPTER V

5. Analysis

In this chapter, the theory and case study will form the basis for the analysis and discussion, which links directly to our findings. This part of the thesis will mainly address and answer the research questions. As presented in 1.2, the overall research question was: *How does the use of open data enforce innovation?* Further, the following underlying research questions were:

RQ1: How to entice the public participation for utilizing the open data?
RQ2: What should be emphasized in the coming years to unlock the potential of open data to enforce the innovation?

This chapter is distributed into four main sections, the findings we found from the conducted in-depth interview, and further discussion about open data enforces innovation. The first part provides our findings set up in a value driver, which will clarify the layout that aims to reach the comprehensiveness of the thesis. The results will be illustrated, presented, and discussed simultaneously according to the value driver. Within the second part, we will discuss and analyze how open data enforces innovation as well as answering the underlying research questions. The third part discusses the possible actions to implement to create an evident impact. This part offers solutions to the issues that the government is facing to exploit the open data. Finally, in the fourth part, the visualization initiative is displayed. The visualization refers to the future expectations toward the Stavanger open data portal, from the user experience collected through interviews.

5.1 Findings from the in-depth interviews

We will use the information we have obtained throughout conducting interviews in this part of the thesis. We discuss and try to compare both similarities and differences of the answers from each answer across category from the subject of interviews, according to the sequence of the interview guide. Based on these findings we summarize the thesis contribution with respect to managing the data, what criteria are needed to make the data sets used and to increase the public participation, and what factors should be emphasized to exploit the potential of open data to enforce innovation.

To answer our research question "*How does the use of open data enforce innovation?*", The interview was conducted according to the interview guide, which is attached in the appendix to gather our findings, categorized by topic. This topic is built from the theory that we form into value drivers to enchase the answers from the interviews. Furthermore, the category or role with relation to open data is used instead of the representatives' names and the projects they worked in are not disclosed, to keep the subject of the interview anonymous. The category labeled in this thesis is business student, Start Up, IT Consultant, App Developer, IT Student, and Project developer. These labels are aimed to ease the reader to follow the chapter. Therefore, the contrasts found in the interviews can be more apparent when comparing the answers.

The table below elucidates the result of an in-depth semi-structured interview. The table shows the matrices of answers constructed according to the six principles of open data by Open Data Charter. The answers are highlighted into points which will further be explained in the following section.

Key Theme	Civil Society as open data users		
	Business Student	StartUp	IT Consultant
Experience	School Project	Hackathons	Hackathons
Open by Default *(see 5.1.1.1)*	1. Criteria: data availability 2. Data sets: transportation, traffic data, emission data, air quality. 3. Format: CSV, ZIP, DOCX, PDF	1. Criteria: built on IT perspective 2. Data sets: kindergartens, kindergarten route 3. Format: TXT, JSON, GeoJSON, CSV	1. Criteria: good overview 2. Data sets: Kindergarten, Schools 3. Format: JSON, GeoJSON, CSV
Timely and Compreehensive *(see 5.1.1.2)*	1. Easy: No 2. Language barrier: Yes 3. Data update: Some are not updated 4. Unclear categorization	1. Easy: Not that easy in several factors 2. Language barrier: Yes 3. Data update: Depends on data	1. Easy: Yes 2. Language barrier: No 3. Data update: Yes, but keep the historical data
Accessible and Usable *(see 5.1.1.3)*	1. Data sets used as the secondary source of research and for decision making. data sets are also used as the ground the build a product.	1. Data sets used as the ground of product (technical)	1. Data sets used as the ground of product (technical)
Comparable and Interoperability *(see 5.1.1.4)*	1. Unclear categorization 2. Visualization: needs graph and illustration for decision making	1. Category is not built effectively 2. Visualization: simple but it doesnt mean its easy to use	1. No issue for data sets categorization 2. Visualization: simple yet lack in terms of categorization.
For Improved Governance and Citizen Engagement *(see 5.1.1.5)*	1.Public Engagement: Need to increase the awareness by collaboration to universities.	1. Public Engagement: training, education	1. Public Engagement: Showcasing products, more data, hackathons
For Inclusive Development and Innovation *(see 5.1.1.6)*	1. Development: learning purpose, data literacy for decision making 2. Innovation outcome: mobile application, information monitor, and censor device	1. Development: competition purpose 2. Innovation outcome: website application	1. Development: competition purpose 2. Innovation outcome: website application

Table 5.1 – Summary Table of Interviews Findings part 1

Source: Own Author

Key Theme	Civil Society as open data users		
	App Developer	IT Student	Project Developer
Experience	hackathons	School Project	hackathons
Open by Default *(see 5.1.1.1)*	1. Criteria: data availability 2. Data sets: Environmental stations, Daily Trips 3. Format: GeoJSON, TXT, CSV, DOCX, gpx, PDF	1. Criteria: no irregularities 2. Data sets: Schools, school route, school timetable 3. Format: CSV, GeoJSON	1. Criteria: complete data availability 2. Data sets: ATM locations 3. Format: CSV, GeoJSON, API
Timely and Compreehensive *(see 5.1.1.2)*	1. Easy: Yes 2. Language barrier: No 3. Data update: Yes, but always in contact with municipality in case needed	1. Easy: Relatively easy 2. Language barrier: No 3. Data update: not always, but it was the school´s mistake as they copy-paste last year´s schedule	1. Easy: Yes 2. Language barrier: No 3. Data update: -
Accessible and Usable *(see 5.1.1.3)*	1. Data sets used as the ground of product (technical)	1. Data sets used as the ground of product (technical)	1. Data sets used as the ground of product (technical)
Comparable and Interoperability *(see 5.1.1.4)*	1. No issue for data sets categorization 2. Visualization: good enough to utilize	1. No issue for data sets categorization 2. Visualization: simple, utilizing search tools.	1. No issue for data sets categorization 2. Visualization: simple and easy
For Improved Governance and Citizen Engagement *(see 5.1.1.5)*	1.Public Engagement: more data sets shows transparency, public motivation, basic programming skill	1. Public Engagement: free data sets for people use, collaboration project, basic IT skills. People´s will to learn	1. Public Engagement: More data sets can create value, collaboration of business, municipality, and public to create the best value
For Inclusive Development and Innovation *(see 5.1.1.6)*	1. Development: learning purpose, hackathons 2. Innovation outcome: mobile applications	1. Development: Learning purpose 2. Innovation outcome: website application	1. Development: competition purpose 2. Innovation outcome: mobile application

Table 5.2 – Summary Table of Interviews Findings part 2

Source: Own Author

5.1.1 Open data enables innovation

We will discuss how data sets in the portal can be utilized in the following sections. Open data is possible to utilize if the management of open data in the portal is following the set of principles prior to publishing the data sets online. Although data sets can be published online in the open data portal, the exploitation of open data is heavily dependent on supply and demand factors. The supply factor includes the management of the portal, the number of data sets, the visualization, and the quality of data sets. The demand factor includes the motivation of the users to utilize the data sets to create applications, products and services, websites, and so on. As discussed in 3.2.6 regarding the benefit of open data, many potentials are evident and yet to be discovered. Hence, we formulate our findings according to six principles of open data by Open Data Charter as the instrument to answer the research questions. Furthermore, in addition to the summary table to present the findings, we attached relevant quotes retrieved from our interviewees. It is critical to underline the quotes from our findings as it helps to formulate the answers of the research questions.

5.1.1.1 Open by Default

The heart of the utilization of open data lies in its openness. However, open by default will not work by itself if the data sets are not available or not published. The nature of open data is the data collected, digitalized, and be made freely available online in the portal for the public to use and distribute. Most of our correspondents claimed that the open data by Stavanger municipality are discoverable.

The discoverability of open data is not enough if the needed data from the users' perspective are not available. Six out of six respondents emphasized that data availability is essential to exploit the open data value. However, each respondent has different criteria for utilizing open data such as data sets with good overview, data sets without irregularities, and data sets built according to the IT perspective. Three out of six interviewees mentioned the needs of data sets that have a good overview. A good overview is correlated with factors such as complete description, last updated, maintenance, license, no missing data elements, frequency of updating the data, similar data recommendations, data coverage, as well as the person in charge for the data sets in the case of irregularities. These criteria obtained from their experiences of using open data from The Municipality of Stavanger.

The Criteria to Utilize Open Data	
- Data sets Availability	Very Important
- Data sets with Good Overview	Important
- Data sets without Irregularities	Somewhat Important
- Data sets Built on IT Perspective	Somewhat Important

Table 5.3 – The interview results concerning criteria to utilize open data

Source: Own Author.

> "The more data sets that are available, the more value you can extract out of the data sets."
> – Project Developer, our interviewee

Different categories of interviewees have different answers, as they also have different backgrounds. The level of experience is also different which, the degree of using the open data resulted in a different outcome. The reason lies behind open data usage are varied according to the project and the interviewee's background. Concerning their reasoning to use open data, we use the approach to categorize the purpose. The purpose is categorized into (*see 3.2.3 Open Data: Purpose*) the data to fact, data to data, data to information, data to interface, and data to service (Davis, 2010).

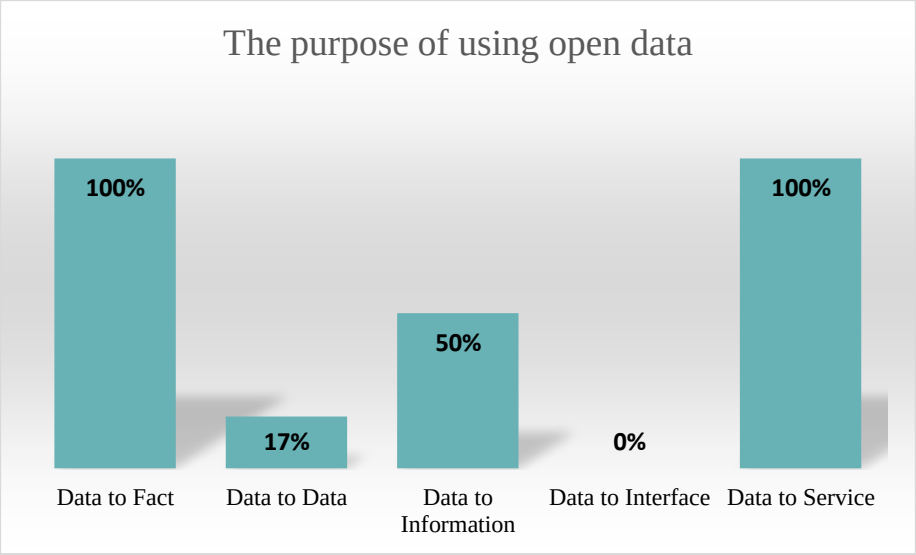

Chart 5.1 – The interview result concerning the purpose of open data usage.

Source: Own Author

Each respondent has more than one overlapping purpose according to the concept. Regardless of their purpose to establish their product and service to the public or not, they all have the intention to create a service function out of data. Six out of six people utilize the data sets to data to fact purpose. Data to fact entails the concept which each respondent specifies the facts they need in open data sets which support their engagement in planning (Davis, 2010). One out of six respondents has data to data purpose, which is concerning converting, manipulating, and transforming data in some way (Magalhaes & Roseira, 2017). These data sets will then be shared and created to ease the user experience.

The next findings we found out that three out of six respondents marked the purpose of utilizing the datasets is data to information. Data to information can be defined as the process to create a static representation out of data sets which leads to visualization, info graph, blog posts, and written reports (Davis, 2010). Data to interface was adopted by none of our respondents to build their product innovation out of Stavanger open data. However, one of our respondents has gained the experience to use the datasets for data to interface on another project. He claimed what he did was categorizing the data sets out of big data. These categorizations were used to provide a tool for users to browse large data sets. The last purpose of how open data is used belongs to data to service. Six out of six respondents aimed to build a service or product out of data sets. The data sets were utilized to grow innovative ideas to solve urban issues.

5.1.1.2 Timely and Comprehensive 

The result of our in-depth interviews elucidates the level of comprehensiveness in utilizing Stavanger open data are associated with the background and the level of experience within the field. The IT Consultant, Project Developer, and Application Developer agreed that it is easy to use open data. They found no difficulties in terms of open data without an illustration. This is according to their experience and their knowledge with respect to the use of open data. The IT student and Start Up claimed that it is relatively easy to utilize open data from Stavanger portal. According to our interviewees, several factors are affecting the comprehensiveness and the experience such as language, categorization, illustration, data availability, and data updates.

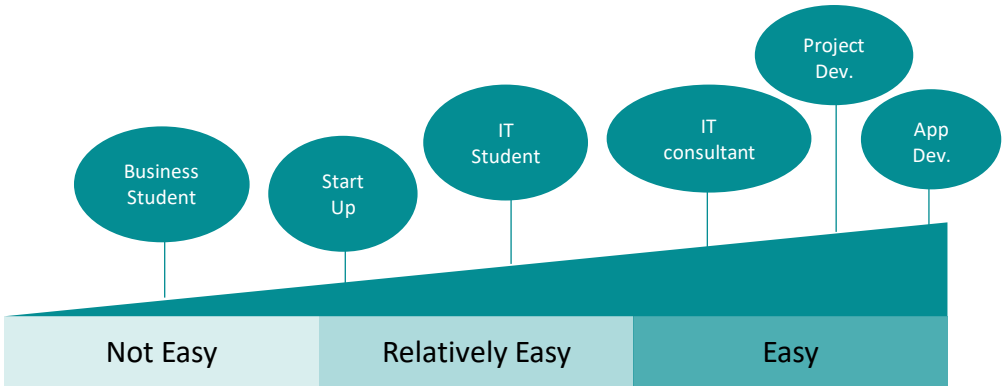

Figure 5.1 – The Scale of Comprehensiveness Level from Interviews

Source: Own Author

The business student tends to have more difficulties in reading the raw open data. The lack of experience in utilizing open data can explain this. The business student claimed that there is a need to illustrate the raw data into a graph that can be understood easily. The raw open data is not only used to produce the end product or service. Besides, the consistency of data which include availability over time can be another factor to succeed in the use of open data. In addition to this, the student believed the purpose of open data can be used for the combination of decision-making and business insight, which opens the avenue to engage the public across different backgrounds. The open data has the potential to empower the public to become social transformation agents by monitoring the government with its actions and policies (Tinholt & Carrara, 2017).

According to our interviewees, language can push the potential to utilize open data. Language is considered to be a factor that can affect the development of a successful Open Data organization (Tinholt & Carrara, 2017) and to exploit open data's potential to be reused. Two out of six, which contribute 30 percent of total interviewees, believe language matters. Language does not only cover the information within the portal but also meticulously into data sets. The Start Up, and business student think that it is important to build the platform with the option to choose English as lingua franca to run the website. Although they agreed that it is possible to use machine translation, they claimed that since there are several abbreviations and terms in Norwegian that are unidentifiable by the machine translation. That the language did not affect the rest of interviewees, could be explained by their language abilities. They prefer the local open data portal to a specific language area. According to (Tinholt & Carrara, 2017),

there are usually specific reasons either in cultural or judicial, to motivate the use of data in a specific language. Meanwhile, there will be a loss of quality when the data has to be translated manually or by machine translation (Tinholt & Carrara, 2017).

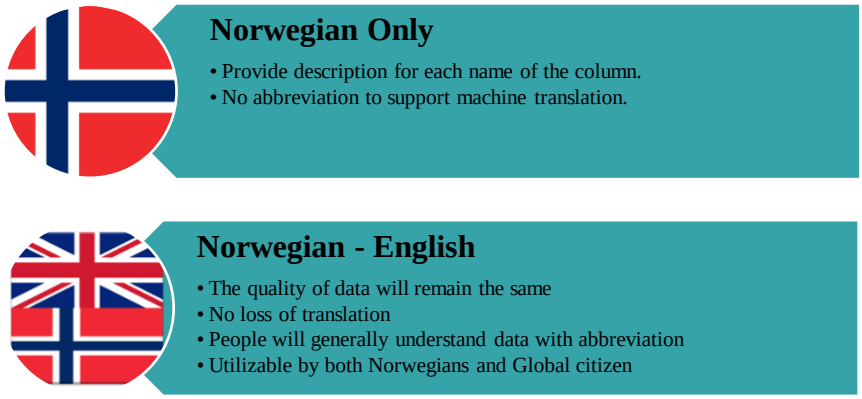

Figure 5.2 – Language preference for using open data

Source: Own Author

Open data is freely available for the public and not associated with any background or nationality for the data sets to be utilized. The Public has the right to use open data and should not be limited by the language. Also, technology supports the possibility for people to work remotely and access any data globally. This growing technology allows the public to make a business out of data sets from around the world. In the era of globalization, providing additional language features e.g. English as lingua franca will improve the comprehensiveness. Adding the language feature will also increase the level of data exploitation and value of data sets.

5.1.1.3 Accessible and Usable

The majority of our interviewee agreed that the utilization of open data becomes the primary source to build their product or service which marks 83.33% of our total interviewee. Only 16.67% use open data as the secondary source for decision making. Different methods and approach were implemented prior to create innovation out of open data. We discovered two ways of open data usability across our interviewee, technical and entrepreneurial approach.

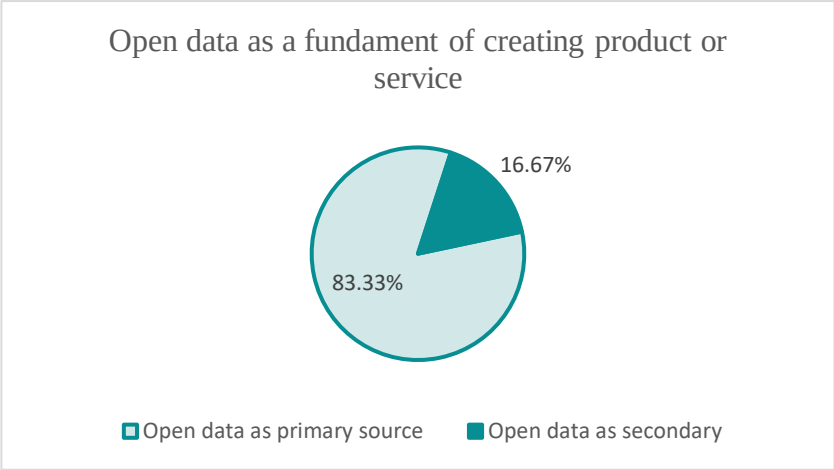

Chart 5.2 – The percentage of interviewees using open data to create products and services

Source: Own Author

The entrepreneurial approach came from our business student interviewee. The business student claimed that open data becomes the secondary source for market research. Open data aids to define the market segmentation, target and the profile of expected consumer before developing a product and service. However, our business student interviewee claimed that open data and combined with other sources later on, were used as the cornerstone for the chosen product and service. This final product and service became a further step after the target, market segment,

> ***"Accessibility makes it possible for people to make solutions that people feel they need. Hence, it is a user-based application. On the individual level there is potential, but it depends on users taking the initiative. On a higher level I think people still need to integrate data from other sources and combine it together to make it useful - IT Consultant, our interviewee"***

and the profile of expected consumer have been determined. This entrepreneurial approach is suitable to make the product and service bigger and acceptable in society.

The rest of our interviewee possessed an IT background which thereby the technical approach is implemented in the case of utilizing open data. Our IT consultant claimed that the research was done with design thinking methods for the approach before making a product or service. Design thinking is the non-linear process of methodology that provides an approach on solution

based to solve problems (Dam & Siang, 2019). The perspective achieved was not only focusing on the solution but also understanding the potential users and the current issues. The further process will be solving these issues along with testing. Many interviewees asserted that the products or services were created for learning purposes, thereby there was no extensive research to define the problem. The rest of these interviewees is certain that they consider themselves as the representative of the citizen. They reflected the issues they found from the environment. The idea to solve the urban issues was turned into an innovative product that uses open data as the main source.

5.1.1.4 Comparable and Interoperability 

Interoperability is data ability to merge without losing the data quality. It is a characteristic of decent quality data related to wider concepts of value, collaboration, knowledge creation, and purpose-oriented (Morales & Orrell, 2018). Data sets shall also have the ability to be comparable, whether it is over time, across the organization, and sector (Open Data Charter, 2015). The open data portal should provide the structure and standardize format to allow users comparing and contrasting data, tracing data points over time and across the project, as well as creating effective and meaningful data to support policy decision (Open Data Charter, 2015).

Some factors make data more usable, such as categorization and visualization. Some of our interviewees agreed categorization helps to manage to find the data sets needed easily. Although filter feature aids to alleviate the data searching, clear categorization will increase the usability and accessibility of the data set. A clear categorization supports interoperability as the data are clustered into either the same topic, theme, formats, and many others. This allows the users to merge, collaborate, compare data across sector and overtime without losing any quality of data sets.

The project developer pointed out a highlight in which the data sets should be available disregarding the visualization. This interviewee stated that visualization would undoubtedly add more value with the form of a graph, map, figure, data comparison and especially the option to self-creating chart in the open data portal. These actions taken will, by all means, depend on the data sets. However, the visualization itself should not be the main concern, as the utilization will depend on the motivation of how the public is going to use the open data, either the orientation is to create product or service or to retrieve information and decision making.

A slightly different opinion comes from several interviewees who believe, depending on the data sets, that visualization like graph, maps, coordinates, figures, and table are critical to the open data portal. Visualization by adding additional preview as is increasing the accessibility of data without letting the users download the data sets (Datagovsg, 2015). Open data is expected to be widely used and consumed by the public. However, the utilization can be difficult to perform the operations, such as collect, process, merge, and make sense of data since there are factors to consider such as lack of technical expertise (Graves & Hendler, 2013).

The availability of data sets is not enough to utilize, there are several factors to consider such as technical expertise including programming skills and knowledge on data management. Lack of technical expertise will disallow a critical proportion of the public to consume such data (Graves & Hendler, 2013). Hence, visualization can diminish the technical impediment as it provides a modest mechanism to communicate data on a large scale (Graves & Hendler, 2013).

5.1.1.5 For Improved Governance and citizen Engagement 

Most of our interviewees agreed that the open data by the municipality of Stavanger are discoverable. However, they did not know its existence if projects did not engage them, and hackathons run by the municipality. They are certain that activities such as binding projects, business competition, and business hackathons are the way to engage the public that has an interest in open data.

The IT student asserted that the knowledge about open data was minimal before the project began even if the capacity is available. Consequently, since the impact of the project is evident, the IT student believes that there is a need for more frequent projects or competitions to raise public awareness of using open data. Furthermore, many efforts can be implemented to increase the involvement and engagement as well as improving the government's performance. The efforts mentioned by our interviewee such as project collaboration between university, municipality, and business, basic IT skill education and training as well as competition. These efforts are believed to exploit more open data and its utilization. Application developer conveyed the message that the engagement should bring the outcome in the form of product or service such as applications or websites.

> “Public engagement and government performance improvement work like a domino effect.”
>
> – App Developer, interviewee

Open data can attract the public on a massive scale if the applications can be based upon urban issues. Good examples of applications can be a platform to showcase the real utilization of open data. Open data allows the citizen to keep being informed due to open data transformation into applications that serve the public. This opportunity will encourage vigilance among the public and improve the collection of data through the public's participation in public discussion (Cabinet Office UK, 2012).

> “Engagement can occur when the public can experience the product/service from the developers as the result of utilizing open data.”
>
> – Business Student, interviewee

The majority of citizen does not have to be involved in the technical process in which data sets turned into a product or service. Moreover, some people do not have the capacity and motivation to utilize open data into products or services, but they deserve to experience the use of open data. Instead, the community and public, in general, will experience the benefit of using open data through the use of applications for every solution needed in urban issues. These sequences of events are the media to promote open data and smart city in general.

5.1.1.6 For Inclusive Development and Innovation

> "The more knowledge the users possess, the more determine they are in utilizing open data and what data sets they need, the better the outcome they would create."
>
> – IT Student, interviewee

The availability of data supports the possibility of innovation that can produce an outcome or product/service. Innovation is defined as the multiplication between invention and commercialization (Aulet, 2013). If a user of open data is determined in terms of the idea, the process, and the lists of data sets they can form a product or service out of, then there is a chance of innovation would better be created. Because a higher level of capability of knowledge will determine in the ability to manage the complex data sets. Therefore, the sophisticated output will more or less be created. Thus, in a certain period of time, a majority of the citizen as an end-user will also benefit from the product of innovation. Indirectly, the utilization of using open data can also be experienced by the people, albeit there must be a certain process done by businesses in general to transform the data sets into products or services. There is a critical part of the population that could benefit directly from the utilization of open data. However, they cannot act on the fundamental operations needed to collect, process, merge, and sense of the data sets due to their limit capacity in terms of lack of expertise and technical knowledge (Graves & Hendler, 2013).

> "Open data is my instrument to make my idea into realization, like applications that are functional and useful for public."
>
> – App Developer, interviewee

Open data contains a valuable raw material and to extract the benefits several actions needed to be implemented such as data transformation, analysis, aggregation, and synthesis (Walker & Simperl, 2018). Some of our respondents stated that the idea comes as they positioned

themselves as the representatives of society. The innovation is built when they found the common issues they had to face daily. The statement quoted above is aligned with the research made by Lakomaa and Kallberg. Open data is fundamental for most IT startups and developers, not only for the realization of the business plan but strengthening the plan (Lakomaa & Kallberg, 2013).

Our respondent, an application developer, claimed that there is a big possibility why open data is not exploited vastly to the public. Non-developers would less likely understand the format of the data sets. This statement is confirmed by our other interviewee, a business student, as a person who does not have an IT background. These findings show that open data can extract values as it becomes a value generator, however, it depends on the ability of the users to exploit their absorptive capabilities (Magalhaes & Roseira, 2017) and explore these data sets to retrieve the potential value (Zuiderwijk, Janssen, Poulis, & Van de Kaa, 2015).

Innovation out of open data can create a broad impact if the collaboration of each stakeholder works as expected. There is a need to boost an urgency to make a project collaboration among stakeholders. Our interviewee, IT consultant, uttered the difficulties of average people to make use of raw data due to the data sets format that not many people understand. However, the majority of people have a desire to harness the products or services out of open data. The collaboration of the business, the municipality and the development team will build conclusive evidence for a massive impact to society. The development team can use, analyze, and transform the data into product and service. Municipality plays the role to make the data needed available, and business has the ability to do the market analysis, commercialize, and discover ways to make the product or services sustainable. Thus, there are benefits which open data innovation is based on collaboration.

5.2 Overcoming Barriers to Enforce Innovation of Open Data

As the result of our interviews it is evident that open data enables innovation process in many perspectives. The lack of open data decelerates innovative process or impedes the initiation of entrepreneurial innovation (Lakomaa & Kallberg, 2013). The innovation will create benefit as it is the activity that contributes to economic growth. The more innovation the more convenience urban life is. Open data as smart city initiative will increase efficiency throughout the outcome produced out of it.

The result of our findings showed four type of barriers mentioned by our interviewees such as awareness, collaboration, technical and business, and motivation. These barriers hinder public to reap open data's thorough benefit to enable innovation. In this chapter, we will discuss the avenues to overcome barriers as to why open data faces complexity to enable the potential for enforcing innovation.

We will cluster the barriers found into categorization. First, enticing public participation will be explained by analyzing the motivation to use open data, harnessing users' engagement to increase the use volume of open data and raising the awareness of open data. The second part will entail the factors to unlock the open data potential in the coming years, such as skills needed to use open data, collaboration of each stakeholders and its implication, as well as emphasizing the management of open data. These topics discussed are in the perspective of increasing open data potential value to enable innovation.

5.2.1 Enticing Public Participation (RQ1)

There are many avenues that a country can implement as the avenue to promote open data. However, it is way more beneficial if a government acknowledge the users that have experienced using open data and the potential users to acquire. Open data has full of potential benefits that are not recognized by potential users due to many factors. Analyzing from the findings, our interviewees mentioned regarding the lack of technical capabilities, lack of collaborations, low data availability, and low level of awareness are the main reasons why open data is still difficult to reap open its full potential. The barriers are crucial to thoroughly identify due to there is a need to create good structures and support for managing open data (Janssen et al., 2012).

There are many other factors resulting in low level of public use and participation of open data which is validated by our interviewee. There is still the preference to choose the real career over exploiting and commercializing the output of open data. There is a chance where the users receive no incentives, no added value, and no time to make use of open data which resulting in the participation stopped (Janssen et al., 2012). There is still a sense of agitation to shift and bring all out of open data's potential for business purpose. Public still needs to be convinced with the career path, capital, and benefits from open data.

The more people know and understand to use open data, the more collaboration will work, the higher quality of open data is. If this chain of open data expectation exists for the future open data, there will be more novel innovative product and services created in the society. Defining and understanding the users will increase a greater impact and efficiency to raise the awareness of utilizing open data. Therefore, there is a need to find the accurate strategy to raise the awareness of open data so that it will give a broad impact that is expected.

These sections below will answer our research questions on how to entice public participation. We will identify it in two ways. First, we will define the users' motivation to work with open data according to our findings on in-depth semi-structure interview. Second, we will define the possible and the right strategies in order to raise open data awareness. We will analyze the way to raise open data awareness by harnessing users' engagement to open data.

5.2.1.1 Users motivation to use open data

Prior to decide on how to entice the public participation, it is a better step to understand the users of open data with their motivations to engage with open data. By defining the correct motivation, the further approach will be then putting the effort on raising the awareness of open data. A research showed that there are six types of people that are interested in open data which remark the motivations for engaging with open data such as government focused, technology and innovation, reward, digitizing government, problem solving, social or public sector entrepreneurialism (Davies, 2010).

The users who are clustered into government focus seek to get better understanding in terms of government actions and want to promote efficiency and accountability. Second, users that has the motivation to seek for recognition and profit are clustered into reward focused users. The users who are interested in making new innovative platforms and utilizing technology tools are clustered into technology innovation focused users. Digitizing government and government focus seem to be vague to differentiate. However, digitizing government focused refer to the users who seek improvements throughout technology to achieve efficiency. Majority of users have motivations to use open data to solve issues and particular challenges. The last one is social or public sector entrepreneurialism whose users utilize open data to innovate and provide services or product to the society (Davies, 2010).

Based on our interviews, we can label our users into several category such as academics (business student and IT student), programmers (start-up, app developer, project developer) and consultant (IT consultant). Each of our interviewee has their own motivations to use open data. Based on the six aforementioned motivations, majority of our interviewee have the overlapping motivations to work with open data. There are imbalance proportion of motivations coming from our interviewee that is minority of them are interested in government related focus. However, these motivations seem to be intercorrelated. It depends on how our interviewees are first engaged with open data either it is university project or hackathons *(see 4.2.1.1)*.

All our interviewees are engaged with government throughout the project and hackathons. Initially they are group of users who joined the hackathons are based on government focused to create e-services. However, on top of that, each of the interviewees has their personal motivation to engage with open data. It is less likely that our interviewees are engaged with only one set of interest. For example, an interviewee may have both motivations to engage with open data in technology innovation and social/public enterprises simultaneously. Our interviewees suggested that open data helped them to make their plan into realization. An outcome either it is products or services are built out of open data as their main instrument.

Reward marks the least motivations to engage with open data from our interviewees' standpoint. Albeit potential profitably, some our interviewees do not seek for reward in terms of profit but recognition. Most of our interviewees admitted that they used open data as their interest to learn more to use open data to solve urban issues and give contribution to the society. Davies described problem solvers are a group of users engaged with open data to learn new skills out of open data because it is the suitable tool to aid meeting a pre-defined goal either coming from colleague, client, or their own (Davies, 2010).

Out of six interviewees, only 16.67% remarks a business background whilst the rest is IT that remarks 83.33% out of total population of our interviewees. There seems to be background imbalances in the way we collected our interviewees. However, it represents the real situation in which there are higher proportion sample of developers who are actively working with open data compared to several other backgrounds such as entrepreneur, civil servant, NGOs and many others. In contrary, this thesis also shows that in fact open data is not addressed only for developers. Many purposes and benefits of open data that users can reap the its full potential *(see 3.2.3 and 5.1.1.1)*.

5.2.1.2 Raising Open Data Awareness through harnessing users' engagement

Raising the awareness of open data involves a cultural change. The evident result of a culture requires a long time change and adjustment. A change by the culture will trigger a higher demand of open data. The investment in capital and effort will be pointless if there is incapability to create a demand. Data is considered to be the new capital of the global economy with its full potential (Hammell, 2012). Open data culture works as a catalysator to the successful of open data initiative. Therefore, raising the awareness of open data place a crucial position in the process to enable innovation out of open data.

There are numbers strategies that we summarize according to the public that used open data. The snowball effect analogy is suitable approach to represent the case. The summarization of strategies makes it easier to identify the potential users to reap the value and make use of open data. Based on our interviews, there are various demand to be consider from our users in order to maintain the engagement to open data such as training, education, call for collaboration, competition, hackathons, and open data community. The engagement of the users should be nurtured from an early stage involving every recognized users and stakeholders from every stage of processes. Harnessing users' engagement is the way to create more demand of open data. It will be pointless if publication is made but the demand of open data will remain low. Therefore, there should be a balance between raising awareness as well as engaging the users.

The first stage of participation that public can make is the involvement of sharing government vision. There are channels to encourage public to be proactively joining the open data decision. According to Norwegian Statistics Bureau, Norwegian people spend seventy percent of their time daily on the internet and social media. This remarks ninety one percent of Norwegian population that are connected to the internet on 2018 (SSB, 2019b). This can be an accurate media to spread the awareness of open data. The additional work will be targeting on what channel of social media such as Facebook, Twitter, YouTube, Snapchat, Digital Newspaper depending on the age category. If there are numbers of evident outcome and success stories to channel that open data is changing the public to have a decent and convenient life, there will be many more people who build curiosity and interest over open data and how to work with it. There will be a raise of engagement and therefore, the participation is enticed.

The participation to encourage more users is business competitions out of open data with a high frequency of a year. The competitions can be used to raise awareness and entice public participation. This can be addressed to many users such as academics, programmers, business incubators, start-ups, consultant companies, NGOs, and journalists. The competition can be built according to many factors on different topics. It can be based on the current issues in the society, availability of data, or the category of the data sets which represent education, government service, environment, budget, and many others. The events will be used to encourage the innovative products and services. These competitions can also be a platform to inform and share a new released data set, provide guidance about privacy and safety, and draw on the expertise of participants (Chui et al., 2014).

The government should introduce a work plan, benefits and how the little act can impact the economic growth. Furthermore, the activity will trigger more availability and transparency of the data if the demand is raising. The competitions tend to attract participation of novices rather than professionals (Chan, 2013). A study made by Janssen remarked that there is a limited chance to use open data for educated people to have time for exploring new business opportunity unless motivated (Janssen et al., 2012). The prize money and publicity can be offered along with the competitions to foster enthusiasm and motivations among participants. The competitions are conducive to create and raise awareness as well as entice wider participation but low quality e-services (Chan, 2013). Albeit the mediocre quality, the competitions can act as a learning base to increase the skills and as the way to entice more participation.

Hackathons are a type of competitions addressed to programmers or software developers to work collaboratively in order to manage a project that is related to software. Since the intention of hackathons are software related project, many hackathons held do not consider the importance of entrepreneurship. Entrepreneurships or business incubators can be positioned as mentors during hackathons. Business mentors are crucial to introduce entrepreneurship topics and skills to the application developers prior to establish their output that is application. Mentoring can be the way to monitor and train the developers to commercialize the application. By presenting the mentors, the government can convey the message to the public about their vision of open data, as well as the utilization of open data while maintaining the expansions and growth of new application (Kitsios, Papachristos, & Kamariotou, 2017). Furthermore, hackathons can be a platform for collaboration to gather the skills needed in order to create

applications and make these applications as potential businesses to grow and expand. Besides, other marketing platforms can be included such as interagency meetings, roundtables with NGOs and business, and public-awareness campaigns (Chui et al., 2014).

Another soft and long-term effect approach to raise the awareness of open data is by education at the early stage. The material can be regarding basic skills that are beneficial for open data. Education aims to prepare the future generation to develop skills that can meet the demand of open data. The result education-themed application can be used to introduce the use of open data in daily lives of students. Middle school can start introducing the subject regarding open data either in technology class or entrepreneurial class. The benefits and the challenges of open data can foster their enthusiasm. Positive experiences obtained by student interviewees. A project collaboration between academics in this case university and government regarding open data. The material of lectures can be formed into a projectized based where students are divided into groups. The group should contain business students and IT students. Under supervision of the lecturers, students can sit down together discussing the potential product or service they can build out of open data and have the output commercialize in the society.

Hackathons and education lead to the training program effort. Training can be a continuous program that government can provide to the public. Training can act as the way to acquire and enhance skills of the users and potential users. It can be addressed to the students, recent graduates, or majority of people who have interest in data, technology and entrepreneurship. There are many ways to do the training effectively. The younger people are more familiar with technology and internet as they are experiencing the era of digital technology. The media such as YouTube and Facebook can be platforms to build a community that have interest over open data. The channel created in YouTube to provide the participants with training videos. At the same time, monitoring is still implemented through utilizing social media as well as meeting in person to maintain two ways of communication.

Albeit possible, it is difficult to have a person that possesses well developed complete skills to exploit open data and transformed it into outcome. The training skills can be divided into several focus skills such as technical and entrepreneurial. These skills can complement across focus skills. Ideas that are trained and refined can transform to be an innovative business. The most important out of these programs are the sustainability, the government is possible to track how

the business is going. Therefore, the impact of open data fostering innovation will be evident and exist for the community.

There are avenues to harness the engagement as mentioned previously. The soft skills and hard skills needed in the future to work with open data should be included in each project effort *(See 5.2.2.1)*. the higher skills the more honed the ability, the more possible to make innovation. When there are motivations to start a business due to there are more ideas and more available capacity, open data can be an absolute economical and societal prospect value to invest more in the future. In a long-term perspective, there are possibilities for the economy to grow out of open data. Albeit less evident, there are still efforts to attempt to change the culture by inducing the awareness of open data through medias chosen.

5.2.2 Unlocking potential of open data in the coming years (RQ2)

The utilization of open data can achieve the expected outcome if the open data barriers *(see 3.2.5)* can be minimized. Innovation can be unleashed out of open data if there are motivations, curiosity, and enthusiast from the users to yield outputs to solve urban issues. Beside motivation, an open mind is required to identify and pursuit the economic and societal added value of utilizing specific data sets (Berends et al., 2017).

Users that have motivations, enthusiast, and curiosity will find avenues to work with data sets and exploit values out of them. In this section, we will discuss regarding two highlights. First, the required skills to perform open data in order to obtain open data's potential. Second, we will discuss with regards to collaboration of each stakeholders and its implication, and the last one is emphasizing the management of open data.

5.2.2.1 Skills needed to work with open data

There are several aspects in the findings regarding skills to perform open data. From our interviews, the skills mentioned mostly are the collaboration of technical and entrepreneurial skills. Innovation is possible to achieve when a knowledge and idea are combined with skills transformed into a sustainable product or service. The skills are fundamental to thoroughly utilize open data's potential. In an overview, we can deliberately consider that both hard and soft skills are evenly important to perform open data into a usable product or service. By identifying skills, it is easier to analyze the current situation with respect to skills that the surroundings need to support the open data that can enable innovation.

Finding and customizing the relevant data sets require the hard skills as each set are different in terms of format and structure (Berends et al., 2017). Moreover, there is also a need of soft skills which is needed to recognize how open data can solve particular business challenges (Berends et al., 2017). Both soft skills and hard skills seems to be equally fundamental and have to work in balance. Moreover, the communication must be maintained to connect the technical solutions with business problems. This aims to comprehend thoroughly the synergy between analysis and its implication (Carrara, Fischer, & Steenbergen, 2015).

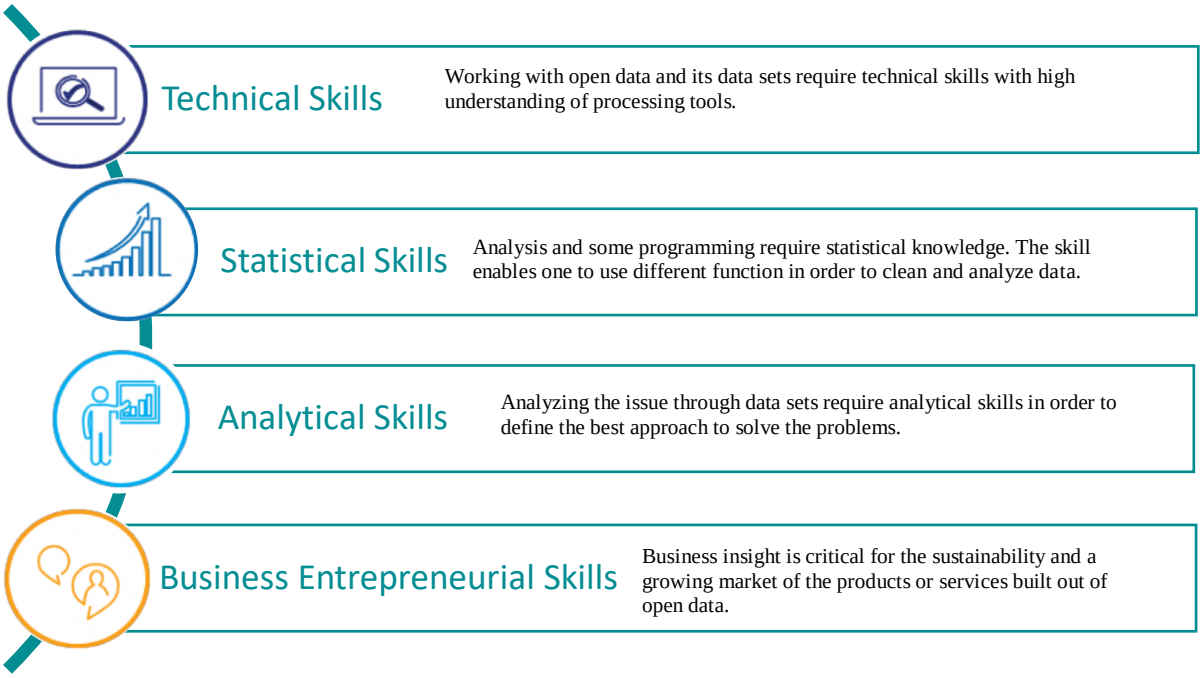

Figure 5.3 – Skills required to enforce innovation of open data

Source: own author adapted by (Berends et al., 2017)

The figure above elucidates the skills required to work with open data. Technical skills and statistical skills are clustered into hard skills. Soft skills consist of analytical skills and business entrepreneurial skills. Business entrepreneurial skills include the ability to problem solving, storytelling, curiosity, collaboration, communication and creativity (Tinholt & Carrara, 2017). These skills are accounted for both supply and demand sides, government and public to unleash the potential of open data.

Beside the data literacy, technical is the most fundamental skills needed to work with open data. Running software platform, knowing how to program the data, acknowledging the data sets needed, machine learning, and algorithms are the ability required to perform open data (Carrara

et al., 2015). As our interviewee stated that the most important skills to work with open data is basic programming skills. The raw data sets, with technical skills, can be transformed into new innovative products or services as outputs to solve urban issues. Prior to this step, there are needs for collaboration in order to make the whole business process work, a need of statisticians, analyst, and businesspeople.

The demarcation between each of skills seems to be vague in order to work with open data. Technician needs a knowledge of statistics, statistician needs analysis, analyst needs to know a business perspective, as well as business entrepreneur needs to know analysis. One person can possess more than one skill mentioned. Statisticians need statistic tools and programming skills for data analysis. Additional skills that require analysis are analytical skills as well as business entrepreneurial skills. Analytical skills are important to analyze the immediate problem and find the suitable approach to solve the issues using data as the instrument (Carrara et al., 2015). Analytical skills also require knowledge to run statistical tools.

Business entrepreneurial skills are fundamental within the whole process of the innovation. It starts from analysis to determine correct customer, comprehending the market as well as the target for the business, setting the best promotion tools, creating brand awareness, finding the strategy to achieve sustainability, and raising the capital and budget allocation. These are the business strategy to make the products or services built out of open data can grow. The most important knowledge that underlines among the skills is data literacy skills. The skills needed can be nurtured by harnessing the users' engagement as well as raising the awareness as its snowball effect *(see 5.2.1.2)*. Entrepreneurs run a critical role in transforming open data into nascent products or services to the society and make it sustainable. As mentioned by our interviewees, collaboration matters to bridge the gap between skills. While, Communication are the key to connect the gap among IT, business, and politics (Carrara et al., 2015).

5.2.2.2 Collaboration of stakeholders to enable innovation

Stakeholders *(see 3.2.2)* that involve in the use of open data have different factors such as concerns, needs, motivations, and roles (Manyika et al., 2013). Thus, these factors should be employed so that the concerns can complete each other to bring out a strategy for collaboration. Collaboration are the crucial factor to enable innovation according to the experiences of our interviewees. Innovation out of open data can establish a larger impact if the collaboration of each stakeholder cooperates and works as expected. Government as an intermediary actor

should not forget the demand and supply chain of open data collaboration in order to exploit more from open data´s full potential.

We will discuss several important stakeholders within Stavanger open data initiative that work with open data. The stakeholders include the public, government, businesses, and media (Chui et al., 2014). Collaboration allows the stakeholders to take advantage and gain benefit out of open data. Government plays the role as the intermediary actor within open data ecosystem. Government is the public sector that holds and releases the data sets in the portal. Government acts as a policy maker with focus on safety, national security, privacy settings and rights (Manyika et al., 2013). It is the requirement prior to the process of releasing open data into the system *(see 3.2.4).* Government is the agent to ensure that open data released are accessible and useful for further innovative creation. The role of intermediary means proactively seeking for partnerships and also providing the avenues to engage the users and potential users. Government is accountable for gathering stakeholders to work with open data in collaboration settings.

The public is the stakeholder that gains most of the benefits out of open data compared to other stakeholders. Individuals in the public are the main customers that businesses are targeted. The result of our interviews showed that the public tends to be the end-users of open data. Developers compete in making useful applications out of open data in order to solve urban issues and to ease urban lives. Applications established can be across many categories such as schools, environment, transportation, health, public spaces and many others. The role of government is to engage these individuals throughout a strategy such as open data communities or public forums. The forums can let the public to learn about how open data provide and improve service for the public. The forum can also let the public to share knowledge and ideas to the concern they need out of open data to ease their lives. Government can utilize media to press release of open data innovative creation to attract more users and business collaboration.

Similar to developers, businesses that include entrepreneurs and developers are trying to create innovative products and services out of open data. Open data is not only benefit businesses to gain profit but also to increase the companies' productivity. The public are proactively looking for products and services that can benefit them at most. By looking at the opportunities, companies influence the data holders to establish more valuable data in the portal. Businesses are not only involving government for open data but also many other stakeholders to share and

trade open data. The collaboration will be created to increase innovative offerings that leverage open data (Chui et al., 2014). Therefore, businesses can involve developers to develop strategies and tools to turn open data into useful output such as products and services.

Open data that are established in the open data portal by government, companies and many other parties can be utilized to produce innovative products and services. Specific value lies within the gathered information from divergent sectors of the economy and incorporate the information with data needed (Manyika et al., 2013). The management of open data should also be implemented within businesses. Similar to government, businesses can also engage the public by giving a platform to discuss and give feedback regarding the products or services they produce. This aims to evaluate whether the products or services have met the public's expectation as well as for further development and innovation. Taking the role as the third party, businesses can also engage government to share platform to make the open data accessible and usable. Therefore, businesses can participate in the open data ecosystem along with the other stakeholders as well as commercializing the value of established data (Manyika et al., 2013).

There are several media that government can use to promote the use of open data such as radio, newspaper, blogs, tv and many others. Media seems to be powerful to spread the open data awareness. However, the type of media chosen has to be precise according to the target users and potential users *(see 5.2.1.2)*. In this case, it is not only media as the platform to aid open data awareness but also the men behind these media, journalists. Opinion of journalists can lead the public to give extra attention for open data. Journalists can also ask for two ways communication so the users can feel engaged. Journalists can also benefit from open data to see the trends, patterns, and behavior (Chui et al., 2014). The analysis from journalists can have a decision-making purpose for the readers. The writings can place as a catalysator that lead the public to act upon. Therefore, journalists and their writings can serve as a channel to open up avenues for innovative creations and further development out of open data.

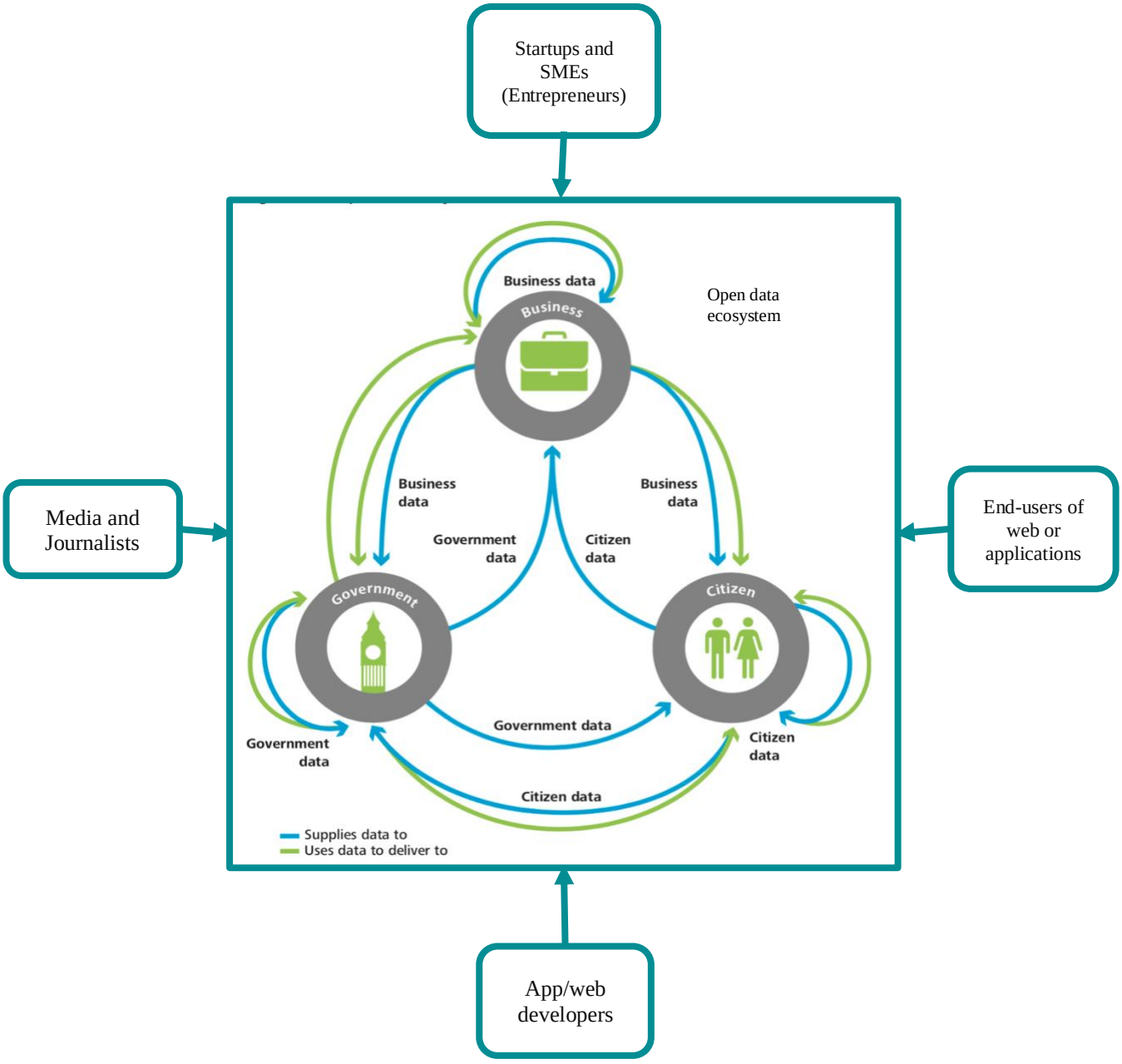

Figure 5.4 – The ecosystem of open data illustrating the stakeholders' collaboration. Source: (Hammell, 2012), (Kitsios et al., 2017), and combined with own author.

The additional actors such as startups or SMEs (entrepreneur), app/web developers including consultant, media and journalists, as well as web/application users representing the public are participating into the open data ecosystem. The participation of these actors can contribute to the nascent innovative creations. These actors are closely related to each other through the flows

open data. It creates a demand and supply chain since the activities done by an actor influence and affect the other actors. Hence, the collaboration of actors that affect each other can trigger the use of open data that can foster innovation.

5.2.2.3 Emphasizing Management of Open Data

Acknowledging the barriers and taking actions on the way to overcome the barriers are equally important. However, there is additional process a government cannot skip that is fundamental for open data, such as emphasizing the importance of managing open data. The portal should be a platform which gathered variety sources of knowledge and innovation components. Furthermore, it becomes a location to conjoin and identify open innovation partnership opportunities (Chan, 2013). Prior to the stage where open data can enable innovation, there should be a prepared and managed platform for the datasets. Therefore, management of open data is crucial prior to the stage that open data can be utilized to foster innovation.

Government should not only focus on creating demand but also focus on the supply. Just like demand sides that require technical skills, internal side of government should also provide technical skills with specific expertise in IT, data processing, and data management (Berends et al., 2017). Management of open data also focuses on making non-sensitive data sets available as many as possible. Moreover, management of open data places a concern on the infrastructure and technology of open data so that public can use and reuse of the data sets (Berends et al., 2017). Besides data availability and its quality, there is also a need to have an open data portal that becomes a platform for an open innovation. Most users are currently focused on the way to easily use the data sets that are embedded in software applications, whereas connecting, linking, and combining data by users requires sophisticated and advanced knowledge (Janssen et al., 2012).

Government through its management of open data acts as a catalyst for open data utilization. It creates a developing ecosystem *(see 3.2.2)* of data users, coders, and application developers. This aims to attract the users and potential users with the expected talent, government can take action by advertising the open data initiative efforts through press releases, user other marketing material or promotional tools, or engage individual outreach efforts (Chui et al., 2014).

Countries around the world plan, implement, and integrate open data programs. However, they place in the different stages. Some are in the first stage to investigate the utilization of open

data and establishing an open data portal. Some countries are running several programs to entice participation. In terms of managing open data, countries can learn from each other in establishing success stories and the best-case practices for others to learn. Each country has its own capabilities, thereby, the governments around the world are required to develop a frank vision of their strategy and goals in the open data portal. Therefore, making sure that data sets quality is high and open data is well managed, are fundamental to enable innovation.

There are three concerns that the open data portal should include. First, the design of open data portal provision strategy according to user demands, open data has to be standardized and harmonized and third, a success story by utilizing open data should also be shared in the portal and social media (Tinholt & Carrara, 2017). Blog for publicity and updates should also be available in the open data portal to add more value and to increase the awareness. Therefore, open data portal as an open innovation platform is not only a mere listing of datasets but also the possibility to build the business should be incorporated, along with the website (Chan, 2013).

There are five potential components for a successful initiative of open data management that covers people, tools, and systems which are the fundamental elements to develop a customized open data approach (Chui et al., 2014). First, the management to inventory available data sets to ease users assessing the sets' value. This includes open data portal management and maintaining the high quality of data sets prior to publishing them in the portal. Second, the element is analyzing the on-going initiatives. This covers training, hackathons, collaboration and many other nascent programs.

Third, it happens to be one of the most important action in management of open data in which the government should have the ability to identify gaps in several factors. The factors constitute knowledge, capabilities, technical infrastructure, portal management, users' engagement and others. Fourth, this chain of element includes the prioritization of actions and investments. Managing open data requires to take into consideration the initiatives prioritization. Open data culture should also be implemented in order to raise the awareness of the importance of open data. Fifth, there is a need to evaluate the stakeholders relations' to open data and whether or not they are thoroughly exploiting full information of open data (Chui et al., 2014).

These elements are the chains of actions for open data management. Open data management is intended to enable the use and reuse of open data to enable innovation and reap open data's full potential. The ease of open innovation process should also be provided when designing the open data platform to attract more users, potential users, and partners. Therefore, emphasizing of open data management will benefit every stakeholders of open data.

5.3 The possible road ahead to create the evident impacts

Many governments establish their data with the purpose to comply obligatory regulations for products or services branding, either competing within local, regional, national, and international level. However, there are also many other governments conducting the initiative to proactively persuade more participants to create the tangible impact for the society. The level of preparation is somewhat different. There are many approaches the government can carry out.

Cultural approach will be suitable to persuade people to use open data. Not only success story that can promote the application of open data, but also the inspiring habits of people that can change people's life and perspective throughout open data. Many tools chosen for promotion can be a platform to introduce the way to use and the evident impact of the products or services out of open data. Statistics showed that 78% Norwegian people hike in the woods or mountain on their free time (SSB, 2017). This entails additional activities such as skiing, jogging, biking, fishing, rock climbing, and many other activities during the hikes. It also represents that the majority of Norwegian people prefer spending their times off on outdoor activities to any other activities. It runs across gender, age, and background showing that the outdoor activities become part of the cultures. Elderly aged 67 and above tend to do mushroom or berry picking than activities that requires more active movements (SSB, 2015).

Building from the aforementioned supporting statistics, the marketing strategy and tools can be applied precisely according to the target and needs. For instance, the mobile application such as biking route can be advertised with the way that is showing the users' preferences. The preferences entail the options of choosing the alternative routes, choosing routes with the views, choosing the type of roads either it is smooth or bumpy, the feature to check the weather with the clothing recommendations, the feature to suggest what accessories needed for a bike to go through certain road and specific weather for safety reasons.

The application is suitable for people across gender and age which can be advertised throughout social media for a closer promotion. The strategy of marketing can draw the situation in which an active person with her daily activity scene has the life organized after using the application with the simulation. Therefore, people who initially choose to drive cars can potentially shift to use bike due to the health concern and their likings toward outdoor activities. They can choose their preferences within a single integrated application. Therefore, the effort of changing the culture toward open data culture is possible to implement. At the end of the advertisement, the commercial should clearly state that the application is developed from open government data and hence call for collaboration for entrepreneurs, developers, or any other potential users who are interested in joining the business with the municipality for open data innovative creations.

We can promote many ways out of this commercialization case. First, we can teach the potential users to simulate and use the application. The application is the innovative creation out of open data. Second, the application promoted is the standout application that can trigger more people to create more innovative nascent ideas from open data to solve urban issues. This application is advertised by the governments which show that government is supporting and harnessing the public engagement. Third, it persuades innovative and motivated people who possess the skills to collaborate and work to altogether exploit the benefits of open data.

The open data portal has to be managed in certain ways that can fulfil the demand of the users. One way of doing it is through visualization that can share an appealing history for the intended users and to attract larger audiences (Graves & Hendler, 2013). The open data portal can be designed in particular way to show the simulation or demos the use of data sets for the visualization part. In addition to this, the open data portal can provide the guides for developers with APIs. APIs provide the access to static data as well as real time data sets. Developers has the privilege to have the option to subscribe the mailing list. The subscription will include the information regarding new APIs, the updates of established APIs as well as the maintenance scheduling.

Increasing the traffic of website is tricky particularly to measure how it fulfills the users' need. There must be an interesting feature to attract more people to visit the open data portal. The open data website needs to be managed in a creative way to alleviate the exploitation strategy such as blog. The blog is the feature that can provide the information such as technology updates, new applications out of open data, upcoming events, call for collaboration information,

business case competition announcements, urban studies, and any other city concern. The blog allows the NGOs, journalists, academics, and other stakeholders to put their thoughts in the form of writings. The municipality will then filter and evaluate if the article is suitable to be published in the open data portal blog. The blog can incorporate other platform like social media such as twitter, Facebook page, YouTube, GitHub, and many others. The blog can also be integrated to the local or national digital newspaper. It allows the citizen to see the activities and events from the municipality that is related to open data. The media and visualization can boost up the open data promotion. The blog serves as portfolio profile for the open data initiative with its activities to showcase open data potential.

The website portal can also be the platform to attract the investors. The investors' roles are significant for the innovative creations from open data. They can support the financial robustness of the projects. However, the investors might demand for the promising value of the innovative creations. Hence, it is expected to provide the platform that the investors can proactively look for the potentials. Furthermore, the product developers or businesses have to be actively approaching the investors to join in the collaboration using the platform provided by the government.

The government create open data initiative such as business competition or hackathon to attract more users in order to exploit open data. The challenge is not only coming from the project implementation but also the sustainability of the innovative creations as the results of the project initiatives. The competition provides the participants with the entrepreneurship and technical mentorship. The mentoring system will include the activities from upstream to downstream. The mentor will teach the topic from the approach on determining STP (Segmenting, Targeting, Positioning) of the business, business model, financial robustness, and the sustainability of the innovative creations. From the technical side, the mentor includes the modules regarding developing applications and websites. The winner of the competition has the opportunity to win the prize as well as the full mentoring to have the output sustained.

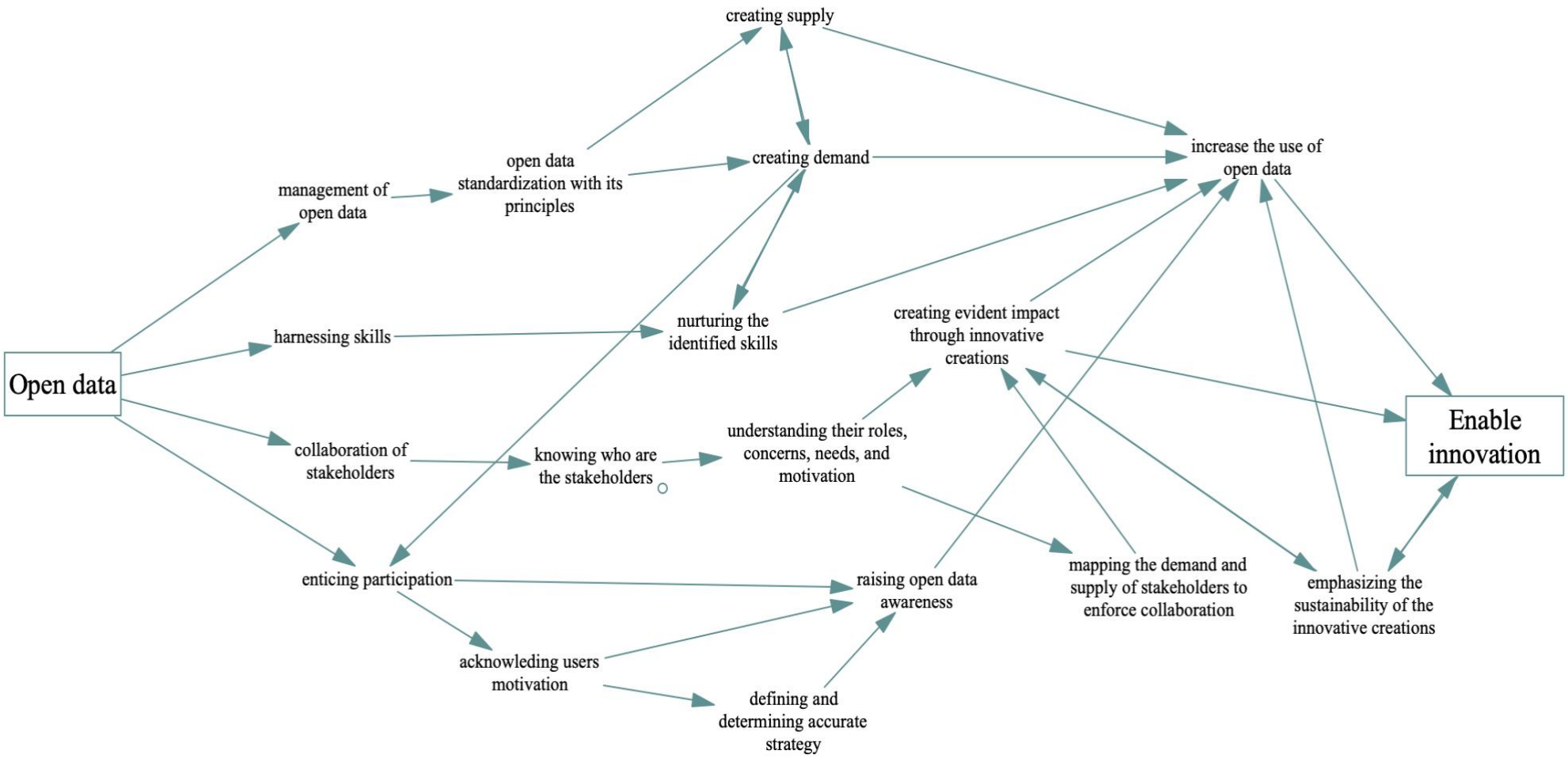

Figure 5.5 – Illustrate the correlation factors of the open data to enable innovation

Source: Own Author

5.4 Visualization initiative

These are the possibility of visualization built upon the expectation of the users from our interviews. The portal has several features besides datasets, developers, blog, community, as well as the platform to showcase innovative creations.

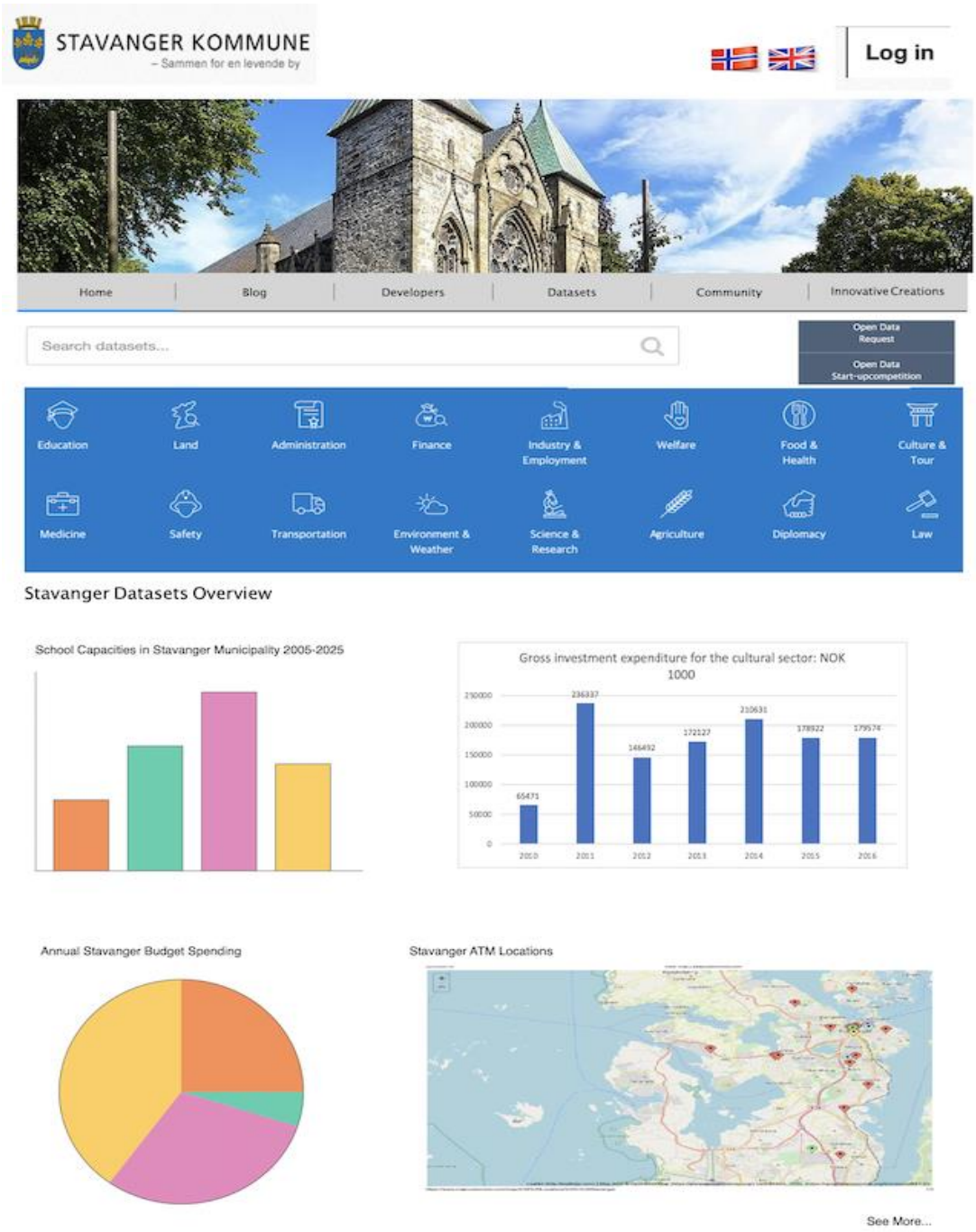

Figure 5.6 – Shows the page 1 of the homepage for the expected visualization

Source: own author with comparison study from open data South Korea, Singapore, US, pictures retrieved from google

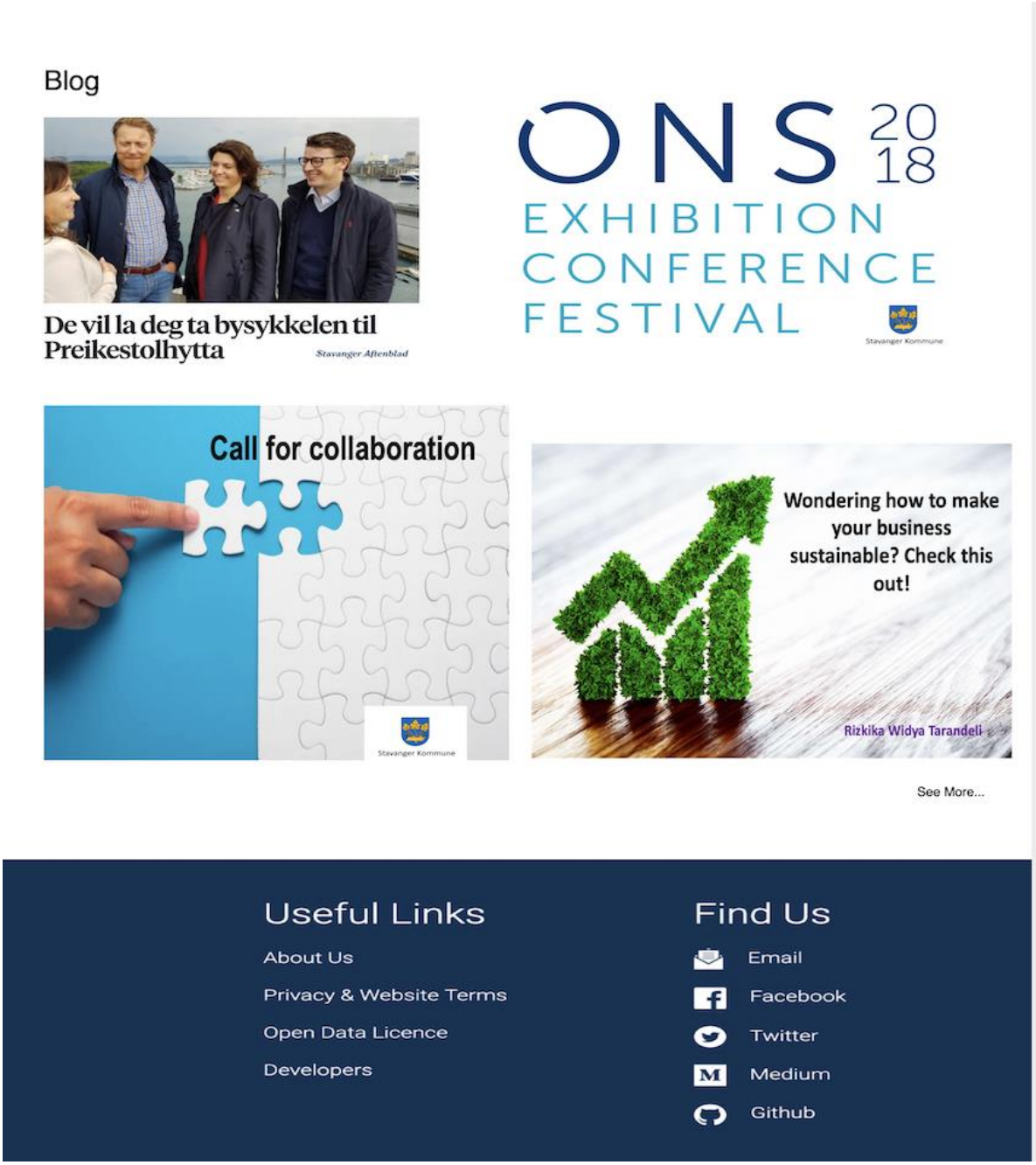

Figure 5.7 – Shows the page 2 of the homepage for the expected visualization

Source: *own author with comparison study from open data South Korea, Singapore, US Picture retrieved from google and Stavanger aftenblad*

The figure below is illustrating the blog feature that is explained in possible road ahead to create the evident impact *(see 5.3).* The blog allows journalists, citizen, NGOs and many other stakeholders to post their thoughts in the form of writings. The topic varies from technologies, announcements, news, application showcasing for investors, and potential updated events in Stavanger.

Figure 5.8 – Illustrate the mock-up blog feature for the visualization of the portal

Source: own author, picture retrieved from google and Stavanger aftenblad

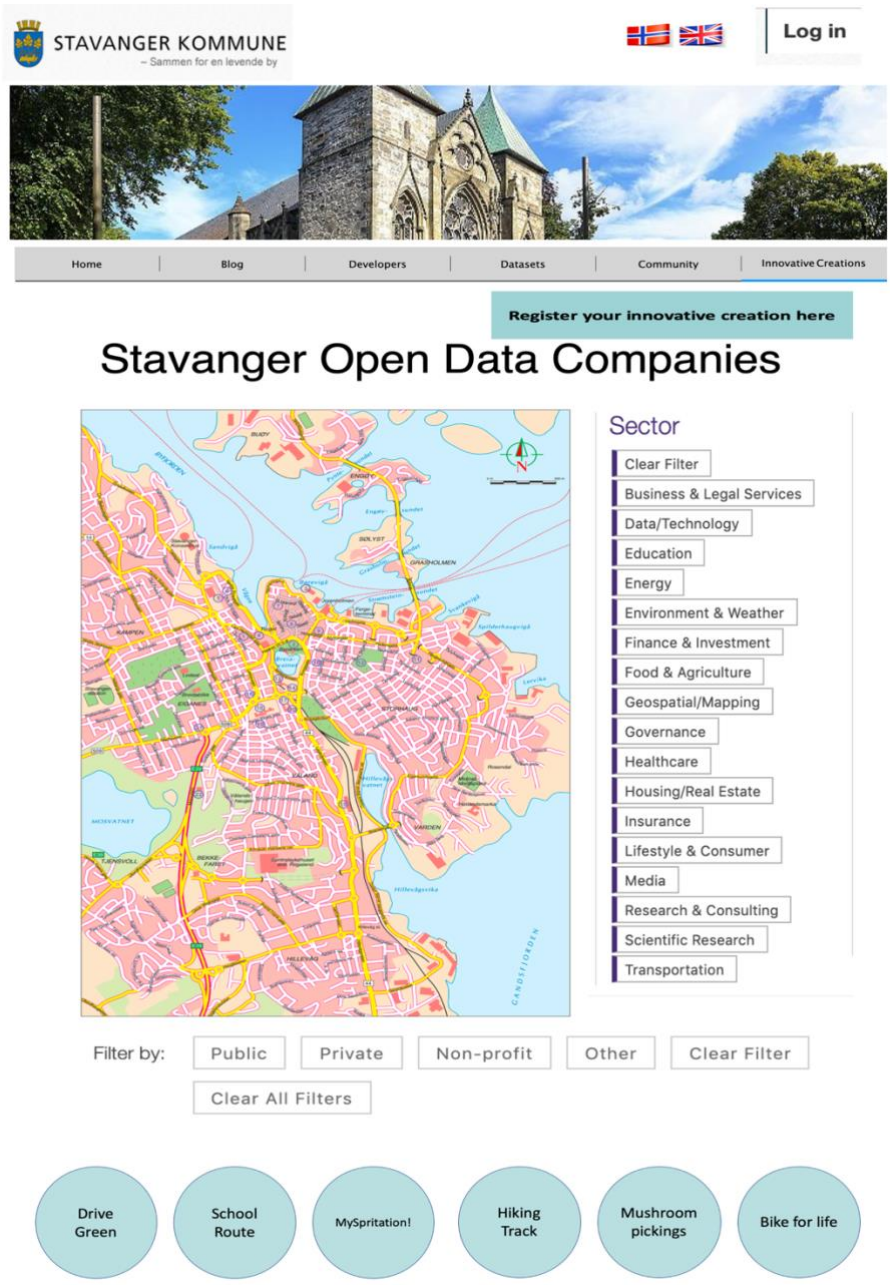

Figure 5.9 – Innovative creations feature to showcase to potential partners or investors

Source: own author adapted from open data 500, picture retrieved from google

The innovative creations feature elucidates the possibility to exhibit the lists of creations from open data. The creations vary from application, webpage, and many other innovations that the public can invent. There will be a description and link of the products/services, demo or simulations, the company descriptions as well as what type of open data they built their creations from. The webpage user can also choose the filter feature to sort out the category or topics of open data. Once sorted, not only the lists but also the area or address of the registered companies.

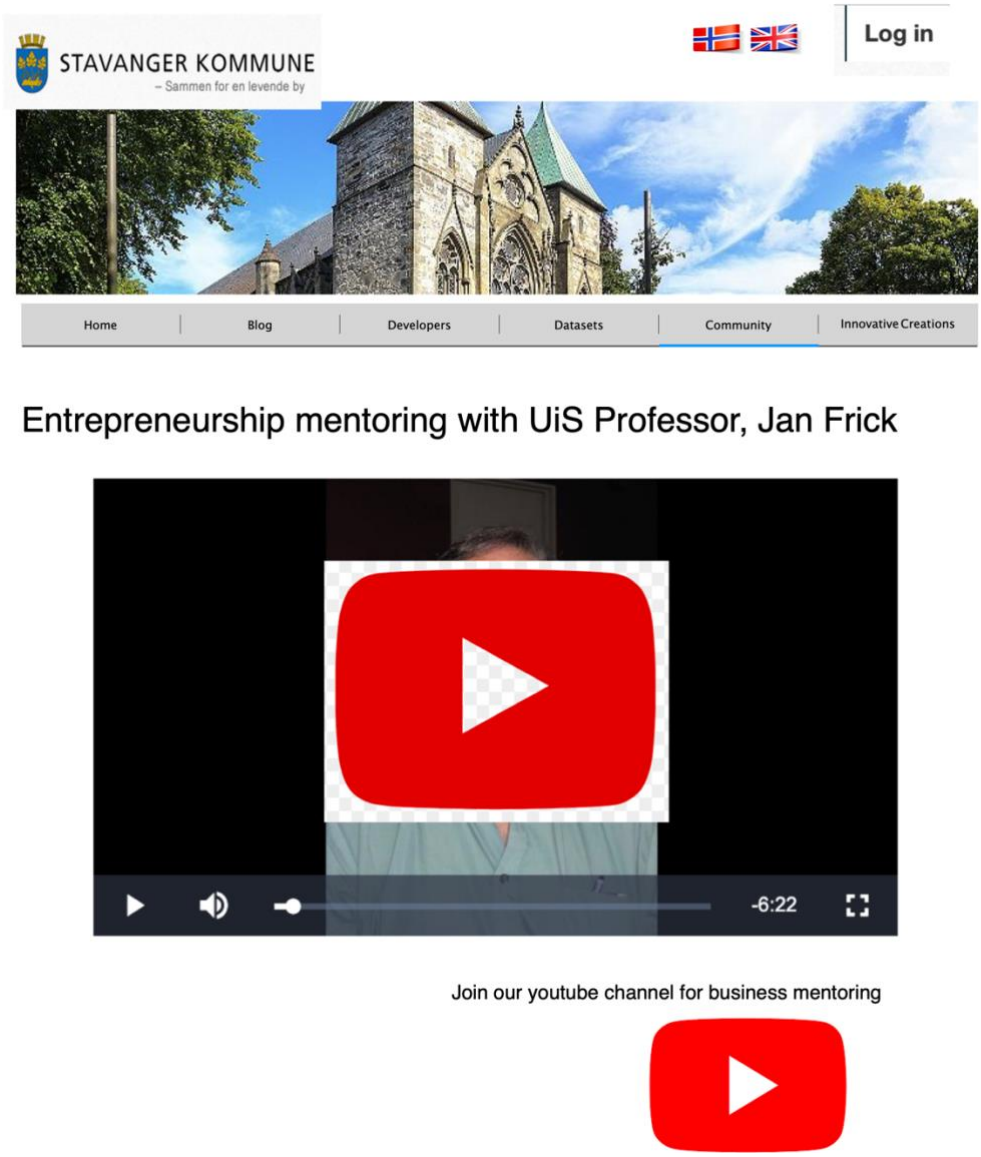

Figure 5.10 – community feature to nurture the users' potential through mentoring

Source: own author, picture taken from google

The community page is the feature for the users who have the motivations to build the business from open data. A consistent mentoring can be given throughout media provided owned by the municipality *(see 5.2.2.2)*. The community is also the forum which all of open data stakeholders can communicate as well as share their creative ideas. The community is the platform to track the sustainability of the projects or start-up business that users build.

CHAPTER VI

6. Validation of the study

This part of the chapter, we will provide the quality of study which will be the assessment section of the thesis. Validation of study aims to assess the overall quality of the study as well as trustworthiness of a research which is divided by the validity and reliability of our research design.

6.1 Validity

The method chosen has to be able ensuring the validity and reliability results. Validity refers to fundamental aspect to measure and conclude whether or not the method selected, and data collected correspond the research question. Validity is divided into internal validity and external validity. Internal validity emphasizes if there is a match between the observations and theoretical ideas of the researchers (Bryman, 2012). Internal validity becomes a strength of qualitative research as it allows the researcher to make sure the degree of congruence between observations and concepts (Lecompte & Goetz, 1982). As opposed to internal validity, external validity shows a tendency to employ case study and small samples, thereby it is considered to be a problem for qualitative researchers (Lecompte & Goetz, 1982). However, Innovation is the variable that is difficult to measure or to compare in qualitative method. Therefore, we constructed several highlights regarding the interviews as the response for the innovation variable. It is intended for our reflection to measure our validity. There are 5 points as our highlight such as if this research has interviewed the right and enough people, whether or not this this thesis has asked the right questions, and lastly if this study answered the research questions.

If the study has interviewed right and enough people

Enticing the participation of the people in general is tricky to measure. Not many people who use it, it shows in the list of the application as the result of public that uses open data, only a few the numbers of people who use open data for their product or service result. However, it can be argued 6 interviewees are sufficient numbers of people to give relevant information to form the findings. Since the nature of qualitative research is to seek the thorough information from the interviews. However, a drawback of it is relatively difficult to check and keep track on people who use open data. Either its project related, research related, application, websites,

and many others. This is also an exploratory case research. Thus, it is difficult to find the right people that represent the category.

If the study asked the right questions

The interview is constructed in semi-structured with the guides. It allows flexibility in interview, nonetheless, we tried as much as possible to follow the guidelines. Although in several cases, the questions were addressed to the interviewee in different orders. Further, additional follow-up questions had to be asked for the author to retrieve thorough information from the respondents. It had to be implemented since some interviewees answered more elaborative meaning that one open-ended questions which covered several other questions. Moreover, these additional questions aimed to clarify the ambiguous terms and different conceptions. The approach was conditioned in a way that the interviewer must adapt to the background of the interviewees.

The research question comprises a general topic which embodies several questions the author can build upon. The degree of difficulty increases when it comes to the case where the interviewees did not answer several aspects of the intended research. It created difficulty when the author had to analyze and decode the data. Furthermore, this method chosen dependent on the personal interpretation to decode the answers. The quality of interpretation depends on the knowledge and perceived value of the author to analyze the result of interviews which makes the process became time-consuming. Moreover, some open-ended questions organized in such a way the interviewee could give the exact answers. This resulted the author was required to excavate the relevant information thoroughly from the interview. There is a risk in which might have inconsistency in observing and categorizing the answers. Nonetheless, the author is confident that the method chosen is a decent method for the research question. The method chosen ascertains the quality of the data collected for the research.

If the study answered the research questions

The overall research question "how does the use of open data enforce innovation?" was answered through conducting semi-structured in-depth interviews. The answers for the overall research question was formulated into key theme from open data principle's category. This aims to standardize the open data according to the experience of the users' that have successfully produced innovation creations in the form of products or services. Standardization of open data can trigger the use of open data, thereby, enforce innovation. The answers for RQ1

and RQ2 were obtained through analyzing the findings. In addition, the answers were conducted by considering the relation of the theory to the analysis from findings. The answers can be found in the chapter 5 for analysis. The summarization of the answers is also presented in the conclusion *(see chapter 6 conclusion)* for readers' convenience purpose.

6.2 Reliability

Similar to validity, reliability is also classified into internal reliability and external reliability. External reliability can be interpreted as a degree to which a study can be replicated and verified that the results can be relied upon (Bryman, 2012). On the other hand, internal reliability refers to the agreements between observers, and members of the research team about what they see and hear (Bryman, 2012). A shortfall embodied as the qualitative method is implemented, the information collected is less structured which makes the responsibility of interpreting the data is heavily on the researchers. The data collection must be conducted in a professional and credible way which also allow the flexibility to achieve reliability of the chosen method. The standardization is critical in order to aid strengthen the reliability (Silverman, 2014). Therefore, the semi-structured interviews can help redirecting and comparing information. It aims to reduce uncertainty for analyzing the answers from the interviews.

We emphasized the requirements of validity and reliability when selecting and implementing the qualitative methodology for our thesis. Different categories make a different answer as they also have a different background. The level of experience is also different which the degree of using the open data resulted in a different outcome. This might result in the limitation of information as the information cannot be analyzed thoroughly. Further, the experience from utilizing open data varied from each individual. The degree of usefulness of open data impacted by each of interviewees' experience. It affects the quality of the answers as some might claim the negative experience and the rest of interviewees experienced the positive benefits.

CHAPTER VII

7. Conclusion

The thesis examined the assumption that the use of open data can enforce innovation. We have discovered that standardization of open data is highly important in relation to open data usage. There is a high correlation between strong motivation and skills possession to achieve to the point which the use of open data fosters innovation. However, there is still a need to have a collaboration for each stakeholder to make the innovative creations are sustainable to create more evident impacts to the society. The objective of this thesis is to address the following issues:

RQ1: How to entice the public participation?
RQ2: What should be emphasized in the future to unlock the potential of open data?

With the purpose of answering these questions, a qualitative method is implemented in order to identify the current state of Stavanger open data and how it enforces innovation. An exploratory study is implemented to obtain a thorough understanding the value of open data which include open data barriers and benefits. There are 6 interviews that have been carried out with individuals from the users of open data. The analysis of findings is built according to the open data principles to gauge the quality of open data for innovation purpose.

We restate the summarization of the research questions stated in chapter 1 *(see 1.2 research questions)* and answers in the analysis *(see chapter 5 Analysis)* in this chapter as follows:

RQ1: How to entice the public participation?
There are many avenues to increase the public involvement to work with open data. Prior to decide a strategy to implement in order to entice public participation, government is accountable to acknowledge the barriers of open data and the motivation of the users. Analyzing barriers of open data and the users' motivation to use open data are crucial to take proper actions to solve the issues. By defining the precise motivation, the proper action can be built upon the valid fundamental reason. Therefore, the effort of solving the problem will be more accurate. The approach on raising the awareness of open data is one of the efforts that can be brought out of the users' motivations from open data. Build upon the findings of our interviews, there are variety demand from our interviewee as the users in order to maintain the engagement to open

data such as training, education, call for collaboration, competition, hackathons, mentoring, and open data community. By utilizing the media available to promote the initiatives, these are the efforts needed to be completed by the government in order to raise the awareness by harnessing the users' engagement. Harnessing users' engagement is the way to create more demand of open data. The effort will be pointless if publication is made but the demand of open data will remain low.

RQ2: What should be emphasized in the future to unlock the potential of open data?

There are three concerns coming from interviews' findings that the government should emphasize to unlock the potential of open data. Two other factors mentioned for the future open data is the collaboration of stakeholders to enable innovation and emphasizing on management of open data. Besides raising the awareness to entice the public involvement, government should also identify skills to increase and maintain the demand to open data usage. By identifying skills, it is easier to analyze the current situation with respect to skills that the surroundings need to support the open data that can enable innovation. There are four skills identified such as technical skills, analytical skills, statistic skills, and business entrepreneurial skills. The skills are impossible to empower open data for innovation without any bridge that can demolish the gap among them. The stakeholders need to collaborate in order to make the use of open data is more effective and the innovative creations sustainable. The stakeholders include the public, government, businesses, and media. Stakeholders possess different intentions, needs, motivations, and roles for working with open data. These factors can be employed to make the chain of stakeholders' involvement in open data become effective for enforcing innovation. Therefore, in order to reap open data's full potential, each stakeholder that has motivations should consider the map of demand and supply chain of open data in order to make the collaboration work as expected. In addition, there is a need to have open data management for unlocking the potential of open data in the future. The management open data portal should be a platform which gathered sources of knowledge and innovation components. Furthermore, it should also provide a location to conjoin and identify open innovation partnership opportunities. Therefore, it is crucial to acknowledge these factors for the future of open data.

7.1 Contribution

According to the findings of our interviews, we collect and summarize several contributions. For the society, we contribute to the fact that this thesis provides an explanation of open data benefit to the stakeholders. In order to drive the use of open data for innovation, there is a need for standardization of open data. There is a need for the management of open data in order to maintain supply and demand of data. In order to make the exploitation of open data, the organizer of open data, in this case, municipality should make the platform function as well as increasing the public involvement through maintaining supply and demand of open data.

Making open data portal function is more than just fulfilling the open data principles requirements *(see 3.3 open data charter's principles).* There are factors to consider in a broader perspective such as supply and demand chain of the open data, raising awareness of open data for the users and potential users, a shifting open data culture among stakeholders, management of open data to harness the public engagement. Furthermore, there are many potential benefits that the currently open data can go beyond to foster its innovation. Thus, this thesis contributes to developing the corpus of open data study with an economic motivation.

7.2 Suggestion for further research

This thesis opens up the avenue for the future research regarding the evident business impact of open data. The municipality of Stavanger or government in general seem to be attracted by the potential open data, as it does evidently generate innovation. Innovation is expected to trigger generating job creation and business development (Gray, 2014). However, the study of open data is still facing data availability that is relatively limited (Magalhaes & Roseira, 2017).

We conclude that there is a need to have several directions for future work that may be of interest:

1. Research that focus more on dealing with the challenges that stakeholders must face. By exploiting the perspective of each stakeholders. It is easier to make the collaboration function.
2. Raising the awareness with social media instrument and how effective it is with the concrete impact. This future work can be based upon the cultural approach and the current situation of government that implements municipality.

3. Analyzing the effectiveness of the public engagement to enable innovation through collaboration, education and IT related in schools and the concrete impacts and implications.
4. How to make the innovative creations of open data sustainable: when the skills are available, the users are challenged with too occupied with work that's what makes the product or service doesn't continue because there seems to be less promising future for the career path of the developers. In addition, the inability of working individually or incapability of commercializing the product or services created.

All in all, we hope that this thesis will give a deeper understanding with respect to open data and the way to exploit its full potential to enforce innovation. We believe that this thesis will help the stakeholders involved to play its role for collaboration purpose and aid the increase use of open data.

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Appendices

INTERVIEW GUIDELINE AND QUESTIONS

My name is Rizkika Widya Tarandeli and I am a business student in UiS and currently doing a master´s thesis. My topic is about Stavanger smart city initiative: the utilization of open data enforces innovation. This is a project between UiS and Stavanger municipality - Stavanger Smart City.

Stavanger municipality has the intention to make Stavanger open data to be exploited and utilized by the citizen so that it will push the potential for new enterprises in Stavanger. This project is supervised by Jan Frick and Hilde Ness Sandvold from UiS and Gunnar Crawford from Stavanger municipality - Stavanger. The target of my interviewees are the users who have experienced of using open data from Stavanger municipality. It can be across background such as entrepreneurs, business students, business innovation lecturers, start-up companies and business incubators. This interview is conducted in semi-structured in-depth way which allows me to have flexibility to ask further questions if necessary. The interview is an instrument to answer the following research questions:

RQ1: How to entice the public participation?
RQ2: What should be emphasized in the future to unlock the potential of open data?

The answers of interview will be formed into findings which will be included in the thesis. However, it will be anonymously which any personal identity will not be revealed neither any other information that can refer to a specific person. The more accurate answers this interview can obtain, the more precise analysis and recommendation for future open data that the thesis will provide. Therefore, answer the questions honestly according to the experience and opinion regarding open data.

Background

1. Can you tell me about your background of expertise?
2. Do you consider yourself as innovative companies/institutions/individual? If yes, how? In what field?

Open by Default (Transparency)

- What were your experiences of using open data?
- Do you need data to support your work?
- What types of data are you dealing with on a daily basis? Dispersion of the data?
- What are criteria of open data for you to utilize?
- Where do you find this data? Stavanger commune.
- How do you access it?
- is that data mainly from internal or external sources?

Timely and comprehensive

- Do you understand easily after you open the data?
- What do you think of the open data has to be improved in terms of comprehensiveness?
- Is the data you need always updated?
- What do you need the most? Historical or future prediction? Future prediction,
- What do you think of the current visualization of open data that makes you understand easily? What do you expect?

Accessible and Usable

- In terms of ease of retrieving data, is it relatively easy to find the data you need?
- How often do you use the open data?
- Have you experienced of paying for the data you need?
- Do you have any direct communication to the government to access the open data you need? Is the data always available?
- Are you willing to register your company as a list of companies that uses open data?

Compareable and Interoperable

- If you use current open data, Did you try to use the open data from other countries or other cities for comparison?
- What is the other bank source of data you use to conduct your research?
- How can you determine the differences of current open data?

For improved Governance and Citizen Engagement

- How do you think the use of open data to improve the community/companies/institutions/individual?
- What are types of data that you think has to be available in open data for your perusal?
- What are types of data that you think has to be made available as a fundament to attract the public or people in general?
- Have you had any difficulties to access the data where you are unable to get due to it is confidential (from government)?
- What impact does open data have on policy-makers and communities?
- Are you willing to participate for a collaboration or training if necessary?

For Inclusive Development and Innovation

- Where do you find the regulations or laws about establishing new business?

- Do you think open data from the public sector can support and strengthen your business plan/research?
- What is your expectation for the future open data?
- If you can suggest, from the categories. What are the things most needed (data set) to build a new business opportunity?
- What do you think the opportunity risen from utilizing the open data?
- Which skills and competencies smash barriers to innovation from utilizing open data?
- How do you think Stavanger people can in general use the open data?
- How to increase the use of open data for business purpose?
- How do you conduct your research for new business opportunity or business development?
- What sources do you use to come up with new ideas?
- How do you predict the business development in the future?

Final questions

- Do you have anything to add in relation to this subject?
- Do you have any suggestions for any participant we can contact for this interview?
- If we have any follow-up questions, can we contact you by e-mail/phone?