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i Stavanger

FACULTY OF SCIENCE AND TECHNOLOGY

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Title page for Master's Thesis
Faculty of Science and
Technology

Municipal opportunity to utilize Smart City technology to improve industry development in the bluegreen sector

- A case study of the unique opportunities in municipal management in New Stavanger

Written in collaboration with:



Abstract

January 1st 2020 three municipalities will become one. Finnøy, Rennesøy and Stavanger municipality as they are known today will cease to exist, and a new municipality, New Stavanger, will emerge. The merger is an effort to increase robustness and improve municipal servitization of citizens.

This thesis has focuses on how the new municipality will operate the bluegreen sector, and how smart city technology can contribute to the new municipal management of these. The thesis has collected information and discussed the municipal room for negotiation and analyzed the new municipality's ability to achieve a well-functioning municipal structure for these industries.

How can Smart City technology help improve the municipal management of Agriculture and Aquaculture in New Stavanger Municipality?

As the societal challenges grow more complex, Stavanger municipality saw a need to develop a more collaborative method to operate. To accomplish this, they created a smart city office, which works on encouraging industrial entrepreneurship through collaboration, citizen involvement, and technology.

The thesis shows that New Stavanger has great potential for achieving the expert committee's criteria for a well-functioning municipal structure.

The thesis also shows that the municipal room for negotiation is limited, especially concerning aquaculture. Within the municipal room for negotiation, their main room for improvement is within the optimization of processes, and through focused strategies and holistic planning.

The agricultural sector benefits more from a close cooperation with the municipality, but are perceived as very adaptable. The findings of this thesis point to the agriculture industry benefitting from better information about possible opportunity for industrial entrepreneurship and actions.

Aquaculture is not subsidized and the industry has a high degree of technology and development. It is also managed through the county and governmental agencies. The industry will still reap great dividend from increased transparency into planning processes, and that the management office for bluegreen sector will have greater capacity to utilize their competence in hearings and professional foundation towards political processes.

New Stavanger can be subject to unintended and possibly harmful silo structuring, which in turn will lead to waste of competence and resources.

The findings in this thesis show that technology can contribute to create overview and focus, which will help New Stavanger increase their degree of collaboration within and citizen involvement. This

will strengthen the industry development for the sector, both in terms of increased profitability and concerning reducing emissions from the sector.

Sammendrag

1. januar 2020 blir tre kommuner til en. Finnøy, Rennesøy og Stavanger opphører, og Nye Stavanger oppstår. Sammenslåingen av kommunene er gjort som en del av en nasjonal satsning for å få mer robuste kommuner som kan tilby bedre tjenester til sine innbyggere.

Denne oppgaven har fokusert på hvordan kommunen vil bli strukturert og hvordan det vil påvirke deres tjenesteyting mot agrikultur- og akvakulturnæringen. Oppgaven har samlet informasjon om og diskutert kommunens handlingsrom and analysert den nye kommunens potensial for å levere gode tjenester med fokus på disse næringene.

Hvordan kan smartbyteknologi forbedre forvaltning og næringsutvikling av akvakultur og agrikultur i Nye Stavanger kommune?

Ettersom samfunnsutfordringene blir mer komplekse, har Stavanger kommune opprettet et smartbykontor, som skal bidra til å skape nye, og mer samarbeidende metoder. Smartbykontoret jobber med å bidra til næringsutvikling gjennom samarbeid mellom aktører, innbyggerinvolvering og teknologi.

Denne oppgaven viser at Nye Stavanger har potensial for å oppnå ekspertutvalgets krav for god kommunestruktur.

Den viser også at kommunen har begrenset forhandlingsrom inn mot havbruk og landbruk, og da særlig inn mot havbruk. Det handlingsrommet de har kan forbedres gjennom effektivisering av prosesser, samt gjennom fokuserte strategier og helhetlig planlegging.

Agrikulturnæringen har større nytte av tett samarbeid med kommunen, men er svært omstillingsvillige. Oppgavens funn tyder på at agrikulturnæringen vil ha stort utbytte av økt informasjon om mulig næringsutvikling og tiltak.

Havbruksnæringen er i større grad selvstendig, og mer styrt av fylkeskommunen og statlige organer. Den vil allikevel kunne ha stort utbytte av innsikt i planprosesser og at forvaltningskontoret for havbruk og landbruk for større kapasitet og rom til å utnytte sin kompetanse inn mot gode faglige høringsuttalelser og innspill.

Den nye kommunen kan bli utsatt for høy grad av silotenkning, som igjen vil føre til sløsing av kompetanse og ressurser.

Funnene i oppgaven viser at teknologi kan bidra til å skape oversikt og fokus, og hjelpe Nye Stavanger kommune øke graden av samarbeid innad og ut mot innbyggere. Til sammen vil dette styrke næringsutvikling i sektoren både med tanke på økt utbytte og reduserte utslipp.

Preface

This master thesis is the last part of finalizing a master degree in Industrial Economics at the Faculty of Science and Technology at the University of Stavanger. The thesis covers 30 ECTs and was completed during the spring semester of 2019.

I would like to take this opportunity to thank all my informants from the interviews, and the cooperation and help provided by the Smart City office of Stavanger Municipality.

I would also like to extend my gratitude to the EPIC project and all the people involved in making it happen. I would especially thank Jens M. Pedersen, for his hard work and dedication in making it all work and fit together. I want to take this time to thank my peers in my EPIC group, Marina Punchik, and Maciej Maskovij, for cooperation, patience, and joined learning.

I want to express my gratitude to my dedicated professor and advisor, Jan Frick, for encouragement and insights. I would also like to thank Hilde S. Ness for invaluable support and knowledge, especially for her time discussing problem statement, and her profound insights in aquaculture.

At last, I want to thank my family and friends, for love and support. I would never have gotten through this without the loving support of them, especially my kind and patient husband Thomas, and Balder, who never cares or asks about academic achievement.

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1 Background

This chapter will lay the foundation for the thesis. It will begin with an introduction to the chapter, followed by background and definitions deemed relevant to the theme. The background aims to set a framework for the thesis.

1.1 Definitions

1.1.1 General terms

Smart City – a Smart City can be many things. In this thesis, I will operate with the definition as presented by Stavanger Municipality. It is as follows, an action that combines Technology, cooperation, and citizen involvement.

Nye Stavanger – or New Stavanger is a term for the new municipality “Stavanger” that will start to exist January 1st 2020. This means that when the thesis discusses Stavanger, it refers to Stavanger before the merger, while New Stavanger is used for the municipality after the merger.

1.1.2 Translated terms

The author of this thesis has directly translated some terms, and some have been left as they are in Norwegian. The author has evaluated where a translated term has been used, and where the Norwegian term has been left. Terms that are not translated are kept in Norwegian as they will lose their proper meaning when translated. Other terms are translated, and will thus have a slightly unclear meaning to readers with knowledge of Norwegian terms. The terms that may be unclear, without perfect English counterparts are listed below.

Kept:

Rådhuskvartalet – a collective term for the collection of municipal administrative buildings related to and including town hall in Stavanger city center.

Innbygger- og samfunnskontakt – A department in the municipality working with Citizen and societal contacts, including service development, industry, political administration, communication, culture, and other such topics.

Gjestebud – It is a non-official ombudsman, used for citizen involvement. Further explanation is in chapter 3.5.1.1 Citizen involvement.

Translated:

Kommuneplan – area plan.

Næringsavdelingen – Business and industry development office, discusses solely the office working with industry development located at Rådhuskvartalet.

Næringskontoret – Business office, refers to the collective office of industry, both the one located at Rådhuskvartalet and the management office for bluegreen sector.

Blågrønn næring – Bluegreen industry, a collective term for primary industries cultivating natural resources for food production, including agriculture, forestry, aquaculture, and fishery. Not including cultivating of energy.

Blågrønn sektor – Bluegreen sector, a collective term for the municipal management sector in relation to bluegreen industry.

Prosjektrådmann – Project Council Man, a position appointed by New Stavanger to work with the merger. It refers to the specific Prosjektrådmann for New Stavanger, and not to the title in general.

1.2 Overview of the thesis

Below an overview of the thesis can be seen.

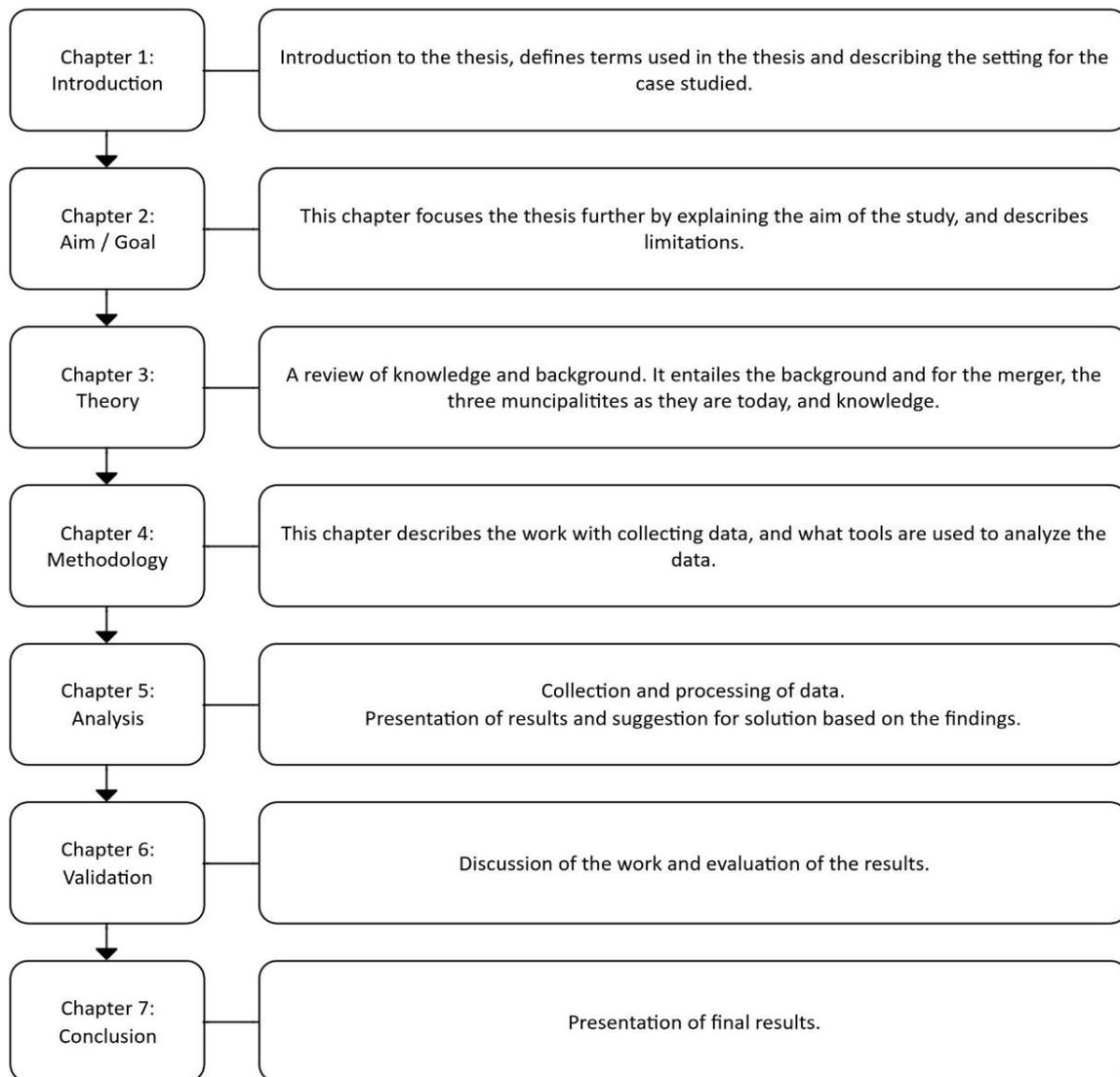


Figure 1 - Overview of the thesis

1.3 Introduction:

On January 1st Finnøy, Rennesøy, and Stavanger become one municipality. This is part of a national effort to create larger and more robust municipalities. Municipal services are a public good paid for through tax income from the citizens. It is the municipal responsibility that their services are as good as they can be, while still being cost effective. This means evaluating at all times what services the citizens want and need, and how to provide these to the best interest of the public. The municipal restructure of Finnøy, Rennesøy, and Stavanger into New Stavanger provides the municipality a unique opportunity to evaluate the extent, quality, and build-up of their services, to optimize their services to the public. Especially when it comes to Aquaculture and Agriculture, which are new industries in Stavanger. (Nye Stavanger kommune, 2019d)

Many of the municipal tasks are regulated by law, hence providing the municipality limited room for negotiation on how and what services to provide. This is also true for the management of Aquaculture and Agriculture. However, with the new municipality, there will be a collection of competence and restructuring of the agricultural and aquaculture sector in the municipality. At the same time, it is not certain that the services the municipality offers are optimized. Could technology contribute to this?

This thesis aims to look at opportunities and considerations for the ongoing process and hopes to be a relevant contribution to the ongoing process of building the bluegreen services for New Stavanger. It will do so by looking into what and how the municipality manages and service the aquaculture and agricultural sector, improvements and suggestions for the new municipality can be made.

1.4 Municipal merger

The Norwegian government implemented a municipal reform in 2014, and all municipality merges were to be finalized by January 1st 2020. 119 municipalities have decided to merge into 47 new municipalities. Reducing the total number of municipalities from 428 to 356. (Regjeringen, 2019b)

The municipality reform aims for each municipality to provide good and equal services to its citizens. The goal is also for the municipalities to become financially and sustainably resilient, as well as providing more wholesome and sustainable societal- and business development. It is also an outspoken goal for the municipalities to strengthen their local democracy. (Regjeringen, 2019b)

Stavanger municipality has a population of 133 410 and is the fourth largest municipality in Norway. Finnøy and Rennesøy have a population of 3 206 and 4 838 citizens, respectively. After the municipality restructure, New Stavanger will have approximately 141 454 citizens. (Nye Stavanger kommune, 2019d)

On the transition into 2020, Finnøy, Rennesøy and Stavanger municipality will be liquidated and replaced by New Stavanger municipality. As the municipalities merge, the new municipality needs to evaluate all services and decide how the new municipality shall be harmonized. (Nye Stavanger kommune, 2019e)

The term harmonized in this context means to equalize the differences that today exist between the municipalities, and establish solutions that create equal services for all citizens in the new municipality. (Nye Stavanger kommune, 2019e)

The new municipality will have extensive agriculture and aquaculture resources that need to be managed. Stavanger today has limited agriculture and buys management services on this area from Sandnes, while it has no Aquaculture. New Stavanger will be among the largest agriculture and aquaculture municipalities in Norway. (Stavanger bystyre, 2018)

This constitutes that New Stavanger will have to think new when organizing itself around agriculture and aquaculture. It will be a challenge to incorporate, while at the same time an opportunity to extend and rethink their way of servicing their citizens.

1.5 Stavanger's 80% goal

Norway has a commitment to the UN sustainability goals, which among others include management of agriculture, aquaculture, energy, and sustainable use of marine resources and active work against climate change and the consequences of these. (Stavanger bystyre, 2018)

In accordance with the goal of contributing to the national challenges, Stavanger municipality has committed to reducing its emissions by 80% by 2030, compared with 2015, and be a fossil free municipality by 2040. (Stavanger bystyre, 2018)

In order to achieve this, Stavanger municipality has a document called "Klima- og miljøplan 2018-2030" (Climate and environmental plan 2018-2030). This document is meant to be the municipality's strategy for sustainable development. The municipality is the authority, facilitator, and driver for the emissions reduction. As plan and regulation authority, the municipality makes guidelines that apply to the municipality as a whole. In order to reach their goals, Stavanger's climate and environmental plan, discuss the options of using incentives, limitations, and information. (Stavanger bystyre, 2018)

In addition to reducing climate changes, the municipality has also decided to take action to be robust against climate changes. This means preparing for more extreme weather and conditions. (Stavanger bystyre, 2018) This will lead to radical changes and considerable investments in order to succeed. (Roskilden, 2019)

This will be particularly affected by the inclusion of Finnøy and Rennesøy. These municipalities have a different business structure than Stavanger. While the greenhouse gas emissions in Stavanger are linked closely to transportation and heating, in Rennesøy and Finnøy they are much more linked to agriculture and food production. This has not yet been included in the municipalities climate goals. (Roskilden, 2019)

In 2016 Rennesøy and Finnøy accounted for 32,5% of the greenhouse emissions in what will be “New Stavanger”, while only accounting for 6% of the population. (Roskilden, 2019)

1.6 Climate

This thesis will only focus on greenhouse gas emissions, GHG, and not on other environmental aspects. Climate and environment is a complex problem with many factors and considerations. However, Stavangers climate goals are based on reducing GHG emissions, thus other environmental factors may be mentioned, but will not be focused on.

The natural greenhouse effect is caused by a process where ozone (O₃), water vapor (H₂O), carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄) in the atmosphere absorb heat radiation from the earth. This warms the atmosphere and the surface of the earth. This is a condition for life on earth as it is known. (Rennesøy kommune, 2011)

Greenhouse gasses is a term referring to the gasses contributing to the greenhouse effect, including all of the gasses mentioned above. The most important is by the Climate and Environment report for Stavanger municipality recalculated to their equivalent value in CO₂ emissions, tCO₂e, tons CO₂ equivalents. This thesis will follow that terminology, thus GHG or CO₂ refers to tCO₂e, not necessarily CO₂ gas. (Stavanger bystyre, 2018)

The climate changes seen at present has substantial scientific support for being caused by human activity. Human activity causes increased emissions of GHG, resulting in a heightened concentration of natural and unnatural heat absorbing particles in the atmosphere. The heightened concentration of CO₂ in the atmosphere cause global warming and an altered climate. Human emissions of CO₂ are primarily due to the use of fossil fuels and deforestation. (Rennesøy kommune, 2011)

1.6.1 Norwegian context

Norway has committed to several international agreements to limit and act on climate change, among them the Kyoto protocol, the Paris agreement, and the UN sustainability goals.

Norwegian emissions were 52,7 million tons of CO₂ equivalents in 2017. The primary sources of emissions in Norway are respectively Oil- and gas extraction; Industry; Road traffic; Transport; Agriculture; Other; and waste. (Miljødirektoratet, 2018b)

In accordance with the international agreements, Norway has committed to becoming a low emissions society by 2050. Norway's national goals are to reduce climate emissions by 40% by 2030, compared to emissions in 1990. By 2050, Norway aims to be a low emissions society, which means emissions need to be reduced from 10 tons per capita annually to 1-2 ton per capita annually. Thus reducing Norway's collective emissions by 80-95% from today. (Stavanger bystyre, 2018)

1.6.2 New Stavanger context

Stavanger has ambitious climate goals of 80% reduction of tCO₂e, tons CO₂ equivalents, by 2030 compared with 2015. The municipal administration recommended 50%, while the national request was 40%. "Klima- og miljøplan 2018" (Climate and environmental plan 2018-2030) was created as a strategy document for the municipal work towards this goal. Because of the impending restructure, agriculture and aquaculture was also included in the plan.

Rennesøy has a document called "Kommunedelplan Klima og Energi 2011-2015" which aimed to create a focused tool for the municipality to give direction in dealing with climate issues. Finnøy has no plan or document on climate.

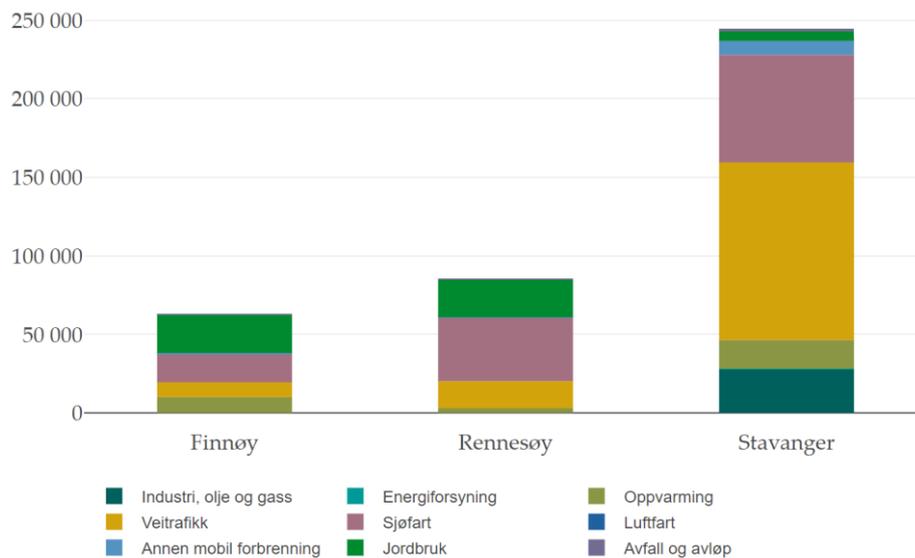
In current Stavanger municipality, the primary emissions are from road traffic, cruise tourism and from energy use in buildings, industry, and plants. In addition, they have challenges with pollution on the sea floor, periods of poor air quality, pressure on species and nature, air and sea traffic emissions. (Stavanger bystyre, 2018)

In addition to reducing climate changes, the municipality has also decided to take action to be robust against climate changes. This means preparing for more extreme weather and conditions. (Stavanger bystyre, 2018)

In order to deal with these challenges, Stavanger municipality is going to work with heating solutions without climate footprint in all of the municipalities own buildings, and use the "plan- og bygningsloven" more actively in order to promote environmental actions in regulation and area plans as well as in private building cases. The municipality aims to manage raw materials, materials and energy with the principal of circular economy. (Stavanger bystyre, 2018)

The emissions from the three municipalities are quite different. With Stavanger having the highest emissions by far, almost 250 000 tons tCO₂e. Rennesøy is second, and Finnøy has the smallest emissions of the three, as shown in the figure below. (Miljødirektoratet)

Finnøy, Rennesøy og Stavanger



Kilde: Miljødirektoratet

Figure 2 - Collected emissions from the three municipalities, (Miljødirektoratet)

However, if one looks at emissions per person, the numbers change drastically. Finnøy has the highest emissions per capita, right above Rennesøy, and Stavanger has the lowest emissions, with respective tCO₂ with 19,5, 17,4 and 1,8. (Miljødirektoratet)

| | | |
|--|--|---|
| 📍 Finnøy | 🏠 19,5 | 🏠 63 019,8 |
| Antall innbyggere: 3 235 Areal: 104 km ² | Utslipp per innbygger i 2017 (tonn CO ₂ -ekvivalenter) | Utslipp i 2017 (tonn CO ₂ -ekvivalenter) |
| 📍 Rennesøy | 🏠 17,4 | 🏠 85 011,3 |
| Antall innbyggere: 4 892 Areal: 66 km ² | Utslipp per innbygger i 2017 (tonn CO ₂ -ekvivalenter) | Utslipp i 2017 (tonn CO ₂ -ekvivalenter) |

| | | |
|---|--|---|
| 📍 Stavanger | 🏠 1,8 | 👤 243 887,9 |
| Antall innbyggere: 132 729 Areal: 71 km ² | Utslipp per innbygger i 2017 (tonn CO ₂ -ekvivalenter) | Utslipp i 2017 (tonn CO ₂ -ekvivalenter) |

Figure 3 - Total emissions per citizen in the three municipalities, (Miljødirektoratet)

This means that Rennesøy and Finnøy have almost double emissions per capita compared with the Norwegian average. Stavanger comes in close to the ideal for 2050. In 2016 Rennesøy and Finnøy accounted for 32,5% of the greenhouse emissions in what will be “New Stavanger”, while only accounting for 6% of the population (Roskilden, 2019).

1.6.3 Emissions from Agriculture

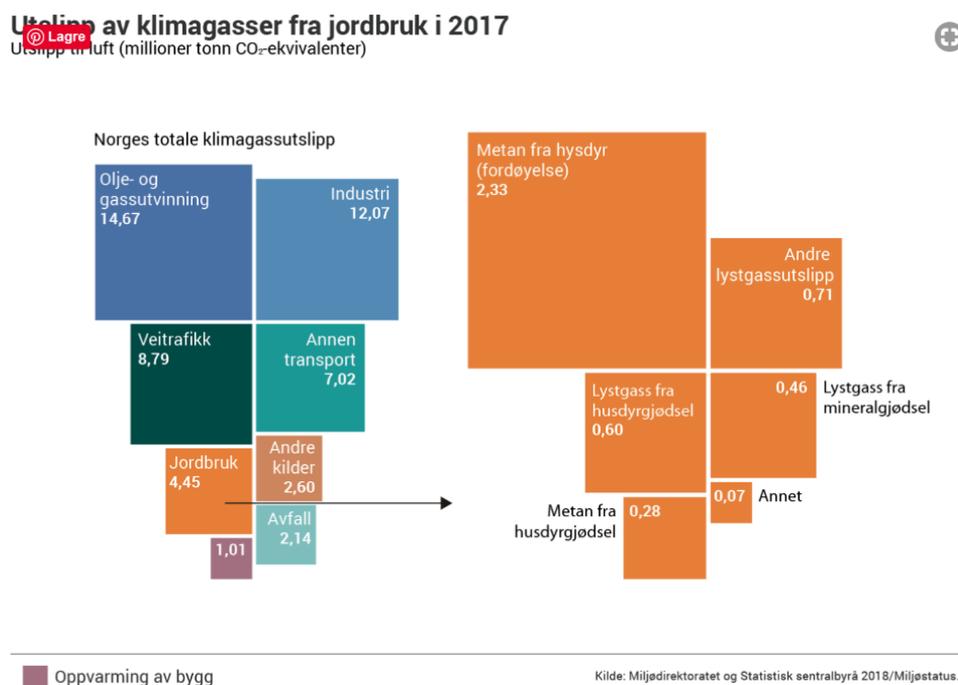


Figure 4 - Total GHG emissions in Norway and total emissions from agriculture (Miljødirektoratet, 2018a)

On a national basis, agriculture is the fifth leading GHG emission driver, with 4,45 million tons of CO₂ equivalents. That represents 8,7 percent of Norwegian emissions. The emissions consist of respectively after significance, methane from livestock digestive processes, nitrous oxide in general, nitrous oxide from manure, nitrous oxide from mineral fertilizer, methane from manure, and other. (Miljødirektoratet, 2018a)

Agriculture is the largest source of methane and nitrous oxide. Methane and nitrous oxide are the main GHG drivers from agriculture. These can be reduced by using fertilizer to produce biogas and by throwing out less food and have a more sustainable diet. (Miljødirektoratet, 2018a)

Since 1990 the emissions from agriculture has declined by 4 percent. The leading causes for this are decreased use of mineral fertilizer, increased use of concentrates in feeding rather than grass, and optimized dairy production. (Miljødirektoratet, 2018a)

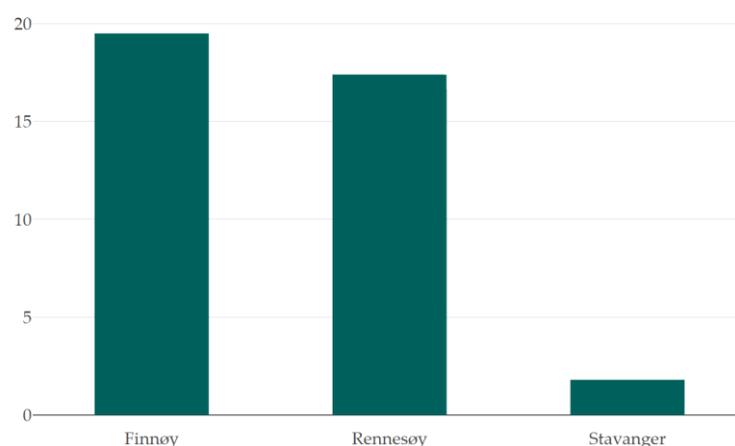
Emissions from energy consumption in agriculture is normally not included in emissions calculations. However, energy consumption from vehicles, heating, and other activities also contribute to the national emissions. (Miljødirektoratet, 2018a)

The actions taken to reduce emissions from agriculture has mainly been focused on reducing pollution and runoff of nutrients to the water. Several of these actions contribute to reducing nitrous oxide. However, there has been little focus on GHG emissions. (Miljødirektoratet, 2018a)

1.6.3.1 Agriculture in New Stavanger

The agriculture in Finnøy and Rennesøy is characterized by intensive livestock production and greenhouse farming. As Agriculture is a much larger industry in Finnøy and Rennesøy, their respective emissions from Agriculture are significantly larger than the Agriculture emissions in Stavanger, this is illustrated in Figure 5 below. (Miljødirektoratet)

Finnøy, Rennesøy og Stavanger

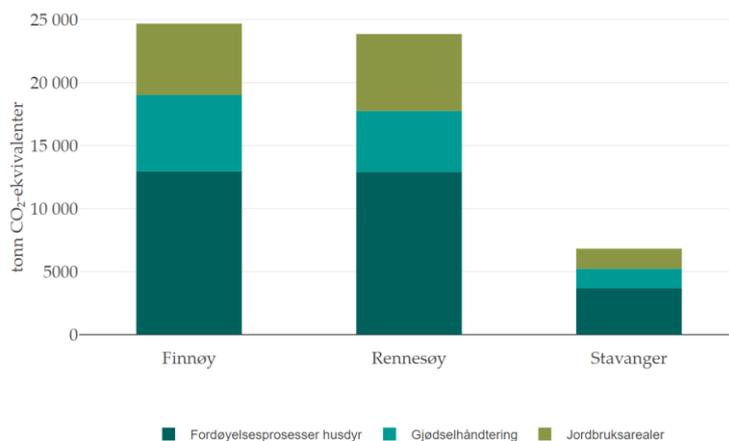


Kilde: Miljødirektoratet

Figure 5 - GHG emissions from agriculture from the three municipalities, (Miljødirektoratet)

The build-up of the emissions is similar for the three municipalities. The three significant CO₂ drivers are respectively methane from digestive processes, handling of manure and emissions for agricultural areas, as seen in Figure 6 below.

Finnøy, Rennesøy og Stavanger



Kilde: Miljødirektoratet

Figure 6 - GHG emissions in the three municipalities

1.6.4 Emissions from Aquaculture

The impact of aquaculture that has been focused on is mainly pollution of the local environment, in the sense of affecting the local environment. Among the effects of aquaculture is the escape of salmon, which affects the wild salmon population negatively, salmon lice also thrives in the densely populated farms, and threaten wild salmon and sea trout. In addition to this, excessive nutrients from the farms contribute to increased algae and eutrophication of the sea bed. The copper and chemicals used to combat salmon lice are harmful to the natural environment. (Miljødirektoratet, 2015)

Thus, there are several negative effects of fish farming. However, the industry has implemented several actions. The industry, among other things, has halved the amount of nutrients and other organic waste released from their farms per ton fish. The industry also gains from producing using less feed per fish, which reduces the impact per unit of fish. However, the production volume continuously increases, hence increasing the impact of the industry as a whole. (Miljødirektoratet, 2015)

In addition to pollution, agriculture has a climate impact through the use of energy. The agriculture facilities are often run on diesel (Stavanger bystyre, 2018).

The industry itself has already implemented alleviation actions on pollution, and are continuously looking for actions to reduce their impact(Stavanger bystyre, 2018). At Grieg seafood, they have installed solar and wind power solutions, to replace the diesel. In addition to saving diesel, and decreasing climate emissions, the aquaculture facility in Ryfylke has also saved considerable amounts of money. (Skodje, 2019)

It is useful to the aquaculture industry to take preventative measures, as the measures often make the facilities more cost-efficient. Aquaculture will also only be allowed to increase their production if they operate within national standards for pollution(Stavanger bystyre, 2018).

1.7 Smart City

Stavanger municipality has a Smart City office as a part of their municipality. The aim of the office is mainly that as society's challenges become more sophisticated, a new and more collaborative way of working is needed to solve them.

Smart City is a new method and way of thinking for the municipality. The Smart City office aspires for their methods and tools to become a natural part of the way Stavanger municipality works.

According to Stavanger municipality (Stavanger kommune, 2018): A smart city is based on the citizen's needs and applies new technology to make the city a better place to live, reside, and work.

The smart city office of Stavanger has three factors for defining or identifying a project as smart(Stavanger bystyre, 2016):

- The solutions make use of modern technology. This could be new technology or incremental extensions of existing technology.
- The projects involve different cooperation constellations across local authorities, industry and commerce, organizations, and academia.
- The project is based on the citizens' and users' needs, and involve them in the development of solutions.

2 Aim of the thesis

This chapter will discuss the aim of the thesis by explaining the focus and value. It will explain the problem statement, and questions to be answered and discussed in the thesis.

This study is conducted as an explorative case study, looking into the current restructuring of Finnøy, Rennesøy, and Stavanger into a new municipality; New Stavanger. It is a relevant topic, as the merger is happening this coming January 2020(Nye Stavanger kommune, 2019d).

This thesis is written as a contribution to the discussion on the municipal restructuring and intends to share reflections of opportunities and obstacles the new municipality will face regarding the new business office.

The thesis is written with a focus on New Stavanger's Innbygger- og samfunnskontakt department. The department structure can be seen below in Figure 7. Innbyggerservice (Citizen service office) and Næringsforvaltning landbruk og havbruk (management of bluegreen industry) will be localized at Judaberg. Innbyggerservice will also be located in Stavanger and in Vikevåg in Rennesøy.

More specifically, it highlights how the Smart City Office and Business Office can work together in developing better services. The thesis is written in the viewpoint of Stavanger municipality.

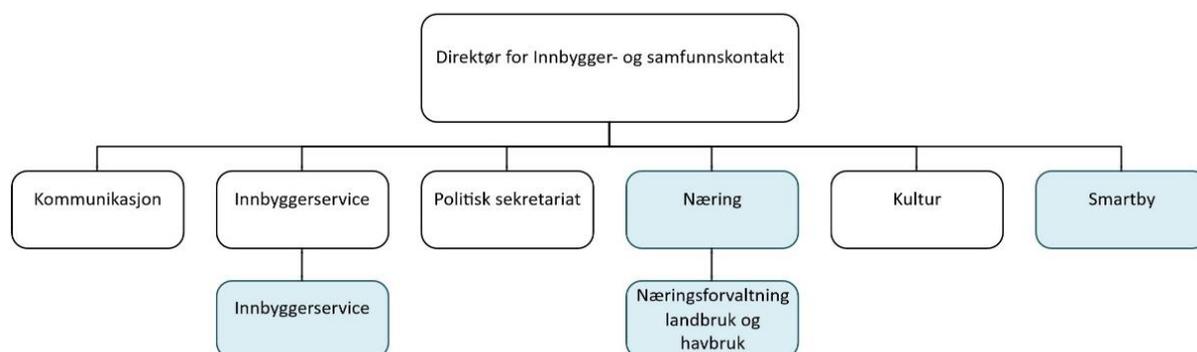


Figure 7 - Overview of the department of "Innbygger- og samfunnskontakt" in New Stavanger, (Nye Stavanger kommune, 2019c)

As Stavanger municipality merges with Rennesøy and Finnøy, to become New Stavanger, new industries that are minimal in Stavanger will be a significant part of the industry build up. Stavanger has limited agricultural activity and no aquaculture. Today, agriculture has been managed through an inter-municipal collaboration with Sandnes, but has been under extensive pressure, and much of the agriculture has been liquidated. In Rennesøy and Finnøy, agriculture and aquaculture are key industries, both for the tax income and employment.

For New Stavanger, how management and development of the blue-green industries are conducted will affect the experience of the merger.

For Finnøy and Rennesøy, agriculture and aquaculture are the foundation for their settlement and identity. In Stavanger, agriculture represents increased contributions to the climate footprint, hindering their work to achieve 80% carbon emission reduction.

The background for the municipality restructure is to provide good and equal services for the inhabitants of all municipalities. As New Stavanger builds a new agricultural and aquaculture management office, they have the opportunity to think new, to build services and scope of work with a new perspective.

Industry management is a key task for municipalities, and this situation is unique in the form that New Stavanger will offer management of services into a new type of industry, that Stavanger previously outsourced.

The smart city commitment is about adjusting to citizens increased expectations and the increased complexity of the services offered by the municipality to its inhabitants to create a better municipality to work and live in.

This thesis will thus explore how using smart thinking, and smart technology can contribute to New Stavanger's management of its new industries. It will do so through identifying the scope of work for the agricultural and aquaculture management offices, collecting and evaluation what services they are required to do, and analyzing how they can build a new smart municipal office that will handle the current and future needs for citizens and industry in an optimized way.

The thesis aims to see how smart thinking can help the municipality offer better services to agriculture and aquaculture in the new municipality. Smart technology, or smart thinking, as defined in this thesis, is about using the citizens, or users, of a service actively in defining their needs. Smart technology is also about utilizing technology in better ways to create new and improved services, but also actively using the community and citizen involvement, both in defining services, as well as designing and delivering them.

How can Smart City technology help improve the municipal management of Agriculture and Aquaculture in New Stavanger Municipality?

This thesis aims to identify how Smart Technology can contribute to the management of Aquaculture and Agriculture in the new municipality. That will be done through identifying the room for negotiation and management framework of the municipality and what constitutes a well-functioning municipality.

Through this suggest improvements and solutions for the new municipality, using end-user input and optimized management processes in delivering these services.

The thesis will also discuss how to offer services to optimize operations. Technological implementation, as well as competence management for the new municipality, will be collected and discussed.

2.1 Limitations

There are many aspects of a merger as the one Rennesøy, Finnøy and Stavanger are going through to become New Stavanger. This thesis will only focus on smart city solutions, as per the definition set by Stavanger municipality, and with a focus on agriculture and aquaculture in general. The thesis will not comment or analyze other aspects of the merger or other sectors of the new municipality.

The thesis is written as the merger is occurring, thus new information is revealed, and new decisions are made. The thesis is written on the premise of the information available at the time of writing. Some information may be decided or revised between the writing and reading of this thesis.

3 Theory

This chapter aims to collect known information about the topic. It will present the information and knowledge necessary to evaluate the collected data in the thesis. The chapter is meant as a foundation for further study and work of the thesis.

3.1 Kommunesammenslåingen

This chapter is a presentation and background for the municipality restructure. It presents the purpose, foundation, and reasoning of the restructuring.

The Norwegian government implemented a municipal reform in 2014, and all municipality merges are to be finalized by January 1st, 2020. 119 municipalities have decided to merge into 47 new municipalities. Reducing the total number of municipalities from 428 to 356. (Regjeringen, 2019b)

The municipality restructure for Stavanger, Rennesøy and Finnøy, was formally decided in parliament June 8th, 2017. The regulations for the merger into New Stavanger was set by Kommunal- og moderniseringsdepartementet, the municipal and modernizing department, on December 19th, 2017. This regulation dictates when the merger is to happen, the new name, number of members of kommunestyret (municipality board) in the new municipality and the regulations that the merger demands. (Regjeringen, 2019b)

The reasoning behind the reform was to improve the municipalities ability to perform their services to citizens. The services provided by the municipality has grown, and thus not all municipalities can deliver the services they are charged with. In order to ensure proper services to citizens, the central government has increased its detailed ruling of each municipality. (Regjeringen, 2019b)

The municipality reform aims for each municipality to provide good and equal services to its citizens. The goal is also for the municipalities to become financially and sustainably resilient, as well as providing more wholesome and sustainable communal- and business development. It is also an outspoken goal for the municipalities to strengthen their local democracy. (Regjeringen, 2019b)

The municipality restructure intends to create municipalities that meet the current and future challenges. Larger municipalities will be more able to facilitate better welfare, more sustainable nourishment of communities, and a stronger local autonomy. (Regjeringen, 2018)

Smaller municipalities depend in great extent on inter-municipal collaborations to serve their duties. Thus, many services will not be located farther away, as they were never close in the first place. (Regjeringen, 2019a)

An average Norwegian municipality has 11 937 inhabitants, while the median municipality has 4661 inhabitants. All Norwegian municipalities are generalist municipalities, which means that they are all required to deliver the same services to their citizens. (Deloitte, 2014b)

Demographic changes demand more and better services from the government and municipalities in the coming years. (Regjeringen, 2018)

The merges will also contribute to more diverse demographics, which in turn will contribute to more robustness. This will also contribute to more diverse industries within each municipality, also contributing to resilience and robust financial standing. Sustainable municipalities will also contribute to more efficient use of resources. (Deloitte, 2014a)

Larger municipalities enable more competence and more extensive professional networks within the municipality. Municipalities today achieve this by collaborating in inter-municipal networks in order to provide adequate services with a high enough level of competence and quality. (Deloitte, 2014a)

The increased local autonomy is because a larger municipality will have greater resources, both competence, financially and politically to make autonomous decisions on behalf of their citizens. The reform also dictates less detail management from central government on how the municipalities choose to operate their municipality in their citizens best interest. (Regjeringen, 2018)

In order to provide the citizens best interests and meet their expectations, it is a necessity to use resources efficiently. The new municipality reform intends to safeguard the local autonomy and provide freedom for the municipalities to maneuver. (Regjeringen, 2018)

In order to safeguard the local autonomy and provide the ability to maneuver for the municipalities, the new municipality reform intends to continue using the same financing method, which provides the municipality with allowances from the government, in addition to the tax base of that municipality, which the municipality autonomously manage the distribution and expenditure of, within laws and regulations. This financial system is referred to as frame management. It is believed that frame management helps entice efficient resource management while allowing the municipality to govern how they provide the citizens with the resources they need and want at the right quality. (Regjeringen, 2018)

In order to stimulate innovation and services tailored to the specific municipality, the municipality needs the freedom to self-govern. (Regjeringen, 2018)

3.1.1 Previous mergers

In this sub-chapter, knowledge of previous mergers will be presented in order to highlight factors that have impacted and characterized other mergers. Two mergers will be described, the merger between Andebu, Sandefjord, and Stokke into new Sandefjord in 2017, and the merger between Hetland, Madla, and Stavanger into Stavanger in 1965.

The first merger is chosen as it was the first merger to be finalized as a part of the current national municipality restructure that the merger discussed in this thesis is. The other was chosen because it was the last time Stavanger municipality merged, and shares similarities in two smaller municipalities merging with a larger municipality (Stavanger in both cases).

The merger between Andebu, Sandefjord, and Stokke, happened 1. January 2017. The work on the merging process had started in 2015. As the merger was the first of a national effort to restructure the municipal sector in Norway, the merger has been studied by KS. This was done to identify successes and room for improvement for other municipalities to learn from. (Brandtzæg, Williksen, Johnsen, & Groven, 2017)

The areas that were identified as subject to provide challenges and/or possibilities include information and communication technology, inter-municipal cooperation, employer policy, cross-sectional coordination, unemployment agency (NAV), culture and communication, and local democracy. (Brandtzæg et al., 2017)

From the work with information and communication technology, Fellesnemda for the three municipalities implemented a project that was called "Digitalisering og nye løsninger" (Digitalization and new solutions). The project was due to start on March 1st 2016, however the municipality underestimated the need for sufficient training, the project was delayed and was meant to progress towards the summer of 2018. (Brandtzæg et al., 2017)

Well-functioning digital services affect the municipal ability to perform their services efficiently and effectively. The analysis of Sandefjord pointed to the importance of consolidating on financial and ICT services as early as possible. (Brandtzæg et al., 2017)

The merger between Hetland, Madla, and Stavanger, happened on January 1st 1965. The aim for Stavanger was to acquire more land, as it was only 11 km², which is within the green frame in Figure 8, and densely populated. Previous to the merger, Stavanger had adopted parts of Hetland's area during subsequent acquisitions. In 1964, Hetland and Madla agreed to merge. However, Hetland, which was the largest municipality based on land mass in Rogaland county, ended up being split

between Sandnes and Stavanger. Riska, Hommersåk, and Dale become part of Sandnes, while the rest of Hetland and all of Madla becomes Stavanger. (Nedrebø, 2007; Roalkvam, 2012)

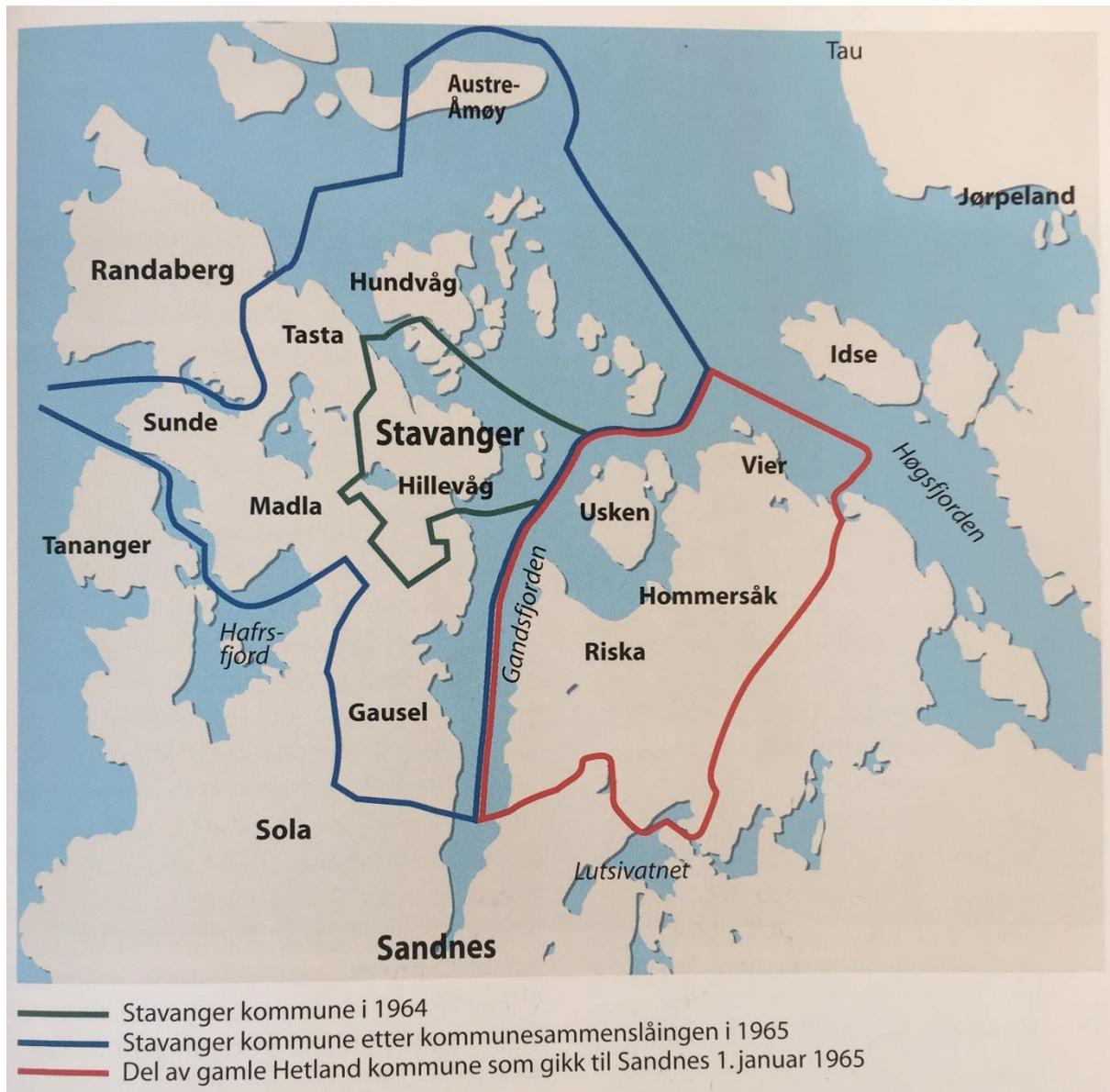


Figure 8 - The municipal structure before and after 1965, pg. 45 (Roalkvam, 2012)

Looking back at the merger, there has not been any talk of reversing the merger. With the massive population increase, Stavanger still has little land area available. (Nedrebø, 2007)

Stavanger today comprises the same 70 km². Most of these are used for residential or industrial properties, and there are little green areas left.

3.2 Overview of the municipalities

In this subchapter, the three municipalities will be presented. The presentation will give insight into the municipalities' respective population, industry structure, and municipal build-up. The chapter aims to provide a background for the three municipalities.

3.2.1 Finnøy

Finnøy municipality consists of several islands in Ryfylke in Rogaland. It has a land area of about 104 km². The municipality has roughly 3200 inhabitants. (Finnøy kommune, 2018d)

Sixteen of the Finnøy islands are inhabited, but over half of the inhabitants live on the main island, Finnøy. The municipal administration is also located on the main island, at Judaberg. Judaberg is the only town in Finnøy municipality. (Finnøy kommune, 2018d)

Finnøy is a popular retreat with several holiday homes, and during the summer months, the population often doubles. (Finnøy kommune, 2018d)

The land is mostly flat, only two of the islands have higher altitudes than 200 meters above sea level. The transportation between the islands is mainly by speedboats and ferries. In 2009 Finnøy got mainland connection to Rennesøy by a tunnel (Finnfast).

Agriculture is a key industry in Finnøy municipality. Finnøy is the municipality where the largest part of the gross product originates from agriculture (Finnøy kommune, 2018d). The primary industries employ 19% of the working aged in Finnøy.

Agriculture also serves an essential role in the inhabitation of the islands without a mainland connection. Finnøy is sometimes known as the Tomato-municipality and accounts for 30% of the Norwegian tomato production. (Finnøy kommune, 2018c)

A large section of the agricultural land is infield pastures. Much of the production is based on grazing's, such as dairy production, sheep, and sucklers (Finnøy kommune, 2018c).

There is also a large portion of agricultural entities that have a limited area available; this has led to intensive production methods, such as tomato production in greenhouses, egg, and slaughter production. Collectively there is a significant livestock density in the municipality. (Finnøy kommune, 2018b)

Finnøy municipality is also the largest aquaculture municipality in Rogaland, with 20 aquaculture localities. Finnøy is the largest aquaculture municipality in Rogaland county, with maximally allowed biomass of 58 860 tons. (Stavanger bystyre, 2018)

The aquaculture industry contributes to employment in the municipality. The natural aquatic habitat around Finnøy is optimal for aquaculture, enabling large productions in relatively small areas. (Finnøy kommune, 2018b)

The municipality has had an active role in ensuring and enabling access to sea areas for food production. (Finnøy kommune, 2018d; Rogaland Fylkeskommune, 2015)

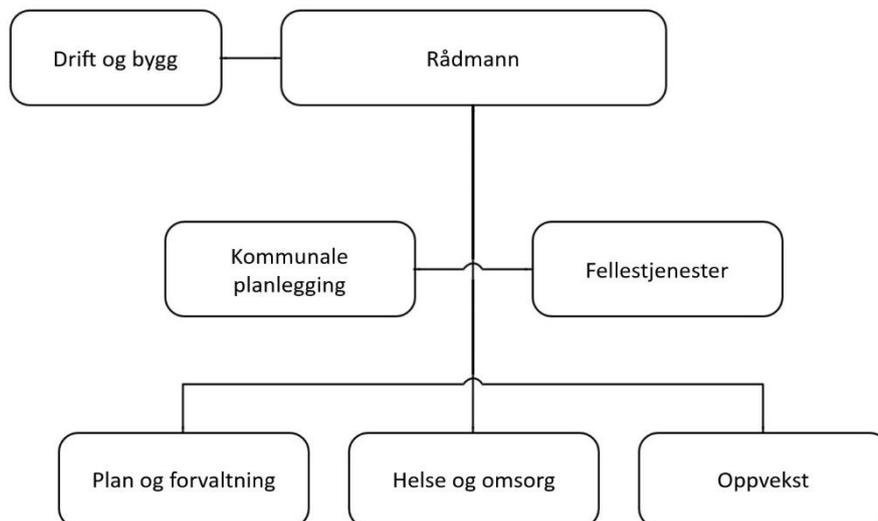


Figure 9 - Organization structure for Finnøy municipality, (Finnøy kommune, 2018a)

1141 Finnøy



Statistikk (SSB), 2017:

| | |
|--|-------|
| Tal innbyggjarar | 3 235 |
| Totalt areal, km ² | 103 |
| Jordbruksareal i drift, km ² | 37 |
| Produktivt skogareal, km ² | 33 |
| Avvirking, m ³ | 308 |
| Tal landbrukseigedomar | 396 |
| Tal jordbruksføretak | 203 |
| Tal sysselsette i primærnæring ¹⁾ | 332 |

1) Jordbruk, skogbruk og fiskeri

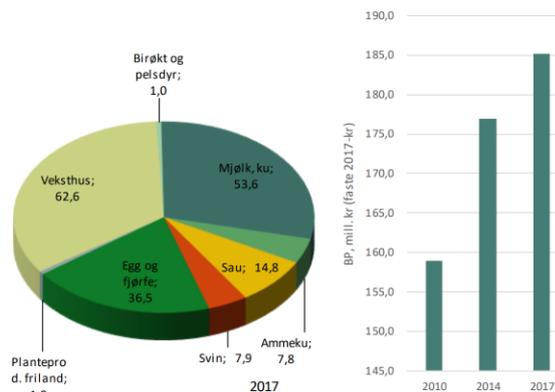
Utrekningar, 2017, verdiskaping som bruttoprodukt og sysselsetting

| | |
|---|-------|
| Bruttoprodukt jordbruk, mill. kr ²⁾ | 185,2 |
| Bruttoprodukt skogbruk, mill. kr | 9,5 |
| Sum bruttoprodukt primærledd, mill. kr ³⁾ | 203,6 |
| Bruttoprodukt landbruksbasert industri, mill. kr | 5,3 |
| Årsverk à 1 845 timar, jordbruk | 385,6 |
| Sysselsette personar i landbruksbasert industri ⁴⁾ | 6 |

2) Inkl. pelsdyr

3) inkl. tilleggsnæring

4) avhengig av landbruk i kom.



Verdiskaping jordbruk, bruttoprodukt, mill. kr



Figure 10 - Graphic explanation of agriculture in Finnøy (Fylkesmannen i Rogaland, 2019)

3.2.2 Rennesøy

Rennesøy municipality is also a collection of islands, where eight of the islands are inhabited. The municipality has right over 4800 inhabitants. (Rennesøy kommune, 2016)

The land area is around 65 km², and all of the islands, except one, Brimse, has a mainland connection either by tunnel or bridge. After the toll was removed from Rennfast, settlement in the region increased. New settlement threatens topsoil land, as it is more accessible to building. (Rennesøy kommune, 2011)

Agriculture is the primary industry in Rennesøy municipality, and 94,7% of the land area at Rennesøy is the agricultural area. 17% of the gross product originates from the primary industries. (Rennesøy kommune, 2016)

In similarity to Finnøy, Rennesøy also has intensive livestock production and significant greenhouse industry. In 2011 there were 123 greenhouses in the municipality. (Rennesøy kommune, 2011)

With their ten aquaculture locations, aquaculture industry also contributes to employment and is an important industry for Rennesøy. (Rennesøy kommune, 2011)

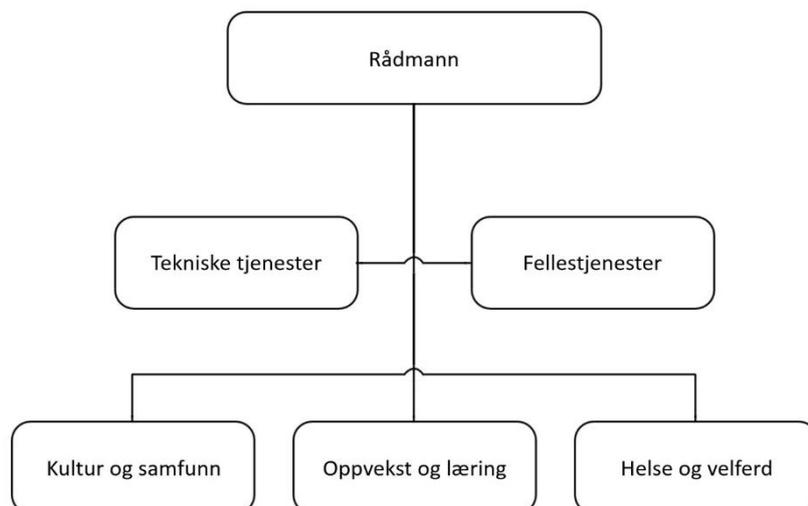


Figure 11 – Organization structure of Rennesøy municipality (Rennesøy kommune, 2018)

1142 Rennesøy



Statistikk (SSB), 2017:

| | |
|--|-------|
| Tal innbyggjarar | 4 892 |
| Totalt areal, km ² | 65 |
| Jordbruksareal i drift, km ² | 37 |
| Produktivt skogareal, km ² | 4 |
| Avvirking, m ³ | 606 |
| Tal landbrukseigedomar | 250 |
| Tal jordbruksføretak | 133 |
| Tal sysselsette i primærnæring ¹⁾ | 171 |

1) Jordbruk, skogbruk og fiskeri

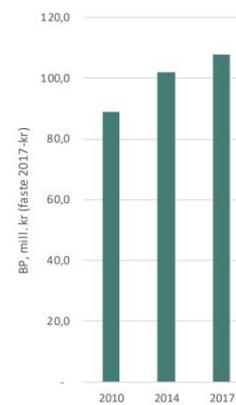
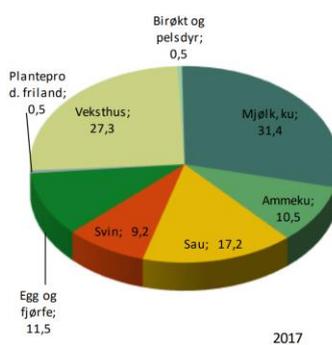
Utrekningar, 2017, verdiskaping som bruttoprodukt og sysselsetting

| | |
|---|-------|
| Bruttoprodukt jordbruk, mill. kr ²⁾ | 108,0 |
| Bruttoprodukt skogbruk, mill. kr | 1,0 |
| Sum bruttoprodukt primærledd, mill. kr ³⁾ | 113,8 |
| Bruttoprodukt landbruksbasert industri, mill. kr | - |
| Årsverk à 1 845 timar, jordbruk | 228,2 |
| Sysselsette personar i landbruksbasert industri ⁴⁾ | - |

2) Inkl. pelsdyr

3) inkl. tilleggsnæring

4) avhengig av landbruk i kom.



Verdiskaping jordbruk, bruttoprodukt, mill. kr



Figure 12 - Graphic explanation of agriculture in Rennesøy, (Fylkesmannen i Rogaland, 2019)

3.2.3 Stavanger

Stavanger municipality is the fourth most populated municipality in Norway, with just over 133 400 inhabitants. It covers 70 km². Stavanger and Sandnes region is the third largest urban area in Norway and consists of Stavanger, Sola, Sandnes, and Randaberg, with a population of just short of 250 000 inhabitants. Stavanger has a densely populated municipality. (Stavanger kommune, 2019a)

Stavanger has for a long time been an oil and gas region but is today an energy region. (Stavanger kommune, 2019a)

Today Stavanger has minimal agriculture and no aquaculture. They purchase management services on these areas from Sandnes. (Asplan Viak AS, 2018)

The agriculture in Stavanger has been under intense pressure to redistribute areas to other purposes. (Stavanger kommune, 2019a)

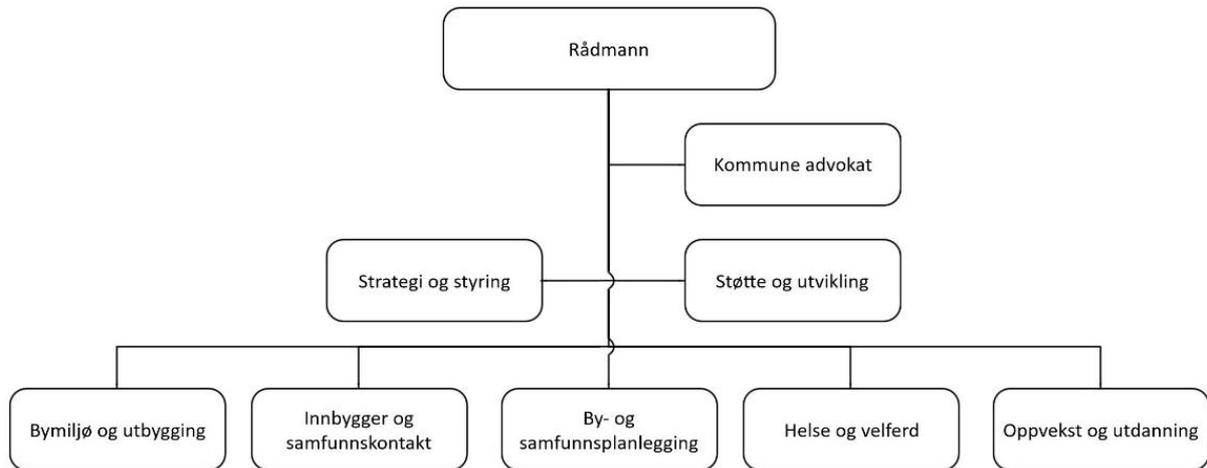


Figure 13 - Organization structure of Stavanger municipality, (Stavanger kommune, 2019b)

1103 Stavanger



Statistikk (SSB), 2017:

| | |
|---|---------|
| Tal innbyggjarar | 132 729 |
| Totalt areal, km ² | 68 |
| Jordbruksareal i drift, km ² | 11 |
| Produktivt skogareal, km ² | 5 |
| Avvirking, m ³ | - |
| Tal landbrukseigedomar | 297 |
| Tal jordbruksføretak | 50 |
| Tal sysselsette i primærnærings ¹⁾ | 181 |

1) Jordbruk, skogbruk og fiskeri

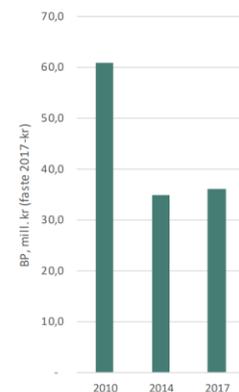
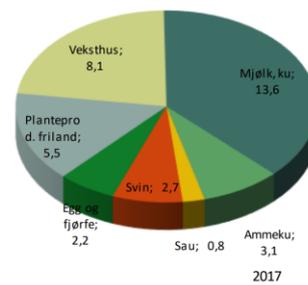
Utrekingar, 2017, verdiskaping som bruttoprodukt og sysselsetting

| | |
|---|-------|
| Bruttoprodukt jordbruk, mill. kr ²⁾ | 36,1 |
| Bruttoprodukt skogbruk, mill. kr | 1,1 |
| Sum bruttoprodukt primærledd, mill. kr ³⁾ | 40,0 |
| Bruttoprodukt landbruksbasert industri, mill. kr | 794,2 |
| Årsverk à 1 845 timar, jordbruk | 74,2 |
| Sysselsette personar i landbruksbasert industri ⁴⁾ | 892 |

2) Inkl. pelsdyr

3) inkl. tilleggsnærings

4) avhengig av landbruk i kom.



Verdiskaping jordbruk, bruttoprodukt, mill. kr



Figure 14 - Graphic explanation of agriculture in Stavanger, (Fylkesmannen i Rogaland, 2019)

3.2.4 New Stavanger

New Stavanger will cover an area of 241 km² across 37 islands. It will have 141 000 inhabitants and become the fourth largest municipality in Norway. In New Stavanger, energy, agriculture, aquaculture, and tourism will become among the most important priorities. (Nye Stavanger kommune, 2019d) (Om Nye Stavanger)

As stated by the councilman of Finnøy kommune in contribution an Asplan Viak report about building new municipalities: “How shall “little Stavanger” of 70km² manage to take in 170km² with agricultural municipality, where they today purchase services on these areas?” (Asplan Viak AS, 2018)

Today the three municipalities are structured similarly. Rennesøy and Finnøy are more similar than Stavanger. The reason for this may be that Rennesøy and Finnøy are smaller municipalities.

The organization structure for New Stavanger is very similar to the one for Stavanger. One of the more significant changes is that management of agriculture and aquaculture is added underneath the business department of the municipality, see Figure 17.

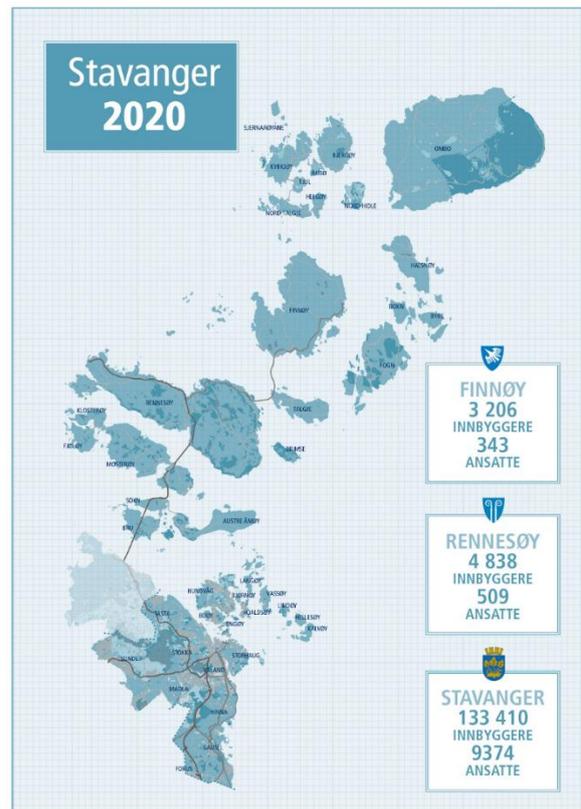


Figure 15 - Overview of the new municipality, (Nye Stavanger kommune, 2019d)

In the figure below is the structure of “Innbygger- og samfunnskontakt”. It is under this section both smart city, and business office is located. The management office for agriculture and aquaculture is located as a subsection of the business office.

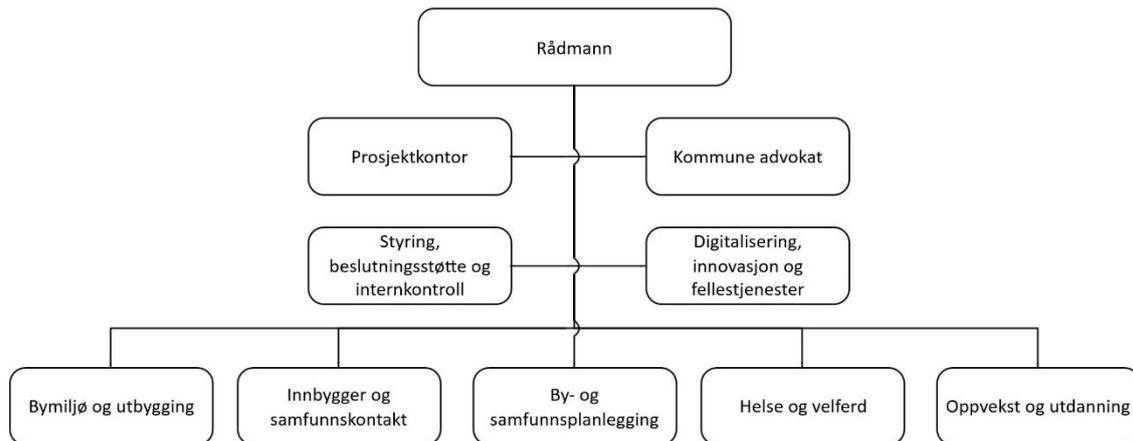


Figure 16 - Organization structure of New Stavanger municipality, (Nye Stavanger kommune, 2019f)

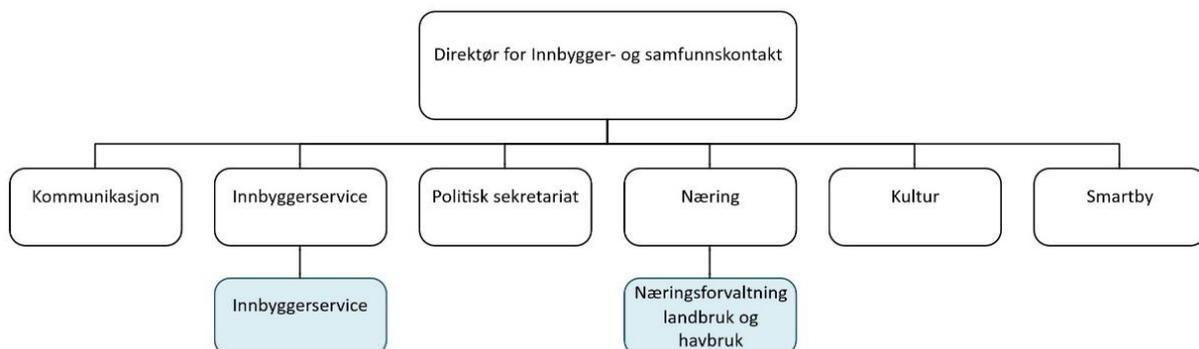


Figure 17 - Substructure of "Innbygger og samfunnskontakt", (Nye Stavanger kommune, 2019c)

The management section for agriculture and aquaculture is to be located at Judaberg. This is according to the recommendation of the Project Council Man (PCM) for the municipal restructuring. The PCM highlighted the value of locating the management office centrally for the industries, and with that in mind, Rådhuskvartalet in central Stavanger was deemed not appropriate. Following that recommendation, the municipal council of New Stavanger decided on Judaberg. These sections are color-coded in blue in Figure 17.(Stavanger kommune. Fellerneemda. Rådmannen, 2019; Stavanger kommune. Fellesnemda - Nye Stavanger, 2019)

Innbyggjerservice, citizen service department, will also be located at Judaberg and Vikevåg. The office will be located at the same place as the management office for bluegreen sector. (Stavanger kommune. Fellesnemda - Nye Stavanger, 2019)

The business and industry development office will be located at Rådhuskvartalet, in Stavanger city center, while only the management of bluegreen sector will be located at Judaberg, together with Innbyggertorg. Innbyggertorg can be seen in the figure above as the subsection under Innbyggjerservice, citizen service. (Stavanger kommune. Fellesnemda - Nye Stavanger, 2019)

The business office is responsible for both tasks related to industry development and industry management (forvaltning). The primary department, located in the municipal center downtown in Stavanger, will mainly be focused on industry development, while the section at Judaberg will mainly be focused towards management. It is an outspoken goal for the main office to facilitate industry development in the blue and green sector. Hence, the Project Council Man recommended a strengthening of the competence of these areas in the main office of the business department of the municipality in Stavanger. (Stavanger kommune. Fellesnemda. Rådmannen, 2019)

3.3 New Stavanger's new industries

As Finnøy, Rennesøy, and Stavanger merge, the industry buildup of the municipality will change. From a Stavanger perspective, agriculture and aquaculture will be new industries.

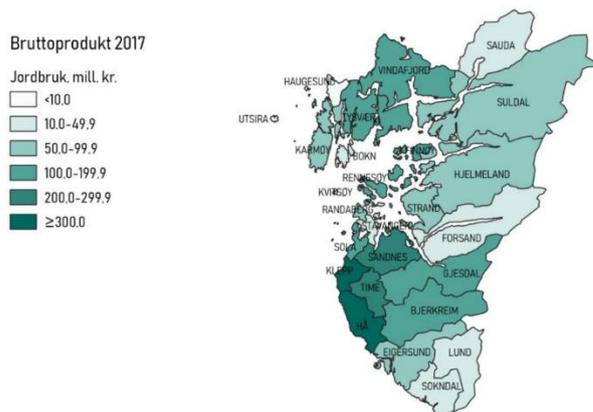
The new municipalities will, as stated, bring new industries into New Stavanger. These industries are as stated before, vital for the people living on the islands. In Stavanger, there has been no tradition for preserving these industries, and they have been mostly obliterated (Gundersen, 2017). In a global setting, preserving and developing the industries is essential. According to the European Commission, the world will need to produce an estimated 50% more food and energy and 30% more fresh water by 2030 (European Commission, 2017).

3.3.1 Agriculture

Agriculture is in this thesis defined as traditional husbandry and plant production and forestry, including the production of milk, meat, wool, eggs, grain, fruit, berries, potatoes, and vegetables. Forestry is not much focused on in this thesis.

There is a limited agricultural area in Norway; only three percent of the land is an agricultural area (Bye, 2019). As agricultural area, for food production, is a limited resource, this should be safeguarded.

Agriculture is a key contributor to settlement and employment in rural Norway in general, and at Rennesøy and Finnøy in particular (Knutsen, 2019).



Figur 3.3 Kart: Verdiskaping i jordbruket i Rogaland, bruttoprodukt, mill. kr, 2017

Figure 18 - Gross product for agriculture 2017 (Knutsen, 2019)

Agriculture and agricultural activities are important for employment and value creation in many municipalities in Norway and Rogaland. This is true for Finnøy and Rennesøy. It will also become true for New Stavanger. The agricultural sector is under pressure from many directions. (Knutsen, 2019)

Value creation in agriculture compared to inhabitants draws a picture of how important the agriculture industry is for agricultural municipalities. Calculated per citizen, the value creation from agriculture was calculated to be 6730 kr on average for Rogaland in 2017. The highest was for Finnøy, with 57250 kr per citizen. (Knutsen, 2019)

Table 1 - Agriculture in the three municipalities from 2014, (Rogaland Fylkeskommune, 2015)

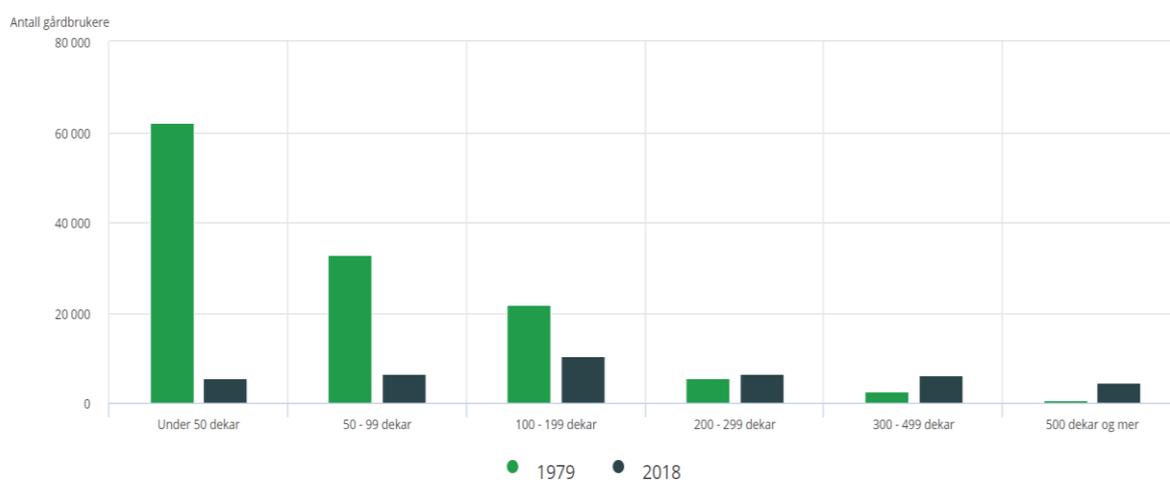
| | Finnøy | Rennesøy | Stavanger | Total |
|--|----------|----------|-----------|----------|
| Agriculture | | | | |
| Total agricultural land | 36884 | 37465 | 11284 | 85633 |
| Fully cultivated land | 13092 | 15448 | 9413 | 37953 |
| Surface cultivated land | 3450 | 776 | 196 | 4422 |
| Infield pastures | 20342 | 21241 | 1670 | 43253 |
| Applicants production subsidy | 201 | 139 | 53 | 393 |
| Number of acres of agricultural area per applicant | 184 | 270 | 213 | 667 |
| Rented area in % | 35,50 % | | 65,80 % | 1,013 |
| Milk Quotas | 11464462 | 7193978 | 3564049 | 22222489 |
| | | | | 0 |
| Citizens | 3147 | 4794 | 132102 | 140043 |
| Area (in km2) | 103 | 65 | 68 | 236 |
| Freshwater | 2 | 1 | 3 | 6 |
| Productive forest area | 43851 | 4135 | 4463 | 52449 |
| Number of forestry's | 130 | 37 | 33 | 200 |
| Liquidation for sale | 3771 | 2667 | 647 | 7085 |
| Replanting | 0 | 0 | 0 | 0 |
| Tending | 0 | 0 | 66 | 66 |
| Ecological agricultural area | 40,8 | 148,9 | 34,9 | 224,6 |
| Number of ecological entities | 1 | 2 | 2 | 5 |
| Measured in number of animals | | | | |
| Dairy cows | 1453 | 1034 | 476 | 2963 |
| Suckler cows | 289 | 401 | 178 | 868 |

| | | | | |
|---------------------------------|---------|---------|--------|---------|
| Other cattle | 2972 | 2343 | 1049 | 6364 |
| Pigs | 2684 | 17051 | 4843 | 24578 |
| Winterfed sheep | 9935 | 12163 | 623 | 22721 |
| Chickens for slaughter/broilers | 1686890 | 645231 | 119000 | 2451121 |
| Laying Hens | 209225 | 37459 | 14636 | 261320 |
| Potatoes (in acres) | 1 | 15 | 313 | 329 |
| Vegetables open farmed | 6 | 35 | 196 | 237 |
| Tomatoes | 4112420 | 1312117 | 70974 | 5495511 |
| Cucumber | 0 | NA | 361275 | 361275 |

Collectively for Rogaland, the value creation in the primary industries account for 1,5 percent and the agricultural industry for 1,3 percent. The value creation thus accounts for equals a total of 2,8 percent of the total value creation in Rogaland. (Knutsen, 2019)

In 2013 a dependence analysis was done for Rogaland, which estimated that accumulatively agriculture has an employment multiplier of 2,23. This means that one person employed in agriculture in Rogaland employ 1,23 in other industries. (Knutsen, 2019)

Bønders jordbruksareal



Kilde: Strukturen i jordbruket, Statistisk sentralbyrå

Figure 19 - Structure of Norwegian farm sizes, (Statistisk sentralbyrå, Collected 20. april 2019)

Over the last decades, the structure of agricultural entities has changed. Previously, the agricultural sector was built up by many small entities, while today, more and more entities have been merged and acquisition by each other, creating fewer small entities, and the structure now consists of a larger portion of larger entities. (Statistisk sentralbyrå, Collected 20. april 2019)

Employment in the agricultural sector has also decreased in Rogaland, while the gross product has increased. This means that fewer farmers create more value, which means that farmers in Rogaland have become more efficient. (Fylkesmannen i Rogaland, 2019)

Agriculture is the sector in Norway that is most at risk of being affected by climate change (Bye, 2019). Therefore a climate perspective is vital for the agricultural industries and their management. The agricultural sector also contributes to a large carbon footprint, and to identify the agricultural carbon drivers is important to controlling the climate emissions nationally as well as for New Stavanger (Stavanger bystyre, 2018).

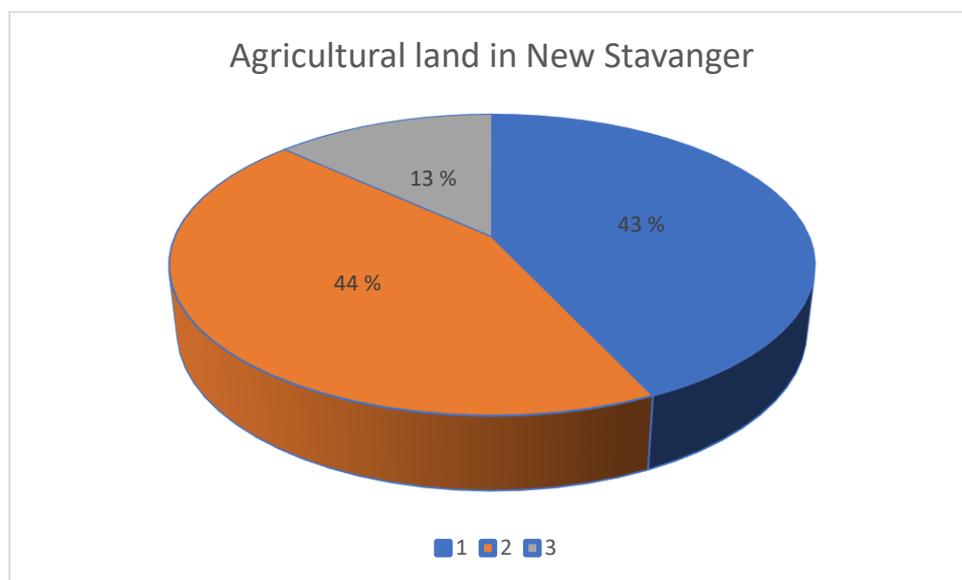


Figure 20 - Agricultural land in New Stavanger divided between the three municipalities, created with data from (Rogaland Fylkeskommune, 2015)

Explanation of the diagram; 1 is Finnøy, 2 is Rennesøy, and 3 is Stavanger.

Today Stavanger is not a large agricultural municipality, but New Stavanger will be. The agricultural land for New Stavanger will be about 86 000 acres, roughly eight times the size of Stavanger's agricultural area. (Stavanger bystyre, 2018)

Infield pastures make up about half of the agricultural land, while the productive forestry's make up just shy of 50 000 acres. In new Stavanger, livestock production will be intensive, with massive production of dairy, meat, and eggs. New Stavanger will also be the largest municipality on sheep farming. (Stavanger bystyre, 2018)

Because of the intensive husbandry, New Stavanger will also produce massive amounts of manure. Today, there are produced more manure than can legally be distributed as fertilizer in accessible areas. Thus much of this is redistributed to other parts of the country. (Stavanger bystyre, 2018)

More than 30% of greenhouses in Norway are located in Rogaland(Fylkesmannen i Rogaland, 2015). Greenhouses will also become significant, as Rennesøy and Finnøy combined represent 41% of the total tomato production(Stavanger bystyre, 2018).

3.3.2 Aquaculture

Finnøy and Rennesøy have in total 30 aquaculture localities, which will make New Stavanger the largest aquaculture municipality in Rogaland county(Stavanger bystyre, 2018).

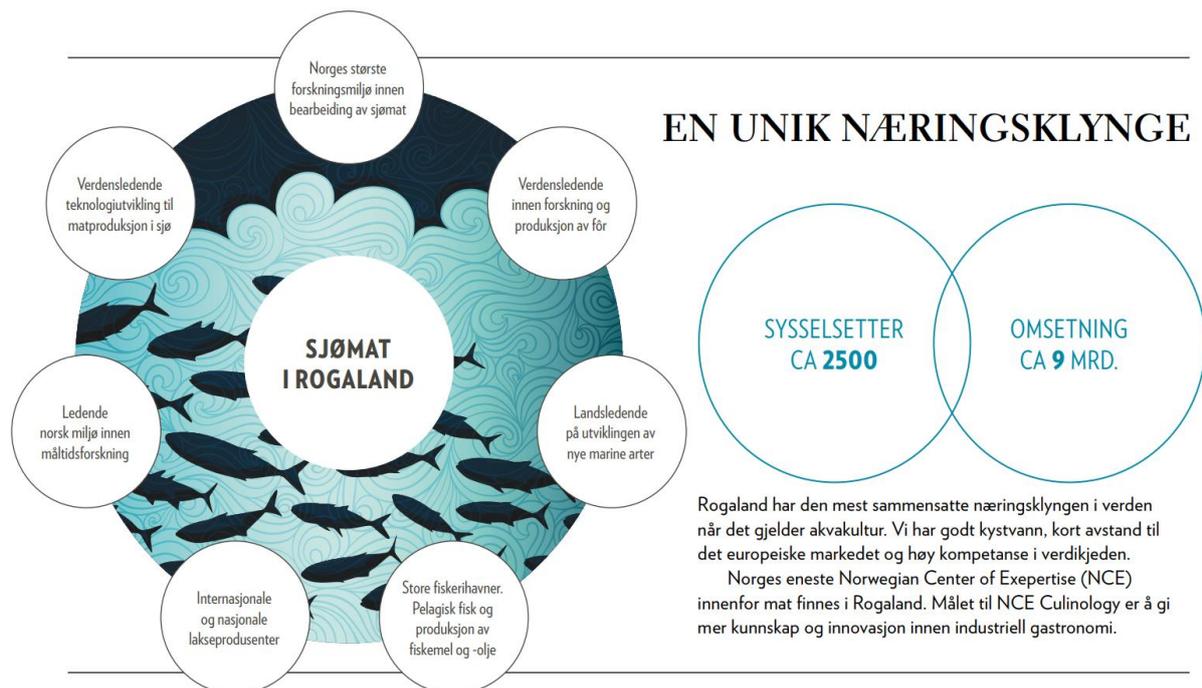


Figure 21 - Seafood in Rogaland, (Fylkesmannen i Rogaland, 2015)

Rogaland has the most complex industry aquaculture cluster in the world. The natural conditions, with water conditions and proximity to the European market, makes it an ideal location for aquaculture. The cluster also has high expertise on the value chain has given them an exceptional advantage. The cluster contains Norway’s biggest research community in the processing of seafood, world leading in technology development and research and production of feed. (Fylkesmannen i Rogaland, 2015)

Municipal room for negotiation

As a planning authority, the municipality can make individual decisions, facilitate efficient energy use and reduce greenhouse gas emissions. The municipality must be a local driving force for local adaptation to changing climatic conditions through the roles of knowledge facilitator, service producer, building owner and purchaser. (Rennesøy kommune, 2011)

The municipality can help put climate actions on the agenda and spread information. This can, in turn, accelerate competence, attitudes, and visualize how citizens can contribute.

This thesis discusses how the business office, including the bluegreen section of that office, can utilize smart thinking and technology in their management of the bluegreen sector. They will not be an authority on planning processes or procurement for the municipality. Thus their room for negotiation is limited through individual decisions and collaboration. Collaboration is information, creating knowledge for good decision making, both internally in the greater municipality and externally towards the citizens.

Saksbehandlingsprosessen

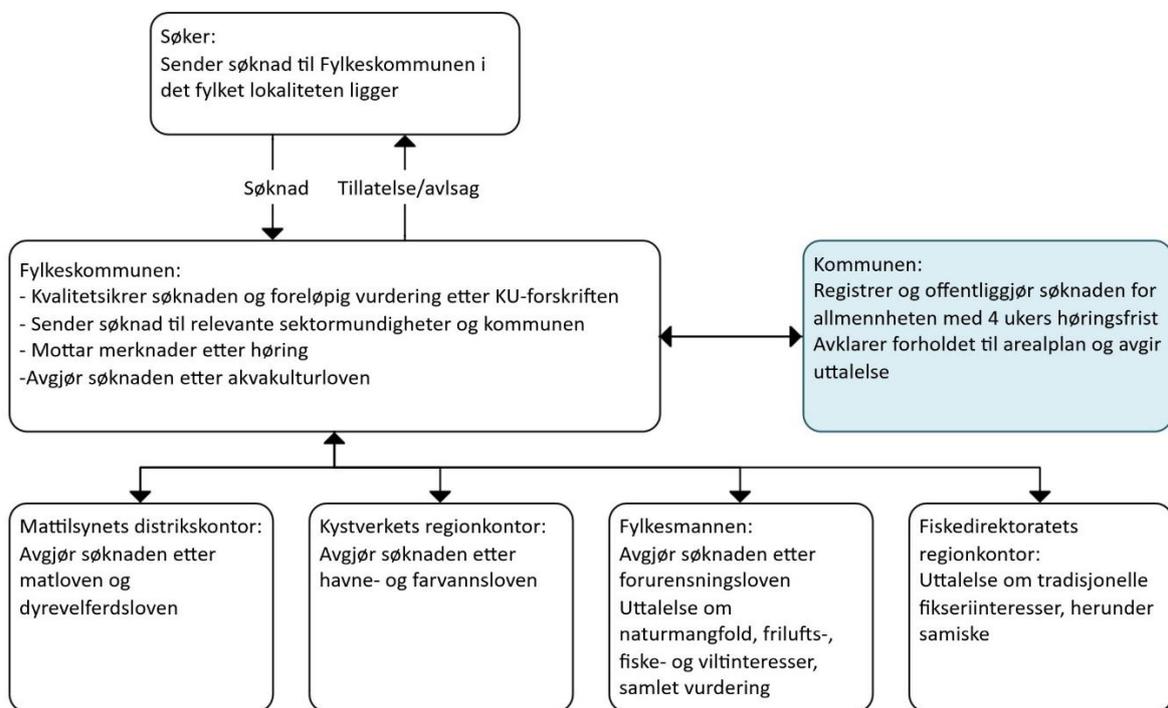


Figure 22 – Proceedings process for management of Aquaculture, (Rogaland Fylkeskommune, 2017)

The municipal room for negotiation for aquaculture is shown above in blue in Figure 22. The Fylkeskommune, county board, is responsible for the management of the agriculture industry. The municipal responsibility is to recommend and approve locations for aquaculture. (Rogaland Fylkeskommune, 2017)

3.4 Industrial development

This chapter will present information and knowledge about what good industry development entails, and some of the hindrances in order to achieve. The chapter will assess the municipal stance on industrial development, and discuss municipal room of negotiation in contributing to promoting industrial

entrepreneurship. The relevance of Industrial development is that the obligations of a municipality include contributing to each municipality becoming a good place for citizens to live and work. In order to ensure this, a thriving business is vital.

Industrial development can be described as the key factors of the development in industry and business in a limited geographical area, such as a country, region, or municipality. The industry development is described as either positive or negative, given certain criteria, first and foremost based on growth or decline in employment. (Isaksen, 2015)

In this thesis, industrial development speaks to industrial development in the bluegreen sectors. Their relevance is that these industries are the basis for the livelihood in the new parts of Stavanger.

The municipality has a central role in facilitating the local industry and has today several important roles in order to enhance intended social and industrial development. Industry actors are dependent on good technical infrastructure, up to date and predictable municipality plans, as well as quick and efficient processing of regulation plans and building applications. (Regjeringen, 2018)

The municipality also has the ability to stimulate the local industries through infrastructure locally and regionally. (Regjeringen, 2018)

Stavanger municipality decided on an action plan for industry in 2017. It is set to be revised the fall of this year, 2019, in order to incorporate Finnøy and Rennesøy. The plan was processed in the city council, bystyret, 05.09.2016. (Stavanger formannskap, 2018)

The plan mapped out and decided on prioritized areas for industry development and are as follows innovation and smart city, inclusive growth, international work and infrastructure(Stavanger formannskap, 2018).

From a Stavanger municipal perspective, the primary need for the action plan was to enable change in the industry, as the municipality moves from an oil and gas region to an industry and energy region. (Stavanger kommune)

Well designed and appropriate services are vital for residents to be motivated to settle in the municipality and in order to attract attractive labor. (Regjeringen, 2018)

3.5 Smart City

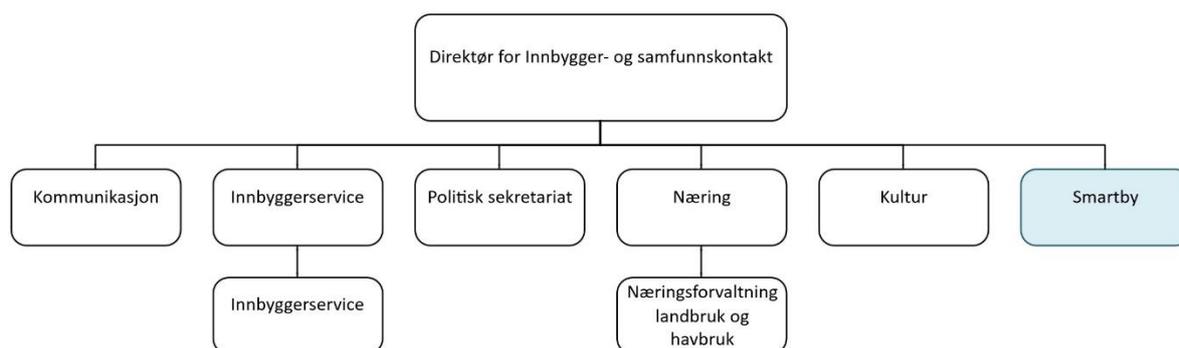


Figure 23 - Overview of the "Innbygger- og samfunnskontakt" department of New Stavanger, (Nye Stavanger kommune, 2019c)

Stavanger municipality has a Smart City department; this department will be kept in New Stavanger. The department is organized under 'Innbygger- og samfunnskontakt', Citizen and society contact. It is organized under the same department as the business and industry development office, as can be seen from the figure above.

The background of the Smart City focus is as societal challenges become increasingly complex than before, there is a need for a new, more comprehensive methodology in approaching and solving them. (Stavanger bystyre, 2016)

The Smart City approach is based on the citizen's needs and applies new technology in making the city a better place to live, reside, and work. (Stavanger kommune, 2018)

A smart city project is a project that follows the following criteria;

- The solutions utilize modern technology, wither new technology, or existing technology used in a new way.
- The projects are collaborative, involving different actors across local authorities, industry and commerce, organizations, and academia.
- The projects are based on the end user needs and involve citizens and users in the development of solutions. (Stavanger kommune, 2018)

3.5.1.1 Citizen involvement

Citizen involvement is a priority in the pending municipal restructure between Finnøy, Rennesøy, and Stavanger. Project New Stavanger has used different methods to involve citizens and collect input. The methods used in the fall of 2018 and spring of 2019 are listed below (Nye Stavanger kommune, 2019a):

- Future workshop // Framtidsverksted
- Citizen panel and guest ombudsman (gjestebed) // Innbyggerpanel og gjestebed
- Gathering for youth panel // Samling for ungdomsråd
- Involvement of elected // Involvering av folkevalgte
- Mapping of citizens // Innbyggerkartlegging
- Trust exploration // Tillitsundersøkelse

Gjestebed

The gjestebed method was developed by Svelvik municipality and is a good method for reaching citizens that would not necessarily get involved, as well as getting more in-depth answers. (Regjeringen, 2015)

A gjestebed is an ordinary citizen, who invites other citizens, such as family, acquaintances, neighbors or others to an informal talk around topics that are of interest to the municipality. This way, the municipality gain valuable insight into the opinions of citizens that would not ordinarily participate in official gatherings or other platforms. (Nye Stavanger kommune, 2019a)

In Stavanger, Rennesøy, and Finnøy, the gjestebed's were recruited through the municipal communication channels, including social media, local news outlets, and the municipal websites, and given a presentation and questions to discuss. Afterward, they went home and held a gjestebed at home, writing down detailed summaries. (Nye Stavanger kommune, 2019a; Regjeringen, 2015)

3.5.1.2 Current smart city projects

Today the Smart City office of Stavanger municipality is involved in several projects. Among these are Innovative light post charging for electric vehicles, LoRaWAN sensor network, smart garbage disposal, digital signage, AV1 robots for children with long-time illnesses, and My Stavanger. (Stavanger kommune)

Below project that the smart city has implemented currently, or are working on implementing are listed (Stavanger kommune):

Innovative light posts charging:

The project is a cooperation between Stavanger municipality and Lyse AS and aims to facilitate electric charging for citizens who do not have assigned parking. The project has received financial support from Klimasats, which is a subsidizing aid for climate actions in Norwegian municipalities.

The idea is to use existing infrastructure for light posts to enable legal charging of electric vehicles. The project is smart because it is based on the citizen's needs, a practical and legal place to charge

when they don't own a parking spot, and it uses the charging technology in a new way, connected with light posts while including cooperation with Lyse.

LoRaWAN – sensor network:

A part of the Smart City focus is measuring and counting. The LoRaWAN is a technology that offers powerful wireless communication that uses little electricity, over large distances. This enables sensors to collect different types of information and communicate them to a network of information, combining this data with open data allows for information that, in turn, can create new services. In the future, more sensors can be implemented, creating more information and collected data that can enable more services.

Among the data and services collected today, we find the following:

Automatic water temperature measurements at local beaches and bathing places. The temperatures are updated on Stavanger municipality's website, and all citizens wishing to go swimming can access the information. This project has saved Stavanger municipality money, as this data used to be collected manually, while now it happens automatically year round.

Microsensor measuring air quality has been set up as a pilot project in Vågen, downtown Stavanger. The sensors show the air quality in real time, and the data is shared through the municipality open data website. The measurements come from equipment that is under testing and may give an unrealistic picture of air pollution.

In cities across the world, there are street drains helping excess water away from the streets. With the water, sand and other pollutants join the water, creating blockages in the water systems. The municipality spends significant resources on maintaining the drains from blockages. Today, a pilot project using sensors in the drains, in order to alert the municipality of malfunctions and blockages, and predict water overflow is being tested. This project aims to improve responding time, optimize maintenance routes, and save money for the municipality. During the pilot, the measurements from the test sensors are connected with the sensor network LoRaWAN.

In the future, new measurements and counting's may arise. New ideas for measurements already collected for improved services and business propositions can also arise. Therefore, the smart city works towards as much information as possible being open data, available to citizens and industry.

Smart garbage disposal:

Stavanger municipality has utilized smart technology for garbage disposal in private households for years. This enables easier disposal of garbage and saves the municipality money through optimizing operations.

There are about 2500 underground garbage containers in the region, that alerts the municipality of fill level, status for maintenance etc. This optimizes the routes of collecting the trash, thus saving cost, environmental impact, and reduces noise pollution. The solution has also been implemented in other municipalities in the region and is run as a cooperation with Stavanger municipality.

In addition, Stavanger municipality has also introduced Big Belly in the city center. They are similar to the private household garbage cans, however, they are powered by solar, not solar and battery, and have a compressor, so that they have more capacity.

In addition, a project surveilling the recycling centers is being tested. If a person leaves recyclables that do not belong at that facility, a camera is turned on, and a voice informs the person or persons that the recyclables should be driven to the main recycling facility at Forus, or that they can order garbage pickups from their home through a municipal website.

This has reduced the problem of garbage and recyclables being left around recycle stations, thus saving resources for the municipality. This test project has been a collaboration with Lyse, Onsite Security, Sandnes municipality, and Fretex.

AV1 Robot:

The AV1-robot works as eyes, ears, and voice for children with long-term illnesses, which disables them from being present in the classroom. The aim of this project is to enable long-term ill children to stay social and participate in learning. Pupils that are hospital-bound or at home, due to illness, can participate through a tablet.

As an extension of the project, the possibility of using the robot for pupils with heightened learning potential. The robot can be placed in a high school, and pupils can access those classes from their schools.

In this project, the smart city owns the robots, and lend them to schools as needed. Previously the schools had to invest independently, but in the new solution, the robots become more accessible to those who need it.

Digital signs:

Stavanger's digital signs have been placed in three locations in the city center of Stavanger. They are to be connected with open data sources and can give information about culture, public transportation,

and municipal information. They can help show directions, but also when the next bus will leave. They can also show the information in other languages, such as German or Italian.

The signs are a test project that will be in place for two years.

My Stavanger:

“Mitt Stavanger” is a new solution for citizens, where citizens themselves can contribute with content and data as they choose. The citizen owns the information and can decide when and by whom it can be utilized. The solution is to be launched this year, 2019.

The services that are to be implemented first are “min hverdagstur”, my walk, and “min møteplass”, my meeting place. This project will let citizens share information, the information can also be utilized by the municipality to improve the city and community.

The project is a collaboration between Stavanger municipality and the technology venture Bolder AS and receives financial support from Innovasjon Norge.

3.5.1.3 Purpose

According to the Smart City Roadmap of 2016, the purpose of the smart city is to help the municipality think new around more complex issues. The smart city office aims to motivate both the public and private to partake in improving Stavanger. (Stavanger bystyre, 2016)

Their stated purpose is:

- + Strengthen the ability to deal with major societal challenges
- + Develop better and more efficient services for the citizens, and
- + Contribute to new business activity and new jobs
- + Reduce greenhouse gas emissions, and contribute to more sustainable community development (Stavanger bystyre, 2016)

3.6 Technology and digitalization

Digitization describes converting something from an analog to a digital format. Digitalization describes using process technologies to take advantage of digitized content. (Bloomberg, 2018)

Industry 4.0 or The Fourth Industrial Revolution describes the change in industry due to new technological advances. I4.0 describes the way things and systems talk to each other, and communicate without human interference. (European Commission, 2018; Marr, 2018)

One of the potentials of industry 4.0 are machines able to collect and process volumes of data and communicate it's findings. Smart computers can identify patterns and provide insight that is not possible for humans to identify manually. (Marr, 2018)

According to the European Commission, information, and communication technologies (ICT) sector represents almost 5 % of the European economy. They expect digitization to stimulate an increase in European productivity growth substantially. The European Commission estimates that the digitization of goods and services will contribute EUR 110 billion in revenue annually for the European industry for at least the next five years. (European Commission, 2017)

The potential for digitization is not limited to economic growth, but can also improve the lives of citizens. It is also assumed that digitization will change society as a whole. This includes citizens lives, and work. (European Commission, 2017)

“By ‘going digital’, the industry can increase productivity and efficiency, reduce energy and resource use as well as waste, and enable more customized and diversified product portfolios”(European Commission, 2017). When industries digitalize, they have the potential to increase productivity, while optimizing resource use and reducing waste. ‘Going digital’ can also enable more customized product portfolios. (European Commission, 2017)

The European Union considers digital innovation and digitization an vital factor. They have created the Digitising European Industry (DEI) initiative, which among other things include an investment of EUR 500 million in a PAN-EU network of digital innovation hubs. (European Commission, 2017)

4 Methodology

This chapter explains the methodology of the thesis. The chapter aims to describe what decisions were made about the collection of data and information, through describing and discussing research design. It will discuss decisions made and the background for these when selecting an approach, and application of the process. The chapter then describes how the collected data was processed, and what tools were used, and discusses the background for these choices and how that can affect the result. At the end of the chapter, some reflections about the choices and applications of these are evaluated.

4.1 Basis of the thesis

The basis for this thesis is to evaluate to what extent smart city technology and thinking can contribute to New Stavanger delivering improved and equal services to its citizens, with a focus on agriculture and aquaculture.

This was done through a case study of the ongoing merger between Finnøy, Rennesøy, and Stavanger. This process is a unique process in a limited area. The relevance of the thesis is as a comment on the ongoing merger.

The case explored in the thesis is unique in being about how Stavanger's smart city focus can contribute to better management and industry development in New Stavanger. The unit of analysis then becomes services of the municipality. The thesis first had to identify the municipal room for negotiation, the scope of work for the new municipality on the servitization of the bluegreen industries, before analyzing key causes to create optimized services and service production. Access to information was also made difficult by the fact that decisions were being made simultaneously as the thesis was conducted. As information was divulged, the scope was redefined.

4.1.1 EPIC

The task was in part conducted as an EPIC-project. The EPIC-project is an Erasmus+ project, where participants from different universities in Europe collaborate on solving a problem using multidisciplinary backgrounds to approach a task together. The EPIC-project aims to further collaboration skills, by setting people of different backgrounds, both culturally and academically, together to learn-by-doing, problem-based learning. (EPIC seminar, 2019)

Some parts of the thesis, especially background and introduction, are also used for the EPIC-report submitted in Eduspace on June 1st 2019, but is written by the author. The EPIC-project collaboration has also inspired ideas for solutions and analysis.

4.1.2 Research process

The research process is shown in the figure on the next page. As the thesis is an explorative case, the process is based on finding new theory. This entails that the research process started with limiting the scope and purpose. The research process also entailed a collaboration through the EPIC-project. The scope was defined through research on the impending municipality structure. Both the reasoning behind it and identifying factors that will result in success. As the thesis is based on an ongoing process, the relevance of the thesis is to be a contribution to the merger it speaks of.

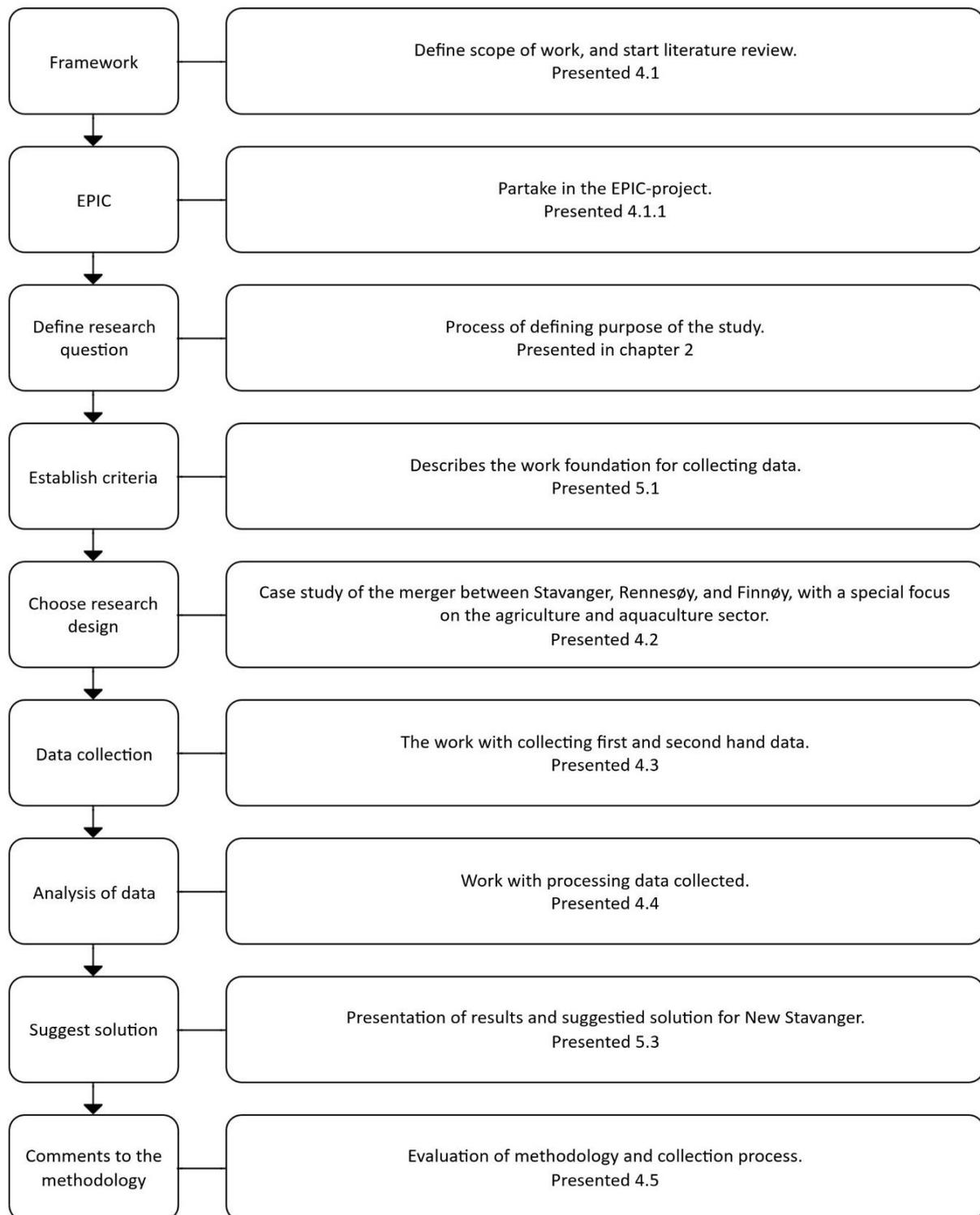


Figure 24 - Research process

4.2 Choose a research design

A qualitative method was chosen, as the thesis explores an ongoing event, thus there is little available data and knowledge. The thesis does not aim to identify final answers, but rather to explore causes and effects, contributing to or hindering, the quality of services delivered from the municipality. The qualitative method fits better with the why and how questions (Lantz, 1993)

The thesis discusses a specific municipal restructure, the case was chosen as a qualitative research design. The aim of the thesis is to identify how the management of agriculture and aquaculture is done, and what smart city technology can contribute. In this research design, the thesis is based on exploring current conditions and how these will be affected by the merger.

A case study is concerned with the complexity and particular nature of the case in question (Stake, 1995). It commonly discusses a single organization, group, location, family, or event. A factor of a case study is that the case is the focus of its own right and not merely the setting of a study. (Bryman, 2001)

An extreme case, or unique case, refers to a case that is not directly transferable to others, as it is not a representative case for the general population. A revelatory case, on the other hand, can be defined as a case where the researcher has an opportunity to study a phenomenon or situation that has not previously been accessible. However, the term revelatory is also often used when a single case is examined inductively.(Bryman, 2001)

The case at hand can be argued both to be unique, and to be revelatory. The case is by nature, the only time the three municipalities in question will merge. The setting for the approach to the case is to evaluate the relevance of smart city technology and thinking to the inclusion of bluegreen sector into a municipality where the largest has no competence in the sector. The case is approached using the inductive approach.

4.3 Data collection process

Data collected directly from informants are considered primary data. Primary data is data collected by the researcher for the first time by going directly to the source. In this case, the informants. The methodology for the primary data was chosen to be interviewed.(Jacobsen, 2015)

Interviews were chosen as the preferred method because the actors involved in the process had first-hand knowledge of their own situation, and their thoughts on improvements were also collected.

4.3.1.1 *Identification of informants*

In order to adequately illuminate the problem, some criteria were set for the selection of informants for the interviews. The criteria gave a direction to possible informants, in the process of arranging interviews with the initial informant's new informants were discovered.

The criteria set for the selection of informants were that all municipalities should be represented. In addition, the smart city office was to be included. One aim of the smart city office is to contribute to carbon reduction, hence, one representative for the climate reducing project was also desired. There was also intended to represent viewpoints of both blue and green sector.

Goal

1. Identify current management practices
 - a. For all three municipalities
 - b. For both sectors
2. Identify smart city relevance
 - a. Identify climate factors
 - b. Identify current projects
 - c. Understand smart city work approach

Criteria

1. Representation of all three municipalities
2. Representation of the climate aspect
3. Representation of the two industries, aquaculture, and agriculture.

During the recruitment phase of interview objects, all initial interview objects but one responded positively. The desired informant that did not respond positively was a key informant in covering the criteria. Some informants were hard to reach, and thus, the interview process from the start of recruitment to conducting the last interview took time. Stavanger has no management of agriculture today but buys this service from Sandnes. Therefore it was chosen to interview a representative for management of agriculture of Sandnes as well. The informants are presented in Table 2.

Table 2 - Overview of informants

| Informant | Relevance | Place and date | Duration |
|-------------|---|-----------------------|----------|
| Informant A | Representative for the climate and environment plan for Stavanger | Stavanger, 08.04.2019 | 1:24 |
| Informant B | Representative for agricultural management in Rennesøy | Rennesøy, 08.04.2019 | 1:01 |
| Informant C | Representative for agricultural management in Sandnes and Stavanger | Sandnes, 09.04.2019 | 1:07 |
| Informant D | Representative for the Smart city office | Stavanger, 24.04.2019 | 1:08 |
| Informant E | Representative for the new business office of New Stavanger | Stavanger, 24.04.2019 | 0:50 |
| Informant F | Representative Aquaculture industry, Blue Planet | Stavanger, 26.04.2019 | 1:11 |
| Informant G | Representative for agricultural management in Finnøy | Finnøy, 30.04.2019 | 0:55 |

4.3.1.2 Create an interview guide

The interview guide was written on the premise of the working problem statement at hand at the time of the interviews. During the process, the problem statement was refined. The interview guide was a series of questions to remind the interviewer of covered topics and relevant questions. In some of the interviews, the questions were followed closely, while in other interviews, the questions were altered to the setting, or asked in a different order. According to (Bryman, 2001), the semi-structured interview guide is meant to be only a direction for the interviewer and not a script.

In all interviews, the interviewer, strayed from the interview guide to ask relevant follow-up questions. All informants shared information, not initially expected by the interviewer. This was in accordance with the theory of (Bryman, 2001). However, the interview guide worked as a tool to ensure all topics were covered, and that all informants were asked similar questions. The interview guide was also an excellent tool for ensuring more open-ended questions than what the author would have asked if not following the guide.

The interview guide can be seen in Appendix A.

4.3.1.3 Conduction of interviews

The interviews were conducted as semi-structured qualitative interviews and were conducted face-to-face, individually. Conducting the interviews face-to-face creates a closeness between the interviewer and the informant (Kvale, Brinkmann, Anderssen, & Rygge, 2009). Non-verbal communications and impressions become more evident. The interviews were recorded and transcribed by the author before they were analyzed. All interviews were conducted at each informant's place of work, this was primarily done to ease the recruitment of informants, but it is believed that this made the informants more comfortable as well.

A part of a semi-structured interview is follow-up questions. The researcher chose to let the informants speak freely and rephrased the questions after relevance to the informant in question. This entailed that not all questions were posed in the same way, or in the same order to all informants. Some questions were deemed irrelevant to the informant in question and were skipped altogether.

Most of the informants responded to the open sequencing of questions well, while some seemed a bit uncomfortable by the unstructured view. Some of the informants apologized for wasting the interviewer's time and seemed to have a desire to answer the right questions.

One informant, informant A, requested the interview guide beforehand. The informant was emailed the interview guide and had made notes in preparation of the interview. None of the others asked or were offered the interview guide beforehand. One informant, informant G, remarked that some preparation information would have been helpful.

4.3.1.4 Transcription of the interviews

All the interviews were recorded during the interview process. This was done to free up the interviewer's hands and mind to focus on the interview process. While conducting the interviews, the interviewer made field notes.

All the interviews exceeded 50 minutes, and the transcribing process was conducted by the author. This made the transcription process slow, and there was often more time than ideal between the interview and the transcription. The transcription process was longwinded, but it was conducted in parallel with the analysis.

Most of the citations collected during the transcription were not kept, however, some are inserted in the analysis to understate a point.

4.3.1.5 Secondary data

In addition to primary data, secondary data was also collected. Qualitative secondary data is often texts, while quantitative data is often numbers and statistics. Both were collected during the research

process. Factual numbers were collected from the municipality itself, and from statistical sources, such as the SSB. Among the qualitative secondary data collection, where municipal and governmental information on the merger, the municipal structures, thoughts, and plans for each of the municipalities and the combined municipality.(Jacobsen, 2015)

4.4 Analyze

This chapter aims to explain the way the collected material was processed. It will explain the methods used for analyzing and understanding the material. It also aims to explain why the chosen tools were used.

4.4.1.1 *Field notes*

During the transcription process, the author chose to take out citations from the interviews and write new field notes of thoughts made during the transcription. The author also created field notes during the conduction of the interviews, and during discussions with the advisors. The field notes were used to initiate the analysis process. (Jacobsen, 2015)

4.4.1.2 *Fishbone*

To analyze the information from the interviews, a cause and effect diagram was utilized.

The cause and effect diagram often referred to as a fishbone diagram or an Ishikawa diagram, is a diagram showing possible causes to a problem, or effect. The diagram can be used to brainstorm or create hypotheses for a problem. A fishbone diagram aims to identify causes to a problem, through asking “why is this a cause?” several times, until key underlying causes are identified. ("6M Method for Cause and Effect Analysis," ; Heizer, Render, & Munson, 2016)

A problem may have several causes. Some of these causes are changeable, while others are not. Using a fishbone diagram can identify all causes, and then identify which causes can be alleviated or eliminated, thus changing the effect. Identifying all possible causes will also show which causes are out of our control, and will therefore not be in the scope of the analysis.

In this thesis cause and effect, diagrams are used to understand the mutual factors described by the informants, and the secondary data collected. The fishbone points to causes that contribute to a problem. The data was analyzed to identify the key factors that would hinder or empower the municipal management of the bluegreen sector going forward.

The cause and effect diagram is useful both in understanding problems, but also in generating ideas for improvement(Heizer et al., 2016).

(c) *Cause-and-Effect Diagram: A tool that identifies process elements (causes) that may affect an outcome*

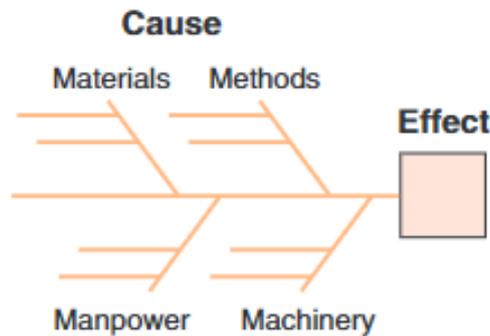


Figure 25 - Fishbone diagram, pg. 264 (Heizer, Render, & Munson, 2016)

In order to better understand and compare the causes contributing to a problem, categorizing the causes can be helpful. One way of categorizing them is through use of the 6Ms. The 6Ms are manpower (man), machinery, materials, methods, measurement, and mother-nature (environment). Below the 6M's are described according to ("6M Method for Cause and Effect Analysis,"):

Man

All factors that contribute to human factors. This includes peoples skills and abilities. The personnel's experience and competence in the processes they are charged with. It also discusses their sense of responsibility. The human ability to do something well can be affected by training, communication, and well-being of the personnel.

Machinery

Machinery discusses the functionality of the machines and technology. Is this a cause of inefficient machines, does the technology malfunction? If the machines and technological solutions malfunction, or are unable to contribute to efficient processes, this can be a hider. Maintenance, or updating or technological solutions can contribute to smoother projects.

Materials

This issue discusses materials physical abilities and properties. Do different processes function with the chosen materials? Could the process be run better with more suitable materials?

Method

What techniques or methods applied affect the outcome of a process. If the methods are inefficient or wasteful, this will affect the overall workflow. The execution of a method will also affect the outcome of the process.

Mother-nature

Mother-nature speaks to the environment the process is occurring in. In a production process, temperature and noise can affect the materials or the personnel's ability to perform a task well. The environment also speaks to limitations the process is occurring under, such as time or financial aspects.

Measurement

Measurement speaks to the measurement method, reliability of the method, and other aspects that affect the ability to measure correctly. The display of the measurement can also affect the measurement and readability.

In this thesis, five of the 6M's were utilized for analyzing the municipal servitization in aquaculture and agriculture.

4.4.1.3 Operations management

Another aspect used to analyze the collected data was operations management and service design. As the municipality, in the end, delivers services to its customers, i.e., citizens.

Lean operations are operations that eliminate waste through continuous improvement and focus on customer wants. The aim is to supply the customer with what the customer wants at the time the customer wants it. (Heizer et al., 2016)

In lean, three concepts are discussed, Muda, Mura, and Muri. Muda is the most known and is often expressed through the seven wastes. The lesser-known M's of lean are Mura and Muri. Mura expresses the waste of unevenness, while Muri expresses the waste of overburden. (lean.org)

Waste in Muda can be described as any process that does not contribute to customer satisfaction or value for the company. According to Taiichi Ohno, there are seven wastes: Overproduction, Queues, Transportation, Inventory, Motion, Over-processing, and Defective products. (Heizer et al., 2016)

Later, three more types of waste have been added: Talent, Resources, By-Products (Heizer et al., 2016).

The relevance of lean to the problem statement is to create the services the citizens want, by doing the right things in the right way, without waste. Waste in a municipal setting includes all actions that are not necessary, by law and regulation, or any action that does not create value for the citizen.

Delivering the right product, by doing the right things, in the right way.

4.4.1.4 *Mockup*

As a part of the analysis, a better tool for understanding citizen needs, quality assurance of products, and delivering services in a better way, a wish to visualize the possibilities of digitalization was raised.

This was originally done as a part of the EPIC assignment. However, another version, capturing the more specific requirements of this report, was created specifically for this thesis.

The visualization was created as a mockup using Balsamiq, both in the EPIC-project and in this thesis. Balsamiq is a conceptual tool for building digital concepts. (Balsamiq Studios, 2008-2019)

4.5 Comments to methodology

This section will discuss some of the aspects of quality in the methodology. In order to evaluate the quality of the research performed, it is natural to speak of validity and reliability. Qualitative studies have generally been criticized for lacking reliability and validity.

During the interviews, the author aimed to remain objective and to ask open and non-leading questions. The author is not an experienced interviewer and has learned much through this process.

The problem statement was reprocessed during the writing of the thesis, and as new information was revealed. The information revealed was a deeper understanding of the context, as well as information not available at the start of the writing. This led some of the questions to stand out in retrospect as less relevant or some even off topic.

While conducting the interviews, it was noticed that the wording of the questions was quite open to interpretation. Especially the word "Kompetanse", which can be translated into Competence, was understood differently by the different informants. If to conduct the interviews again, that word would be changed in order to get more comparable answers from the informants.

In the interview with informant A, hence referred to as A, A asked to receive the questions in advance, which was agreed to. None of the other informants asked for this, and thus informant A was the only one to receive them in advance. This may have affected the way of answering the questions.

In addition, the unstructured and openness of the interviews made some of the informants more comfortable, while others became less comfortable, and felt that they strayed off the original topic.

As the thesis utilizes inductive reasoning, the thesis can never be entirely independent of the author's choices.

The choice of using a fishbone analysis affects the type of results revealed. Another analyzing tool may have led to different factors being focused on and thus conclude the study differently.

5 Analysis

Information in this thesis has been collected through interviews and literature review. The literature review has consisted of a combination of government data, data from the municipalities, and review of reports requested by the government from private actors on municipal matters. Below is a collection of the findings related to what constitutes a good municipal structure.

This analysis is divided into three parts. The first part will present the findings from literature review and interviews and compare them to criteria for a well-functioning municipality. In the second part, three of these criteria are isolated and analyzed using a fishbone analysis to identify causes that affect the functionality and optimization of the municipality. In the last part of the analysis, suggestions for the preservation of strengths and alleviation of obstacles are discussed, and a solution is suggested.

The criteria are based on the criteria set by the government. The Norwegian government appointed an expert committee to evaluate and suggest criteria that have significance for the municipality restructure. They were appointed in January 2014 and submitted their finalized report in December 2014. The committee consisted of seasoned scientists and experienced practitioners in the field, that the government felt represented a wholesome team with high expertise in the municipal sector. (Regjeringen, 2014)

Summed up, the expert team set up a few criteria to be met in order to achieve a well-functioning municipal structure, as can be seen below in Table 3 below.

Table 3 - Kriterier for god kommunestruktur (Regjeringen, 2014)

| Samfunnsmessige hensyn | Kriterier |
|--|--|
| Tjenesteyting | |
| Kvalitet i tjenestene Effektiv bruk av ressurser Likeverdighet | Tilstrekkelig kapasitet Relevant kompetanse Effektiv tjenesteproduksjon Økonomisk soliditet Valgfrihet Statlig rammestyring |
| Myndighetsutøvelse | |
| Rettsikkerhet | Tilstrekkelig kapasitet Relevant kompetanse Tilstrekkelig distanse |
| Samfunnsutvikling | |
| Helhetlig ivaretagelse av areal- og transportinteresser tilpasset klima- og miljøhensyn Tilrettelegging for positiv utvikling i lokalsamfunnet og storsamfunnet | Funksjonelle samfunnsutviklingsområder Tilstrekkelig kapasitet Relevant kompetanse |
| Demokratisk arena | |

| | |
|---|--|
| Betydningsfulle oppgaver og rammestyring Lokal politisk styring Levende lokalt folkestyre Aktiv lokal politisk arena | Høy politisk deltakelse Lokal politisk styring Lokal identitet Bred oppgaveportefølje Statlig rammestyring |
|---|--|

The expert committee later sub-divided the criteria into criteria that should be met by the municipalities, and criteria that should be met by the central government. The criteria specifies what is needed for a municipality to satisfactorily govern and meet citizen needs. Below their compiled list of criteria recommended for the municipalities is listed (Regjeringen, 2014) (authors translation):

1. Adequate capacity
2. Relevant competence
3. Sufficient distance
4. Optimized service production
5. Financial robustness
6. Freedom of Choice
7. Functional development
8. High political attendance
9. Local political rule
10. Local identity

The criteria will be evaluated as to whether New Stavanger will be able to satisfy them better, equally or less than each of the municipalities currently does, and the analysis will point to what factors will affect this for the criteria that could be affected more or less positively.

5.1 Collect and compare

In this subchapter, the governmental criteria for achieving a well-functioning municipality will be evaluated up against the collected information and findings.

5.1.1 Adequate capacity

In order to deliver services at a satisfactory level, the bluegreen office needs to facilitate adequate capacity. Adequate capacity, is by the expert team, defined both as professional and administratively. In order to do so, they need adequate competence. However, one or several employees with sufficient competence does equal a good professional environment. There needs to be a professional network, and people to discuss cases with. (Regjeringen, 2014)

The restructure was intended to enable more competence and larger professional networks within the municipality (Deloitte, 2014a). Stavanger today deliver services to agriculture through buying this

service from Sandnes municipality, in order to provide adequate services with a high enough level of competence and quality (Informant C, 2019). This will no longer be necessary.

The office will be a collection of the two current offices. And there might be added another position. This will ensure a larger office, with more capacity. This will decrease vulnerability and increase capacity. (Informant E, 2019)

5.1.2 Relevant competence

By relevant competence, the fact that the employees have the needed abilities to perform their jobs, having the right background, experience, and training. There also needs to be a comprehensiveness of ability, often represented by different backgrounds and overlapping between the staff. Lack of competence and capacity has also been outlined as a challenge for the municipal ability to perform its duties, according to the expert team.

It is argued that the municipalities workload requires a higher level of competence and capacity than before. (Deloitte) This was also stated by informant C, who stressed the fact that agricultural actors have larger entities, they become more professionalized, and thus buy more services from lawyers and consultants. This increase the workload for the administration. With a larger office, these needs could be met more easily as there are more positions, and thus room to specialize.

A bluegreen office at Judaberg will be bigger than each of the offices of the three municipalities today, counting two for Finnøy, two, but at the moment only one, for Rennesøy and none for Stavanger. How many employees there will be is not formally decided, but numbers ranging between four and six have been mentioned in the interviews. This will allow for more specialization than earlier. As informant G mentioned:

«Generelt sett kan man ikke ha skikkelige spesialister, for da hadde man trengt så mange ansatte at det ikke vil gått rundt, men trenger generalister som har nokså god kunnskap på mange områder. Men i et større kontor kan man spesialisere seg litt mer enn i et lite kontor hvor man bare er to og man skal kunne alt.

[...]

Det blir mulig å spesialisere seg litt mer på ulike oppgaver, og ha litt mer dybde i enkelte områder. Hvis man kun er to, blir man veldig sårbare hvis en er borte. Det blir mye enklere å ta over hvis en er vekke og man er fem. Det kan alltid være to som kjenner en oppgave, og da blir det lettere å avlaste ved fravær.» (Informant G, 2019)

Stating that in a bigger office, there will be more room for each to specialize. Also, another informant mentioned the need for broader competence:

At de har det med seg, de trenger ikke være rene jurister eller planleggere, men fylkesmannen kjører en del kurs på dette. Det er viktig at de har noe av denne ballasten med seg inn, samtidig som det er viktig at de har nærhet til næringen. (Informant C, 2019)

This informant advocated the importance of also understanding related fields, which the sector works in close contact with. This would be more possible in a larger office, due to increased capacity for competence.

One part is having the right competence, another is to recruit the right competence. As New Stavanger emerges, becoming one of the largest agriculture and aquaculture municipalities in Norway, recruiting will become easier, as it becomes a more interesting professional network. In addition to being an interesting professional network, a thriving work environment is also important in order to recruit personnel. (Informant E, 2019; Informant G, 2019)

The increased competence in bluegreen office will also allow for more competence on climate, and advising the industry on how to contribute towards Stavanger's goals of reduced emissions.

5.1.3 Sufficient distance

The expert team advises that each municipality should be of a size that allows for sufficient distance between a municipal caseworker and the citizens (Regjeringen, 2014). In Rennesøy with 4800 citizens and Finnøy with 3200 citizens, this is hard to achieve.

One informant described how the predecessor of that informant was visited at home about rejections. A larger office would shield employees of the municipality of such cases. It would also allow the administrators to choose a caseworker that is not as close to the case. This will save impartiality. In a small municipality, with only two employed, if one is unavailable, there is no possibility to hand such a task over to someone else. This would be improved by the municipality restructure. (Informant B, 2019)

At the same time, several of the informants discuss closeness to the industry, especially agriculture as a strength. (Informant B, 2019; Informant C, 2019; Informant G, 2019)

5.1.4 Optimized service production

A larger municipality can more efficiently utilize economy of scale in order to deliver better services. When speaking of Stavanger's climate goals, municipal procurement was argued as one of the municipality's strongest tools in affecting the industry, through creating demand for climate-friendly

options. This advantage will be a stronger tool in a bigger municipality. (Informant A, 2019; Informant E, 2019; Regjeringen, 2014)

Optimized service production for the bluegreen sector has both financial and climate demands. Because of the localization of the office for management and industry development are separate, the optimization of services could be affected negatively. This is discussed further in the next section of the analysis.

5.1.5 Financial robustness

It is an important factor for a municipality to deliver satisfactory services to its citizens that it has a level of financial robustness. A larger municipality will have a more diverse demographic, making it less vulnerable. Unforeseen events may also affect a larger municipality less, as it has a larger total budget to rearrange from. (Deloitte, 2014b; Regjeringen, 2014)

Stavanger has a larger budget, which has allowed it to create more investments in industry development than Finnøy and Rennesøy. It is likely to assume that New Stavanger will fulfill this criterion. (Informant E, 2019)

5.1.6 Freedom of Choice

Freedom of Choice refers to the citizen's demand for more options in the services provided. (Regjeringen, 2019b) Freedom of choice refers to the fact that not all citizen needs are equal. Thus, the appropriate service for a farmer gradually liquidating his business or of a farmer scaling up his business, will not necessarily be the same. In order to match the appropriate services with the right citizen, the municipality needs a thorough understanding of citizen needs and their differences. Hence, being able to serve each citizen in his best interest.

The core of the Smart City project is about identifying citizen needs, and understanding how collaboration, involvement, and technology can together create differentiated services that match citizen needs (Stavanger bystyre, 2016).

A smaller municipality will not have the resources to provide a multitude of service variations or invest in the technology for achieving this (Regjeringen, 2014). However, just because a municipality is large and financially robust, their services may not be appropriate or aligned with citizen needs. New Stavanger's potential for achieving this will be subject to further analysis in the next part of the analysis.

5.1.7 Functional development

According to the expert team's report, the municipality needs to have a structure that is optimized for those areas where there is a need to secure wholesome solutions. The last decade, there has been an increased regional integration between municipalities through commuting and suburb development, this leads to the municipality becoming a less complete unit, as citizens belong to more than one municipality.(Regjeringen, 2014)

The last part will not be met by the merging of Finnøy, Rennesøy, and Stavanger, as Stavanger is more closely linked to Sandnes, Sola, and Randaberg than to Rennesøy and Finnøy. However, Rennesøy has an increasing degree of commuting towards Stavanger after the implementation of Rennfast. (Rennesøy kommune, 2011).

The way that New Stavanger structure their new municipality will greatly affect the level of services they deliver to their citizens. This will be further discussed in the next section.

5.1.8 High political attendance

High political attendance refers to an active democracy which allows citizens to be heard both during elections, but also between elections(Regjeringen, 2014).

This can be achieved through citizen involvement in different forms. One way to increase citizen participation is through community collection points. New Stavanger municipality aspires to achieve this by preserving the municipal offices in Vikevåg and Judaberg with Innbyggertorg(Nye Stavanger kommune, 2019e).

The smart city aims to increase other types of citizen involvement through its projects(Informant D, 2019).

5.1.9 Local political rule

In order for a local political rule to be satisfactory, it is essential that the municipal administration has the necessary competence and capacity to prepare satisfactory recommendations for decision making in the municipality(Regjeringen, 2014).

A larger municipality will also depend less on inter-municipal collaborations, ensuring the municipality to make decisions based on its own political platform, rather than through collaborations and compromise (Regjeringen, 2019a).

5.1.10 Local identity

Local identity is the feeling of belonging to a certain area and common identity with other areas(Regjeringen, 2014). Finnøy and Rennesøy have a shared identity with Ryfylke, while Stavanger

has had a closer identity with their neighboring municipalities. New Stavanger aims to preserve the feeling of belonging through innbyggertorg at Judaberg and Vikevåg (Nye Stavanger kommune, 2019b).

This chapter has presented government criteria and how these will be affected in the new municipality with a focus on agriculture and aquaculture. In summary, the data collected points to the majority of the requirements will be preserved in a satisfactory way. Three criteria, Optimized service production, Freedom of Choice, and Functional development, are identified as being subject to further analysis.

5.2 Process of analyzing data

In this subchapter, the selected criteria from the ten original criteria will be analyzed using the fishbone analysis and sigma six. The following criteria are: Optimized service production, Freedom of Choice, and Functional development, the criteria were chosen because of their relevance to the problem statement, and because of they were identified as key factors where smart city thinking can have an impact. The goal of using the fishbone analysis, or cause and effect analysis, is to identify the causes that can hinder well-functioning services, and identify the factors that need to be preserved in order to be a strength. The analysis uses the sigma six criteria in order to identify similar patterns from the three criteria, in order to compare them and find root causes and key opportunities.

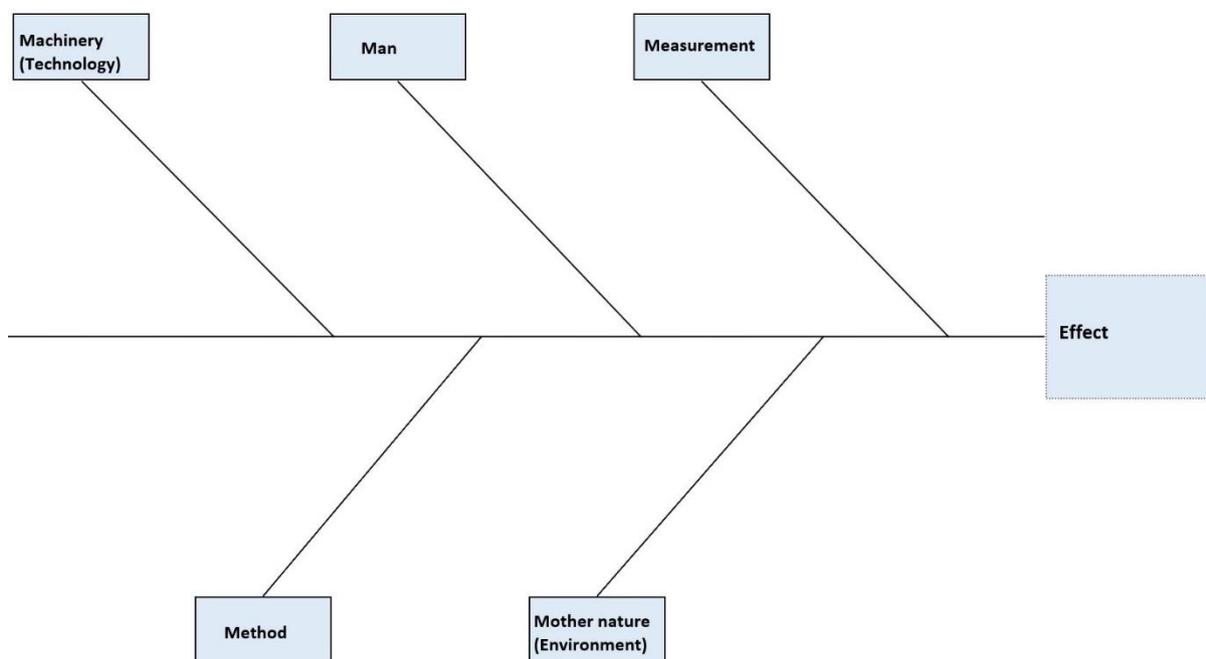


Figure 26 - Fishbone diagram

If we apply the sigma six to the following criteria, some key factors become visible. As seen in Figure 26, material was left out, as this is not a physical process.

The three chosen criteria are evaluated and discussed from a smart city perspective.

The smart city, according to Stavanger smart city office, is two things. It is a type of project or initiative, but it is also a mindset and work method. As stated in Theory chapter, a smart project can be identified through certain criteria, technology, cooperation, and citizen involvement. However, the smart city office also works to improve the work strategy and tools in the municipality. The smart city relevance for this thesis is that this way of approaching a task can contribute to the municipal management of the aquaculture and agriculture. The contribution can be through specific tools and technologies, but also through methodology and mindset.

The specific tools and mindsets are the collection of smart projects, both current projects, and potential future projects initiated or enabled through the municipality. Among these, improved communication tools created by the municipality, such as the new website for Stavanger. The «measure and count»-commitment, driven by the smart city office, is also an example of this. If agriculture and aquaculture are to be managed in the best way possible, stimulate growth and profitability, at the same time as the municipality can preserve its goals for reduced emissions, “measuring and counting” is an important strategy. It is vital to know what the carbon and value drivers are, where they originate, and what we can do about them. It is also important to measure internally as well as utilize new technology and new solutions to increase profitability and stimulate growth.

The other type of smart city thinking is more concerned with methods of work and the internal mindset of the municipality. Implementing citizen involvement in an expedient and valuable way contributes to the collaboration municipality (samhandlingskommunen). A central aspect of smart city thinking is about delivering the services the citizens want, not necessarily the ones the municipality has always delivered.

Obstacles for smart city thinking in the municipality is silo organization, low innovation, and inability to develop and grow. These factors are contributed to by not having adequate capacity or competence, or divided sections with a low degree of communication. Adequate competence and capacity could be insufficient capacity, or not the needed competence, or incapacitating structures.

Below are the three fishbones:

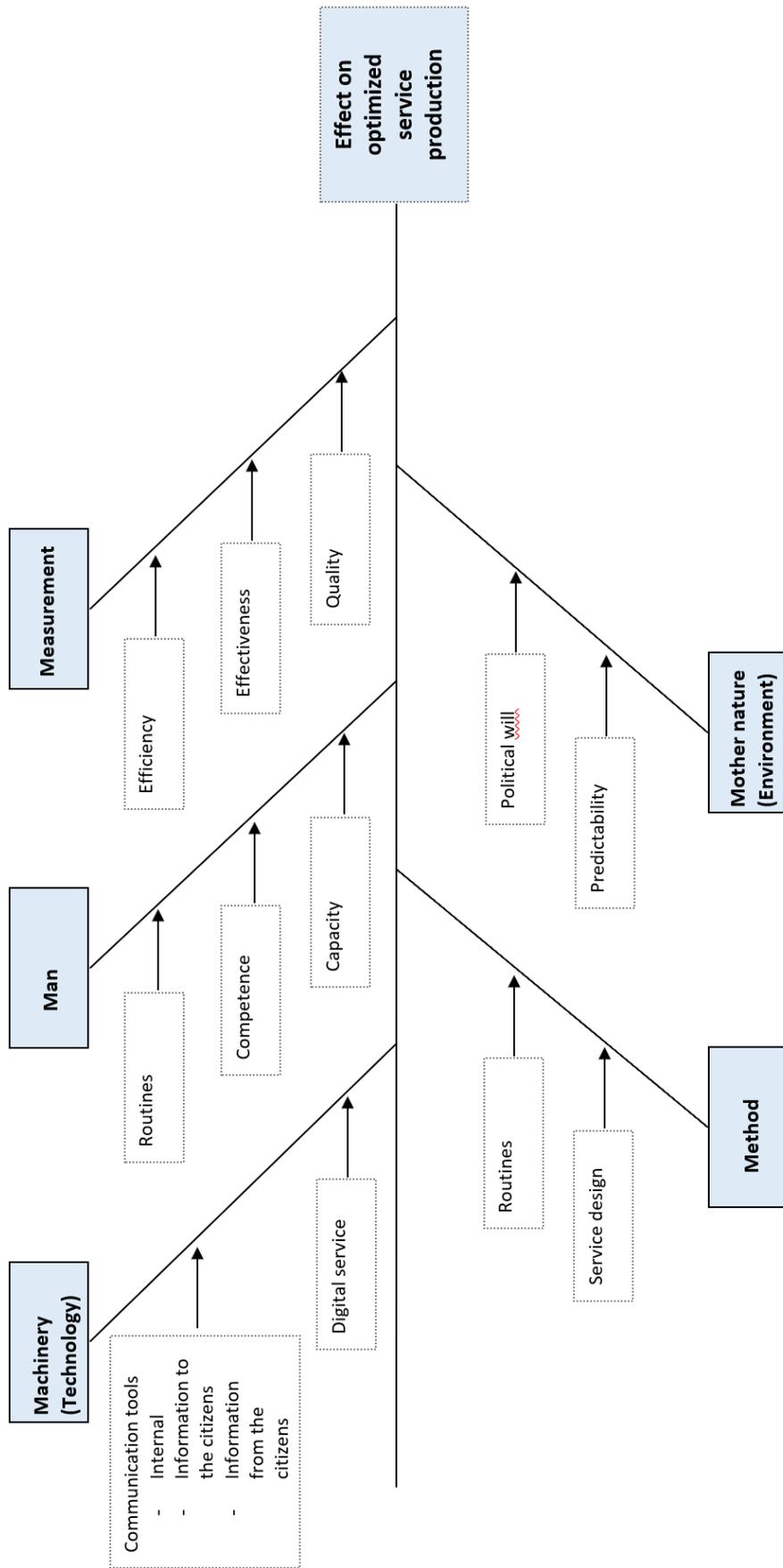


Figure 27 - Fishbone for optimized service production

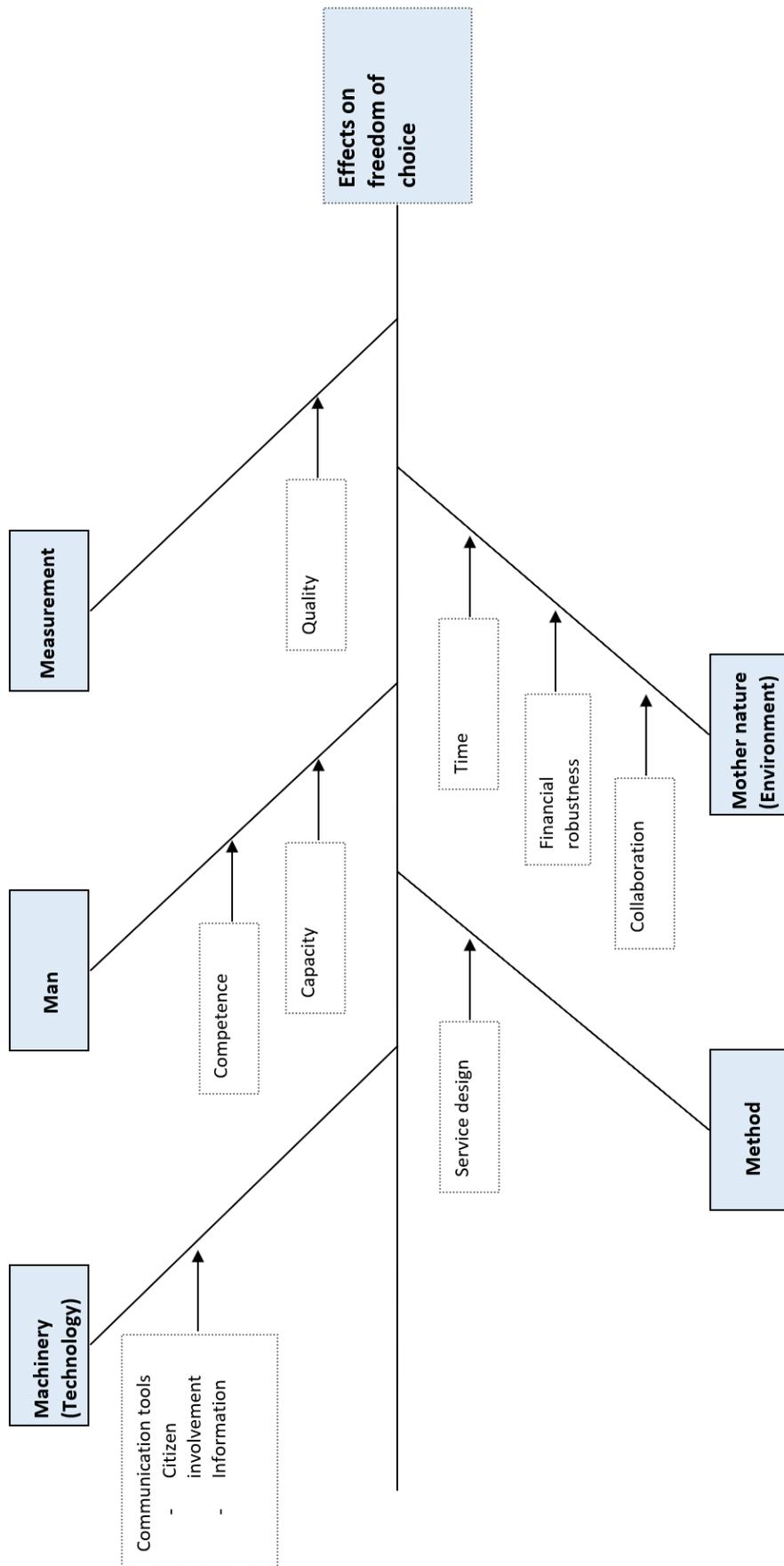


Figure 28 -Fishbone for freedom of choice

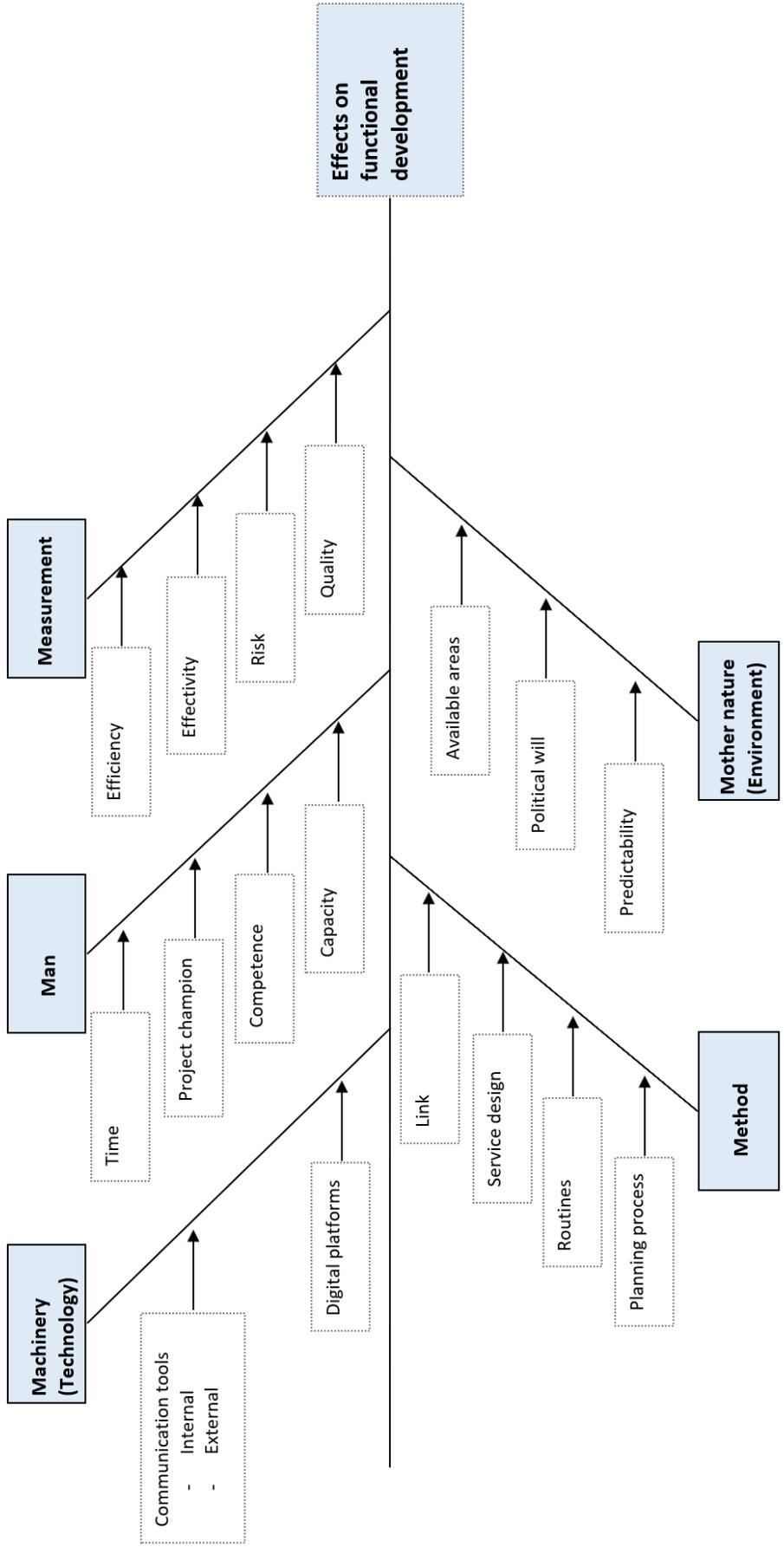


Figure 29 - Fishbone for functional development

5.2.1 Machine

Under Machine, technological necessities are listed. Among these are Communication tools, for the municipality to be able to communicate efficiently. Communication tools, allowing for both internal and external communication for the municipality is a necessity to ensure secure and reliable information flow.

External communication allows for two things, both allowing for the municipality to communicate to the citizens, including the industry, as well as allowing the citizens, including industry, to communicate to the municipality. Communication issues are important for the municipality to process applications fast and in an orderly fashion. It is also vital that if anything is not right in applications sent to the municipality, that they can effectively communicate with the industry in order to fix this. Allowing the citizens to communicate with the municipality will also enable them to come with thoughts and inputs. These inputs will allow the municipality to offer them the services they need and want.

Communication tools are not limited to digital communications. All agricultural sector leaders commented that the public uses both phone and the ability to meet the municipality physically, in addition to digital solutions, such as email and online applications. This is seen as a strength, as it creates a closeness to the public. Through meeting and talking, more information can be detected. Especially when actors from the industry wish to apply for new development or are facing complex or new applications, thorough guidance is easier communicated through rich media. It is important not to undervalue information lost in translation through digital tools. The smart city office referred to the same experience in their work with citizen involvement, that talking to people face to face has a different value than only collecting information through forms and written correspondence.

Digital tools simplify a lot of communication. It alleviates distance and speeds up processes. It is also a great tool for creating an overview, collecting information, and making sure information reaches relevant parties.

Well-designed and optimally employed communication tools, or systems, allows the ability to get feedback from the public. A big part of smart thinking is to create citizen involvement. Citizen involvement cannot happen without communication between the municipality and the citizens. It is also a key part of creating connections between the actors in the industry.

Hence, the combination of digital tools and physical presence is necessary, as long as there is an understanding of the advantages and pitfalls of both.

Internal communication allows the municipality to utilize the available competence and capacity. Especially as the bluegreen office will be located in Judaberg, while the main business office, working with industry development will be located in Rådhuskvartalet. However, digital tools do not replace physical meetings. Routines for information sharing has been mentioned by several as the informants as important to relate information and involving the pertinent actors.

However, as there will be a physical distance between the management office for agriculture and aquaculture, and the main business office, digital tools are a necessity to ensure continuous flow.

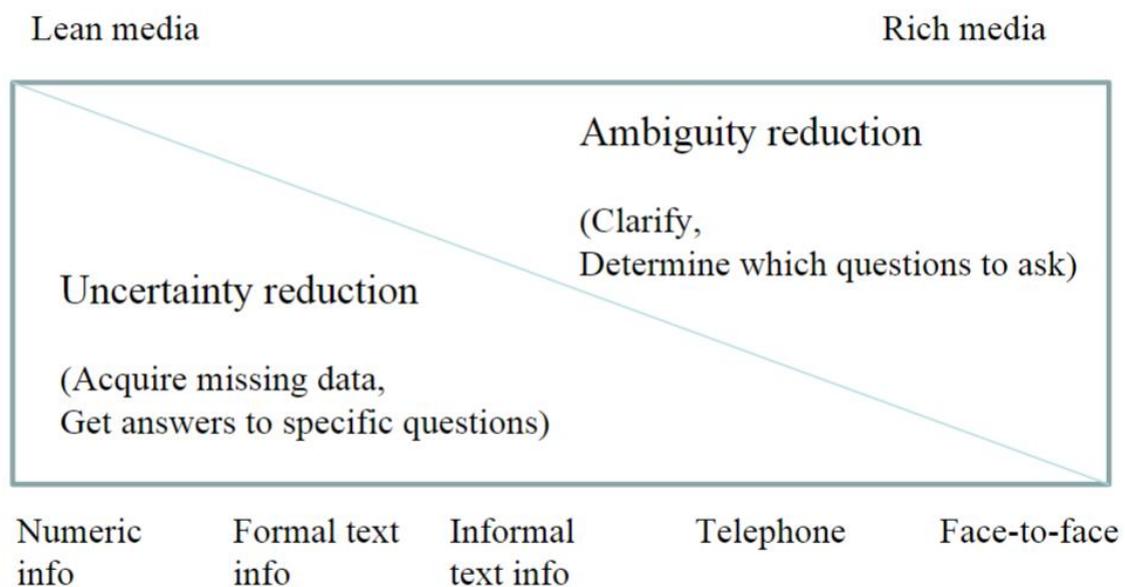


Figure 30 - Lean media vs Rich media adapted for Lecture 3 in IND600 (2018) from (Daft & Lengel, 1986)

Because of the distance, understanding communication is important to evaluate chosen communication tools. While physical meetings are rich media, allowing for ambiguity to be discussed and clarified, digital tools, such as email, charts, and reports, are lean media. Lean media is valuable when sharing specific information, answering questions, and clarifying details. Where information is straight forward, lean media allows for precision and expediency. However, in more abstract cases, such as identifying potential solutions to complex problems, rich media will serve the municipality better. Rich media is also a better tool for utilizing informal competence, such as competence gained from experience. It can be a challenge for the municipality to utilize the right competence and understanding of complex problems when the necessary competence is not present in both offices. Understanding this challenge is the first step to finding optimal solutions.

In addition to communication tools, data systems are a vital tool for the administration in the municipality to collect and count, as they are charged with through laws and regulations.

Man må telle veldig mye, er det hensiktsmessig? [...] Dette blir bestemt sentralt, så enn så lenge det er bestemt slik, vil det hjelpe kommunen med å telle og måle å ha teknologiske løsninger. (Informant G, 2019)

Thus, having efficient data systems for processing counted information becomes vital for managing the sector efficiently, and thus providing the citizens with the best services possible. These data systems should be able to communicate and be user-friendly.

Data systems that collect, identify, and present relevant information can significantly affect efficiency and decision making. Having the right information to make decisions is vital in order to optimize services and create functional development.

Table 4 - Findings for the three criteria about machine

| | Optimized service production | | Freedom of choice | | Functional development | |
|---------|---|--|--|--|---|--|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Machine | Information can move too slowly Information can be hard to collect | Using lean media to convey factual information | Information may not be available to those needing it Industry does not have access to opportunities Municipality does not have access to citizen needs | Using lean media to convey factual information Using rich media to convey complex or abstract needs | Information may not reach the right municipal person, thus wasting capacity | Use rich media to convey complex problems to municipal staff with different competence |

5.2.2 Man

Under section Man, we see three listed points: Project champion, Competence, Capacity, and Time. To address the first, to create value, and help businesses development in the sector, somebody needs to believe in the project. A project champion is defined as someone who drives the project and sells it to senior management (Wysocki, 2014). A project champion for value creation in the agriculture and

aquaculture administration will help see projects through and become the link that is needed to take ideas into projects.

Competence and capacity are mentioned in all three diagrams. Competence and capacity refer to having the right competence and also understanding how to utilize the capacity optimally. The Cambridge dictionary defines competence as “the ability to do something well”. The ability to manage the sector well from a municipal stand-point can mean many things. One is to have a relevant background and knowledge for the day to day tasks, such as standard casework on applications or answering a hearing. Competence, in this sense, could be implemented through sufficient training and experience, as well as proper recruiting. From the interviews, it seems that this is well preserved by the municipality today.

Another part of competence is competence to encourage value creation and development in the sector. In order to have the competence to do that, there needs to be competence, or knowledge, on the sector, from how it operates to what the industry and citizens want and needs. In order to achieve especially knowledge of what the industry and citizen’s needs, there needs to be citizen participation and collaboration with the administration. One informant said it like this:

«Oppi alt dette må vi huske forbindelsen til bøndene. Vi har jo best forbindelse til bøndene, også tipse dem om at her er det noe, eller om de ulike aktørene vil gjøre noe i et veksthus i drift, det å opprette forbindelser.» (Informant G, 2019)

Another part of competence is the ability to know what are good ideas, and whom to create connections between. Evaluation of how to identify good ideas. This competence is located at Rådhuskvartalet, in the main business office. The staff at Judaberg has the closest connection to the industry, and thus have more knowledge and competence to realize what their needs and wants are, as well as what problems they have in their everyday management, they are key personnel in identifying solutions. Hence, having the right communication towards the greater municipality in order to identify solutions together is important, in order to utilize the competence available.

The business office is also organized as a parallel branch to the smart city office. The smart city office has great competence and experience in identifying solutions and on citizen involvement techniques. The smart city office especially highlighted their experience with gjestebud. (Informant D, 2019) The ability to share competence between the municipal offices in order to identify and utilize the right competence is important to offer optimized services, create service production models that give the citizens freedom of choice in service utilization, as well as allowing the municipality to contribute to functional development for the sector. This competence sharing within the municipality will be

hindered by rigid silo organization, not allowing for a flow of competence (Informant B, 2019; Informant C, 2019).

Capacity follows competence and is closely linked. Without having the capacity to do one's tasks, one cannot be able to identify solutions. This is closely linked to time.

Time is essential to be able to become project champion or to apply one's ability to do something well, competence, on other things than must do tasks. After the merger, the office will grow, and the hope from the informants, is that the restructuring will free up more time to work on should and can tasks, as expressed by one of the informants:

«Jeg håper det nye landbrukskontoret får nok kapasitet, slik at vi kan være en koordinator for utvikling og. [...] Og at vi kan ha mer tid til å følge opp ting som ikke er absolutte må-oppgaver. Men som vi egentlig også skal eller bør gjøre.» (Informant G, 2019)

If the administration at Judaberg has enough employees to do their work there might be enough time. Right now, Rennesøy office is understaffed by one employee, out of two. That means that the employee left has a double caseload. In a bigger office, they might not be as vulnerable to change in the staff or illness, as several people work there. Gathering the two offices into one will increase the robustness of the office, and perhaps even allow for the office to perform their tasks better, or even perform more tasks, such as analyzing the quality of output. Quality of output can be measured in how efficiently the inputs are transformed to outputs, but also by evaluating if the output produced is the right output for the situation.

Routines can also allow for more time, and free up capacity. Routines allow for waste reduction.

Table 5 - Findings for the three criteria about man

| | Optimized service production | | Freedom of choice | | Functional development | |
|-----|--|-------------|-------------------|---|---|--|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Man | Potential for increased waste between the sections | | | Increased capacity can deliver more specialized services fitted to the citizen need | Lack of understanding and collaboration between the silos | Increased capacity, both in the collaboration between the management sector for bluegreen industries at Judaberg and the business office at Rådhuskvartalet, but also with other offices at Innbygger of samfunnskontakt |

5.2.3 Measurement

In all figures above, measuring effect and efficiency were mentioned. In addition, quality and risk were mentioned. In this analysis effect and efficiency will discuss the municipal ability to perform tasks well and on time. While quality is seen more as the end users point of view.

Measuring effectivity and efficiency, there need to be requirements to measure against. Without measurable criteria, it becomes hard, if not impossible, to measure effectiveness and efficiency. Effectiveness speaks to the outcome of a task, while efficiency speaks to how expedient a task has been performed.

The criteria will be set in part by law and regulations, for the bluegreen office at Judaberg. Many of the tasks related to management are nationally regulated and must be performed within a standard. Measuring efficiency can contribute to better time management and end-user satisfaction.

However, new criteria might be introduced by the municipality in order to achieve their climate goals. From interviews, it was popular opinion that there is no one solution that will reduce the carbon footprint, but rather several smaller actions across the board. In order to quantify their effect, there is a need for measurement.

Quality can only be measured by the end user, hence a collection of their perspective is needed. Two different ways of measuring the quality of the service are measuring the end-users satisfaction with a service as delivered, or end-user satisfaction with the service in general. It is not optimizing or encouraging freedom of choice only to measure how well one deliver a service if the municipality does

not know if that in fact this is the service the industry wants. This leads back to well-defined tools for collecting citizen input.

Risk refers to something different. In order to change, one needs to allow for some uncertainty, and uncertainty will always elevate risk to some extent. This, however, is closely linked to having the right competence to understand and mitigate risk. Which links back to having the right people, or training them to become the right people, but also communicating, so that the people needed to understand and assess the risk will have the information needed.

Table 6 - Findings for the three criteria about measurement

| | Optimized service production | | Freedom of choice | | Functional development | |
|-------------|---|-------------|-------------------|--|--|-------------|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Measurement | Having the right criteria to measure efficiency | | | Utilizing available (increased) competence to identify specialized solutions | Lack of communication in order to utilize competence | |

5.2.4 Method

Both routines and service design are mentioned in several places, in addition, link is mentioned. By link it is meant that the municipality can operate as a link between relevant actors in order to initiate a project to drive value creation or carbon reduction.

From data collection, routines were pointed out as an important factor in producing satisfactory services. Well-functioning routines secure efficiency and reliability. Routines for communication and information sharing contribute to predictability for the employees, which in turn will contribute to service quality. If proper routines are established, both within the Judaberg office and between the office in Judaberg and the main office in central Stavanger, this can ensure that information reaches the right competence and will help manage capacity within the sector.

Establishing Smart city work processes, such as service design, is one type of routine. Service design was a point on all of the fishbone diagrams. Service design is about developing services with the end-user in mind. Service design is focused on understanding needs, and using this to create new, or improve existing services. (KS, 2019)

In order to achieve service design, the municipality has to acquire knowledge and understanding of the needs and actions of the end-user. This is the foundation of service design (KS, 2019). This way of

working for the municipality can be achieved by routines in work processes around the user. To achieve this, the municipality needs to collect this data, through connection with the industry and citizens, and data systems for organizing and processing the information. The municipality will also need the competence to translate this collected knowledge into possible solutions.

As mentioned in the earlier, creating relevant links, or connections between actors is mentioned in the fishbone for functional development. By links, they are creating the relevant connections between actors in order for them to create value for each other. In order to do this efficiently, the municipality needs an understanding of who the potential actors are and how they can create value for each other. This understanding comes from knowing the industry, their needs, but also through an understanding of innovation and value drivers. The knowledge of the industry and actors are localized in the management office, at Judaberg, while the innovation knowledge is located at Rådhuskvartalet, both in the smart city office, and the business office. It is vital to nurture the connection in these two offices, in order to enable the correct links.

Predictability is also important. One part of the methodology is how they work with contributing to plans and regulations. Planning process depends on many things; it is especially important in order to create predictability for the industry. Predictability created through predictable and efficient planning processes is especially true for aquaculture, and was highlighted as one of the most important services that the municipality provides for the industry. Neither the management office at Judaberg, nor the grand office at Rådhuskvartalet works with planning processes in the new structure. However, the management office responds to hearings during the planning process. These hearings are the main way to preserve the interests of the bluegreen industries. The smart city office can also contribute with their understanding of citizen involvement processes, that are also a part of the foundation for the area plans. If these competencies are preserved, this could contribute to the citizen needs being met faster and better.

Table 7 - Findings for the three criteria about method

| | Optimized service production | | Freedom of choice | | Functional development | |
|--------|------------------------------|--|-------------------|--|------------------------|---|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Method | | Having routines for hearing responses based on fact and citizen involvement Having routines for data collection | | Implementing routines for service design | | Preserving a work method that enables the right connections (links) |

5.2.5 Environment

Environment is the framework that enables or limits each of the goals. In all diagrams, political will is mentioned. This is not something smart technology can affect, and thus will not be discussed in detail. However, there is a political will to reduce climate emissions in Stavanger, and it seems that this will continue to be a goal for New Stavanger. The climate goals will be part of the environment that all the municipal administration will have to work within.

Another aspect made visible in the diagrams is predictability. Predictability was presented by both the agricultural management and the aquaculture industry as vital for the industry to optimize, grow, and develop. As mentioned in Method above, especially the informant for aquaculture pointed to this as the most vital contribution from the municipality (Informant F, 2019). The municipal room for negotiation on aquaculture is closely linked to recommendation and approval of aquaculture locations (Rogaland Fylkeskommune, 2017). These are dictated through area plans. Good routines for predictability in this field will improve the needs of the end user, in this case, aquaculture. This could be achieved through wholesome collaboration within the municipality, well-defined routines for citizen involvement and communication, both internally and externally.

The need for predictability was also present for agriculture, however, was not stated as the same issue from a municipal management, but national and industry standards created their greatest uncertainties. Thus, hindering the will to invest on account of new regulations.

Predictability reduces fuzziness and risk.

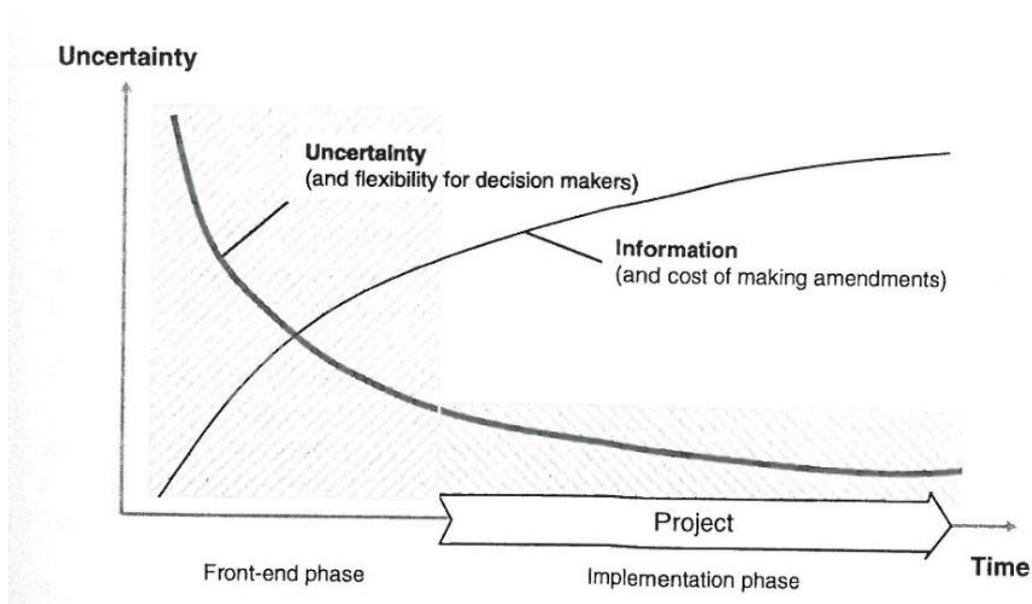


Figure 31 -- Uncertainty v. Information relative to project timeline (Samset, 2009)

As shown in **Feil! Fant ikke referansekinden.** above, uncertainty is alleviated as information is revealed. It can be unwise to invest in new projects when things are uncertain, as the cost of changing increases with project development. The unavailability of information increases uncertainty proportionally. Routines and communication tools for distributing information causes predictability, and can thus incentivize the industry to engage in value creation and collaborative solutions. (Samset, 2009)

Available areas connect into predictability. The knowledge and trust that the municipality will allocate areas for industry are key to become a municipality where industry thrives. Informant E stressed the importance of municipal ability to have plans in place and know where to offer areas for the industry was key to becoming an attractive municipality for a growing industry. (Informant E, 2019)

Thus it can be concluded that transparency of processes and availability of information are key factors for predictability, which in turn make the municipality an attractive environment for industrial development.

Available time is connected with capacity. The municipal room for putting in the time to do “more than the legally required” tasks allows the municipality to create an environment where citizens and industry can collaborate on creating services. Citizen involvement is time-consuming (Informant D, 2019), thus having the time to achieve this will be crucial to implement smart city projects in New Stavanger.

Financial robustness is a factor for a municipality to be a suitable place for citizens to settle and live, and for the industry to settle and grow. Informant E mentioned Stavanger’s ability to initialize and

contribute to projects and clusters as a strength, that the other municipalities lacked somewhat. A bigger municipality can become more robust, as a consequence of a larger budget, allowing for more room for negotiation when facing unexpected or unforeseen expenses (Informant E, 2019; Regjeringen, 2014).

Collaboration is a key value driver, as it allows for valuable connections between industries, clusters, and collaborative projects between the municipality and the industry. The municipal ability to create these useful links or initiate clusters can contribute to more growth and development in the industry. For this to be utilized, there needs to be communication and understanding of the industry actors. (Skodje, 2019)

The second branch is the localization of the office. As stated above, the new agriculture and agriculture office will be a subsection of næringskontoret. As the office is separated, with one section, management, placed as Judaberg, together with “innbyggertorg,” and the other, development and value creation, placed in “rådhuskvartalet”, there will be a distance between the workers. How they will manage communication and collaboration between these sections will be vital for the quality of the services the municipality can deliver.

Table 8 – Findings for the three criteria about environment

| | Optimized service production | | Freedom of choice | | Functional development | |
|-------------|--|---|-----------------------|-----------------------------|------------------------|--|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Environment | Localization, or rather, separation, of the two sections of the office | Greater resources allow time to do more than legally required | Access to information | Availability of information | | Transparency of processes, and the inclusion of citizen involvement in hearings Available information for citizens Enabling clusters and initiatives |

5.2.6 Findings

In this subchapter, the three criteria have been analyzed using a fishbone diagram and discussed based on five sigma six requirements. From the analysis of each of the five branches of sigma six analyzed for the three criteria, the results point to similar causes, both opportunities, and strengths. These are gathered in the table below.

Table 9 - Collection of findings from analysis

| | Optimized service production | | Freedom of choice | | Functional development | |
|-------------|--|--|--|---|---|--|
| | Obstacle | Opportunity | Obstacle | Opportunity | Obstacle | Opportunity |
| Machine | Information can move too slowly | Using lean media to convey factual information | Information may not be available to those needing it | Using lean media to convey factual information | Information may not reach the right municipal person, thus wasting capacity | Use rich media to convey complex problems to municipal staff with different competence |
| | Information can be hard to collect | | Industry does not have access to opportunities | Using rich media to convey complex or abstract needs | | |
| | | | Municipality does not have access to citizen needs | | | |
| Man | Potential for increased waste between the sections | | | Increased capacity can deliver more specialized services fitted to the citizen need | Lack of understanding and collaboration between the silos | Increased capacity |
| Measurement | Having the right criteria to measure efficiency | | | Utilizing available (increased) competence to identify specialized solutions | Lack of communication in order to utilize competence | |

| | | | | | | |
|-------------|--|---|-----------------------|--|--|---|
| Method | | Having routines for hearing responses based on fact and citizen involvement | | Implementing routines for service design | | Preserving a work method that enables the right connections (links) |
| | | Having routines for data collection | | | | |
| Environment | Localization, or rather, separation, of the two sections of the office | Greater resources allow time to do more than legally required | Access to information | Availability of information | | Transparency of processes, and the inclusion of citizen involvement in hearings |
| | | | | | | Available information for citizens |
| | | | | | | Enabling clusters and initiatives |

5.3 Presentation of results

In the previous sub-chapters, information was collected and compared against criteria for a satisfactory municipality. Then, three criteria, Optimized service production, Freedom of Choice, and Functional development, were analyzed using a fishbone analysis. From this analysis, a table of causes that will affect the municipal ability to deliver satisfactory services was collected and presented.

In this subchapter, a presentation of the most important findings from the previous two chapters is presented, with suggestions for how the municipality can deal with key factors.

5.3.1 Analysis

From the fishbone analysis, certain factors were consequential for the service delivery and optimal usage of competence and resources in several aspects.

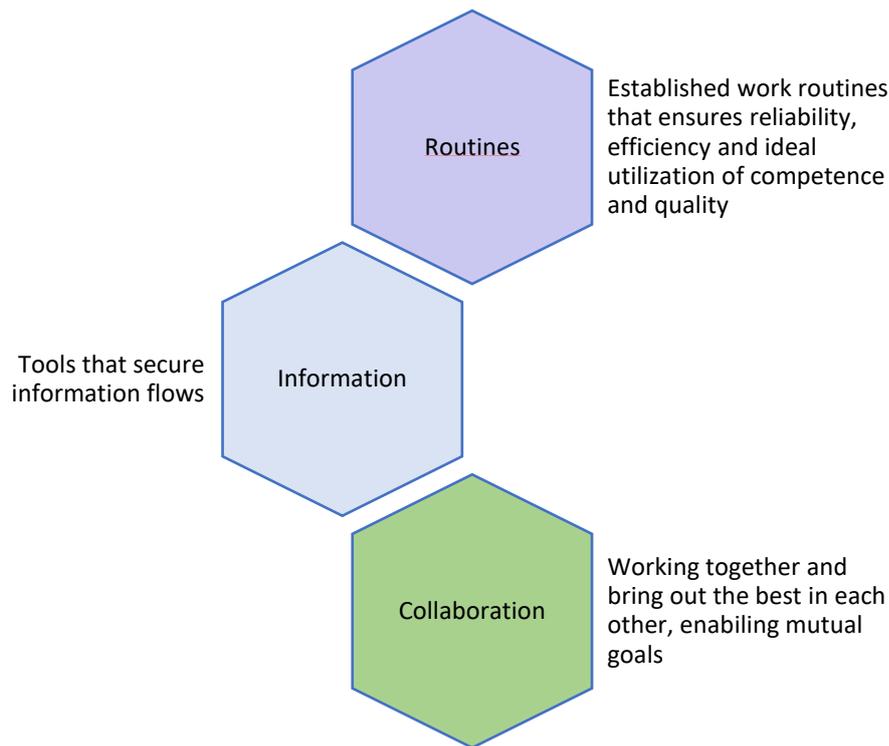


Figure 32 - Results of the fishbone analysis

As can be seen from the figure above, among the causes of the fishbone analysis, three key factors are identified.

Routines: established work routines that ensure reliability, efficiency, and ideal utilization of competence and quality. Throughout the entire analysis, the idea of having proper routines was vital — both in ensuring predictability, equal services, and utilizing capacity well.

Information: Tools that secure that the necessary information is collected, and that information is available to those who need it.

Collaboration: Working together in a way that strengthens the capacity of the municipal competence, and that allows for collaboration between industry actors. The last factor that stood out from the analysis of collected data was collaboration. Collaboration is key to finding the best solutions. Collaboration can take many forms, such as service design based on customer needs, clusters for development, or understanding each other’s competence within the municipality.

The three factors are connected and overlap.

Communication was also a key factor, that was repeated as a catalyst for better services, and a hindrance if not present. Communication tools are not limited to digital tools but can be meetings and phone calls as well. However, structure for communication is vital in order to preserve information

flow between relevant agents. However, if the information is not collected and processed, there is not a foundation for building good services.

What has been stated from data collection and interview with the Smart city representative especially, is that citizen involvement takes time and resources.

One suggestion for understanding customer satisfaction is collecting information. One type of information collection could be a digital platform.

5.3.2 Proposal

Suggestions for New Stavanger:

1. Establish routines for service design, communication, and collaboration
2. Measure value drivers and resource efficiency
3. Create tools for information collection and distribution

By the smart city goal, all of these are relevant.

Information tools stand out as the most technological need. Communication within the municipality is well served through current technology, as long as predictable and well-functioning routines are established. However, information collection from the industry is where smart city technology can be the most contributing factor.

Technological solution:

Create a platform that serves as a communication tool between the municipality, industry, and citizens.

The tool should be accessible for the municipality, the industry, and general citizens.

It should fulfill three main criteria

1. Access to information
2. Gather and process information
3. Enable connections between relevant agents

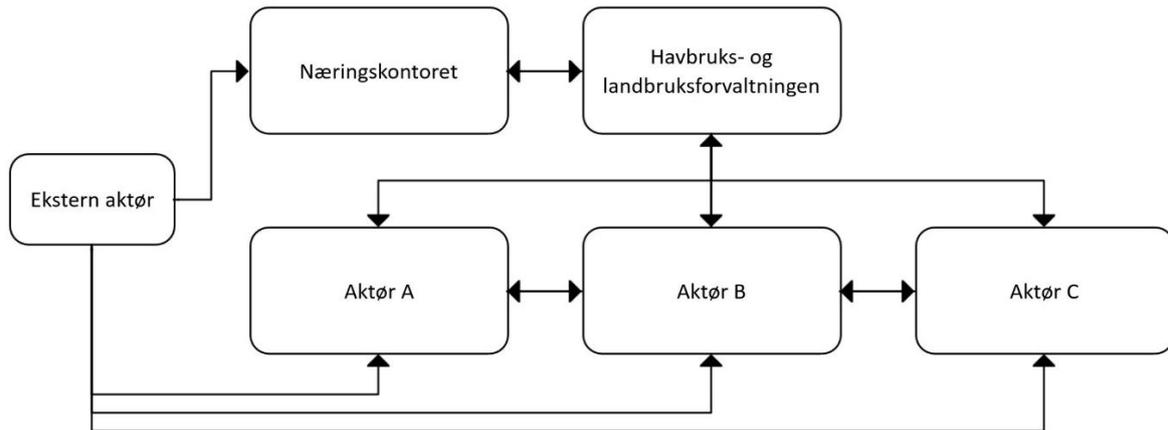


Figure 33 - Communication flows that should be enabled through digital solution

The aim for the system would be to enable communication between all the parties, in an effective and intuitive way. This would allow actors to reach each other. It would enable collection of input from citizens/industry, and connections between them in order to collaborate on new solutions. Figure 33 shows the connections the system should provide for information to and allow connections between.

End user of the system:

The end user will be the municipality for access to citizen involvement and contribution, but also the citizen itself, whether the citizen is an industry representative or simply part of the community.

Table 10 - Criteria for digital tool

| Communication tool | | | |
|--------------------------------|---|---|---|
| | Description of functionality | Relevance to citizen | Relevance to municipality |
| Access to information | <p>Relevant information is collected and sorted in a user friendly way, thus enabling easy access. The information should include regulation and management practices, carbon footprints and access to clusters and new ventures.</p> <p>It should also be updated according to area plans and political processes in redefining these.</p> | <p>It will allow access to information in a more wholesome way.</p> <p>Information is vital in reducing uncertainty and risk mitigation when committing to new solutions and investments.</p> | <p>It was stated that the industry changes rapidly when there is a need.</p> <p>It was also stated that industry, especially agriculture, is very willing to adjust to climate friendly actions, when these are not costly, but lack the time and available information to do so.</p> |
| Gather and process information | <p>There is continuous counting and measuring.</p> <p>Collection and processing of this information in one platform will enable a better information foundation to make decisions and advise the industry.</p> <p>The citizens could also choose to share information in this platform, enabling access to more data.</p> | <p>This could make applications on subsidies more efficient. The municipality could more easily suggest or advice appropriate solutions for each actor.</p> | <p>Create one database for counting and measuring, would optimize their work.</p> <p>They would also have more information, and if processed properly, this could turn into knowledge, improving the municipal work on recommending actions for political action.</p> |
| | <p>There should be a platform for interacting. Not only reporting or sharing data, but giving feedback on efficiency and quality of services.</p> <p>From information collection, rich media is a better tool for citizen participation, however, this is costly and has limited representation.</p> | <p>The ability to contribute will help each citizen though better understanding from the municipality of the services needed.</p> | <p>Access to citizen feedback is vital in service design and optimized management.</p> |
| Enable connections | <p>Functionality that allows for industry to access each other, and for external parties to access the industry.</p> | <p>Allowing for development through collaboration.</p> | <p>The municipality already serves as link and connection enabler, but this would organize it in a more accessible way.</p> |

Through this tool, new smart projects can be implemented, services can be developed and adjusted further.

The system would collect information from citizens and utilize Open data to collect additional information.

Stavanger is already a forward-thinking municipality on Open data and has a large database. The smart city office has a large open data project, and has one of the largest municipal databases in Norway. An increase in standardization of data will be needed to implement optimal solutions and utilization. Still, the skills needed to utilize Open data is available. (Volden-Freberg, 2019a, 2019b)

A suggestion of how a platform could work is shown in the figure below, and a wireframe visualization of what a platform could look like is in Appendix B. Figure 34 was made as an overview of suggested functionalities.

In Appendix B, a mockup using Balsamiq(Balsamiq Studios, 2008-2019) is shown. This is meant as a visualization of how the web solution could work and look. The attachment has live links between the pages, meaning that if one button is pressed, the user is taken to a following page, as shown in Figure 33.

For this thesis, only a web-based version is created. To maximize impact, there would also be a need for an app-based platform that would be accessible through phone.

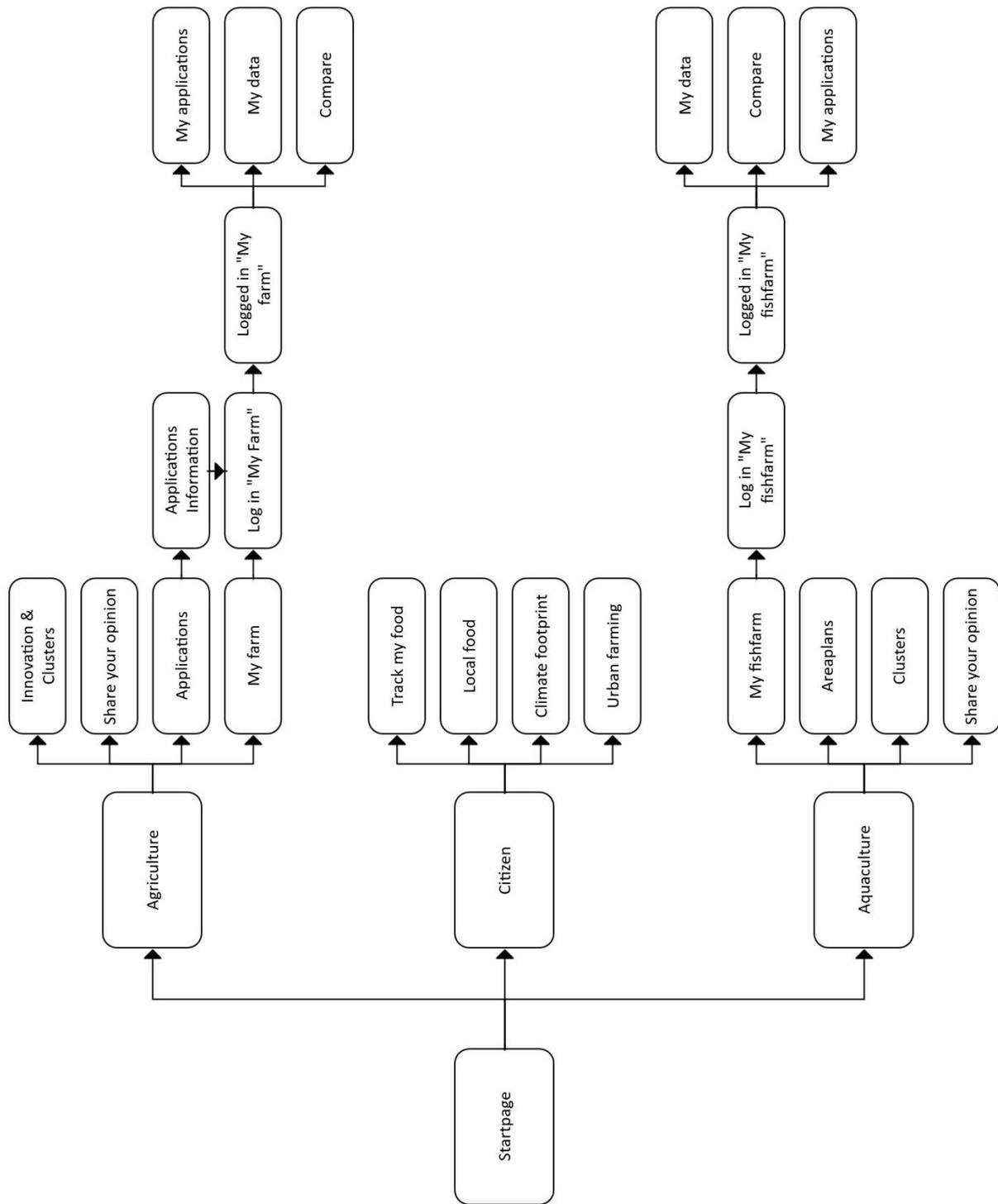


Figure 34 - Suggestion for digital tool flow chart

5.3.3 Impact

This sub-chapter will discuss the potential for impact of an extensive and well-designed digital tool.

The impact of the digital system would be to influence decisions and action patterns. With accessible information, actors have a better overview of making informed decisions. If the system can be implemented so accessibly that actors actively use it, information can be used and shared. This could contribute to value creation, through collaboration and knowledge about possibilities.

It could also provide data for the municipality to build their professional decisions and documentation. The good professional foundation is about their ability to answer hearings about area plans, documentation towards political processes, and about prioritizing their time and efforts.

The impact of the digital tool would be to enable the municipality to serve the public in a more optimized way. The more effectively the citizens can help themselves, the more efficiently data can be collected, the more easily citizens can connect with each other in order to create value, the less time is needed for municipal personnel to organize this. Thus ensuring more optimization of their work.

The tool could also provide the possibility to service the citizens in a more personalized way. The hope is for the digital tool to enable the adjustment of servitization for the individual citizen. If the information about each entity is available and collected in “My Farm” or “My Facility”, the municipality has already defined who the actor is and how they operate. Questions like, what is important to you, what do we know about your operation, the size of your facility, production volume, natural limitations, your value creation, and your goals? If that information is readily available, then the municipal worker can start directly asking how we can serve you? What are your individual needs? This will serve the citizens both more efficiently and more effectively.

Digitized data can also be processed using artificial intelligence, picking up patterns that would be impossible for humans to detect. If the municipality has access to digitized information on the actors, this could be compared and analyzed with national data already available. Through the Norwegian statistical bureau, Miljødirektoratet, governmental channels, and others, the system could run data analysis’ to understand patterns. This could, in turn, be used to choose what information would be selected for each actor, according to their own specifications.

The data could easily become so complicated that it wouldn’t be possible to analyze it and offer the actor only the most suitable data. If this information is already in the system, and run through algorithms to match for criteria set by the municipality, then the system itself, on behalf of the municipality, could offer suitable solutions and recommendations, specialized for each citizen. It will

not be relevant to a farmer producing tomatoes in a greenhouse to know actions to better sheep feed, just as it is irrelevant to a sheep farmer to know about actions to reduce energy consumption in greenhouses. The system should know this, and match information to the receiver.

The data collection led to three criteria that needed further analysis to ensure. The three criteria chosen to analyze further were: Freedom of choice, Functional development, and Optimized service production.

As stated in the collection sub-chapter 5.1, Freedom of choice refers to the citizen's freedom and self-government in choosing his/her own services, based on his/her needs and preferences. It is known that not all citizens are equal, thus their needs or desires for services will not be equal either.

This will be served by the digital tool because the municipality will have knowledge and understanding of the actor from shared and collected data. Legally required data that the farmer must share with the municipality will already exist in the database for the actor in question, in addition to data the actor voluntarily chooses to share with the municipality.

Functional development refers to the municipality's ability to secure wholesome solutions for citizens.

By the actors being able to collect all their information and data in one platform, the servitization from the municipality will be experienced as more wholesome. The aim of the tool is not merely to be another platform to visit, but rather to be a collection of the platforms with the necessary links and connection to other platforms. The purpose of the digital tool would be to assist the municipality in servicing the actors more wholesomely and adequately. Because of the increase in the size of the municipality, the ability to serve more needs for citizens is present and should be pursued in accordance with governmental recommendations.

Optimized service production talks about a larger municipality's ability to utilize resources more efficiently in order to produce better services.

As mentioned in the collection phase of the analysis, 5.1, procurement is a great part of the municipal room for negotiation. Through their procurement, they can both impact the environment and public by driving in demand for what they procure, and by subsidizing by investing in fields in order to stimulate industrial development. Through the digital platform, the municipal ability to make well-informed decisions on procurement, can be increased. This would allow the municipality to use the power of procurement more efficiently.

A pitfall of the merger would be that the bluegreen management office will manage more entities than before. It will be less accessible to each caseworker to have intimate information about every

entity in a larger municipality. Even intimate knowledge about an area could be more difficult. A smaller municipality will be more able to know each entity directly, thus understanding each actor's needs and service them effectively.

The digital tool, if implemented, can alleviate this by providing the municipal staff direct access to each actor. The citizens could be served equally well because even though each caseworker won't know each entity, the system will. The system could even allow for better and more effective services, as the system could analyze each entity and compare to other data sources and thus generate personalized information for each actor.

This will also be a budget issue. A larger municipality will have more resources to invest in such technology than a smaller municipality has.

To conclude, the goal will be that as all actors have the information readily available, that will impact the way they make decisions. With knowledge, they can make their best decisions according to their own interests.

In part it speaks to farmers, and agricultural actors, who are often characterized by low margins, have limited resources to investigate and explore possibilities (Informant E, 2019). If the digital tool already has collected the data and sorted it based on algorithms utilizing their own data, much of this work will already be done.

It was stated in the interviews that farmers are willing to adapt. Reasons to adapt included to maximize profit and to ensure a decent livelihood. It was also stated that they had an interest in contributing to environmental aspects, as long as they were resource effective, both on time and cost. (Informant G, 2019)

The tool could contribute to shaping their actions, both in implementing better processes and to minimize environmental impact.

For agriculture, the margins are considerably higher, and they already partake in research and development. Many of the environmental actions already implemented are done to optimize operations, as they often are cost effective. Agriculture has shown a tremendous will to grow and change over time. (Informant F, 2019; Miljødirektoratet, 2015)

The relevance of the tool would be more to allow connections across actors. Such as the project at Grieg Seafood, where the master thesis of Helleik Syse initiated a big investment in solar and wind energy (Skodje, 2019). Such connections could be made more accessible and will, in turn, contribute to value creation and development.

The industry could also have easier access to area plans and thus increase predictability for the industry.

For ordinary citizens, the digital tool can affect their action patterns as well. It could enable them to self-measure their actions, through for instance, tracking checking their carbon footprint and getting a number for their impact. The climate footprint of food is already collected by Framtiden i våre hender (Lindahl, 2015). Such sources could be used to visualize for citizens the impact of their choices, hence encouraging them to create new habits.

Joseph Poore stated in a presentation at the University of Stavanger that consumer cannot differentiate high impact products from low impact products. Without this information, it will be impossible to make wise choices(Poore, 2018).

The municipal room for negotiation does not allow them to require actors to share this information, however, high performing actors will benefit from sharing the information, thus increasing their market value. This could in turn both inspire others to follow and at some point, social pressure could build up for all actors to feel compelled to share the information, thus affecting their production routines.

Their habits could also be affected by encouraging them to use local products and local outlets. Track my food could help them scan the food and know their origin. All Norwegian meat is traceable to its origin in Norway (Mattilsynet, 2018). It could also encourage them to shop from local vendors directly, ensuring a larger profit margin for their products. This would be enabled by providing them information about where and when they can shop directly from different actors.

In addition, it could encourage more urban farming by allowing them information about how it could be done.

There is already extensive measuring and counting in the management of agriculture and aquaculture. Still, what is not measured will not be focused on. The systems major impact can be to measure and count efficiently. And it will be useful for the citizens and actors to share information with the municipality, because the more data they share, the more specialized their “My farm” and “My facility” service can become. Thus, more feedback can be provided through the system. As an added value, the more information is shared with the municipality, the greater the foundation will be provided for the municipality to make to important decisions.

The system would also enable continuous feedback from industry on their needs and desires.

Perhaps the collective voice of both agriculture and aquaculture could help further the possibility of Lyse building out their electrical infrastructure in Finnøy. This would enable both further investments in aquaculture facilities, and making the biogas facility cost effective enough to be implemented. This would help value creation for both sectors, as well as contribute to greener energy and reduced manure surplus. (Informant E, 2019; Informant F, 2019; Informant G, 2019)

6 Validation

In this chapter, the analysis and process, in general, are discussed. The chapter starts with discussing the credibility of the findings and how the author's choices affected the results.(Jacobsen, 2015) (JACOBSEN NOE) It then progresses to discuss the validity of the proposed solution. The chapter ends with some reflections on choices made by the author in general.

The data collected by this thesis has been shaped by the case. The information has been collected through interviews and documents. Most of the documents are either governmental documents, municipal documents or consultant reports bought by the government. This will affect the findings in the report, because the sources are from a small pool of actors, and thus can be affected by bias. However, there are few other sources available on the topic.

In addition to the literature review, the author conducted seven interviews. All the interviews were made with informants that represented a position relevant to the topic. This gives them a proximity to the topic (Jacobsen, 2015). The setting for the interview could affect the way the informant responds, including the interaction between the interviewer and the interviewee. All interviews were conducted at the workplace of the informant, in their office or in a meeting room, without others present.

Still, interviews will always be characterized by the informant, and thus be somewhat subjective. As the informants were both individuals, as well as representatives for a position, it is difficult to draw a line between their subjective views and their views in terms of their position. Informants could also be affected by their personal views, or by the way they wished to present themselves (Jacobsen, 2015).

However, as this is an ongoing case, there was little to no other material available. The interviews also provided access to information and in-depth reflections by people directly linked to the case, and personally affected by it.

6.1 Validity of findings from interviews:

At the beginning of the work with the thesis, the author had little competence in municipal administration, mergers, bluegreen sector, and smart city technology. There was also limited information about the merger in question at the beginning of the work with the thesis.

In combination with information being revealed, and the authors understanding of the topic, the problem statement changed.

The working problem statement at the writing of the interview guide was *“How can Smart City technology help New Stavanger manage aquaculture and agriculture in a way that ensures the goals for reduced greenhouse gas emissions?”*.

The interviews were conducted from that perspective, and this will ultimately affect the ways questions were posed, and the resulting responses. The criteria for a well-functioning municipality were not identified as relevant until the interviews were already started.

If the author had used these questions during the writing of the interview guide, and the conduction of the interviews, more in-depth knowledge of how the informants viewed the new municipality’s ability to meet these criteria might have been revealed. This could have affected the analysis.

The interviews were posed as open-ended questions, and several follow-up questions were posed. The informants were allowed to speak off topic, and add information that they themselves deemed relevant. Thus, much of the information collected were not direct answers to the questions on the interview guide, but merely a guided conversation on the topics covered in the interview guide. This allowed the author access to information about a wide range of information, and has allowed the author to have relevant information also on the revised problem statement.

6.2 Validity of suggestion:

It is known from the literature, and the data collection process confirmed, that citizen involvement is most effective through face to face communication (Informant D, 2019; Nye Stavanger kommune, 2019a). Especially in Finnøy, and citizens above the age of 60 years old, has communicated that close proximity to services is more important than access to services online (Nye Stavanger kommune, 2019b). However, this is resource consuming, and it is always a challenge to ensure a representative collection of voices. Hence, the digital solution suggested in this thesis cannot replace direct communication with citizens. The aim of the tool would be to supplement and organize information.

One suggestion would be to arrange Gjestebud before starting the work on a digital tool in order to understand what requirements and functionalities would be useful to the users of the service. As well as continuously working on citizen involvement through several platforms and methods.

6.3 Other aspects:

The thesis was written in English. This was a decision made by the author early on. The main reasons for this decision were for ease of collaboration with the EPIC-project, and as the thesis initially focused on technological ventures, language was not deemed relevant. As the thesis progressed, it focused more on the management of the bluegreen sector, and many phenomenon’s and terms were

distinctively Norwegian in nature, for this reason, writing in Norwegian might have been a wiser choice.

7 Conclusion

This chapter will summarize the findings of this thesis, and conclude the problem statement.

The three municipalities are different in nature, with different ambitions and traditions. For the smaller municipalities, the bluegreen sector serves as a foundation for settlement and livelihood, while Stavanger has little agricultural area left, but has had a focus on energy, climate, and industry development.

The findings of this thesis point to the new municipality facing new challenges after the merger, than those they currently operate under. For the larger municipality, Stavanger, there will be a new industry sector to handle. The bluegreen industry will affect the municipal carbon footprint. Even though the 80% target is limited to the current Stavanger, it will still affect the wholesomeness of their ambition.

For the smaller municipalities, Finnøy and Rennesøy, becoming a part of a larger municipality will affect their structure and work method. The new municipality will be perceived as more distant from the citizens.

Aquaculture and agriculture, though both primary industries, are very different in nature. Aquaculture is highly technological and is far ahead on innovation. Because of the way concessions are awarded, they have massive data. Most of the research on aquaculture stems from the industry itself. The industry is characterized by higher margins, and several actions to innovate, and general industry development is implemented continuously. In addition, the industry is mostly managed and regulated nationally. This results in there being few actions the municipality and smart city technology can contribute with. The aquaculture industry still has challenges in interacting with the municipality, these concern infrastructure development, area plans, and application processes. These can be very long winded and unpredictable.

The aquaculture has had favorable collaborations with the municipality, but their main concern is increased efficiency in planning and infrastructure development. The municipality will need to focus on preserving a habitable environment for industry development and should improve their efficiency and predictability towards the planning of area and infrastructure. It is the management office for the bluegreen sectors that create the professional foundation for the decisions regarding the management of coastal zones. This will increase in effectiveness if the municipality establishes routines and wholesome strategies towards collaboration within and with the industry itself. The separation of management from the office can become a hinder for achieving this.

For the agriculture industry, on the other hand, is characterized by smaller entities and lower margins. Even though the average entity has grown over the last few decades, farms are generally a one man

(or woman) business (Statistisk sentralbyrå, Collected 20. april 2019). This has caused a lower degree of Research and Innovation in the production section of food production. Modern technology still offers new and improved solutions, and several are already implemented (KILDE). Still, many technological solutions are available but not implemented. The reason for this is a combination of the solutions not being profitable, having high initial investment cost, but also because the industry generally has limited resources to investigate potential solutions, and low degree of predictability for the sector, with demands from national government and wholesalers, continuously changing.

Agriculture will benefit from a stronger internal competence within the municipality, as well as proximity between the industry and the municipality. Agriculture is subsidized and has lower innovation and internal research. The industry will need the municipality to have an active role as an information channel and as a motivator for development through guidance and management practice.

This created differentiated management needs for the two sectors, where aquaculture manage itself to a great extent, but have a need for efficient clarifications, well-developed infrastructure and solutions. The municipal need for direct competence on aquaculture can, to an extent, be gathered externally.

The thesis points to the limitations in municipal room for negotiation. However, within the available room for management, there are still accessible actions.

There will also be challenges with wholesome management of the municipality, as it will be divided across Judaberg in Finnøy, Vikevåg in Rennesøy, and Rådhuskvartalet in Stavanger. These sections are spread across great distances. Wholesome and united management will become different than before when everything was centered in each municipality.

A pitfall for the municipality will be if it becomes too silo organized, and unable to utilize the competence across offices. This will create waste of talent and reduce the productivity of the municipality (Heizer et al., 2016).

Another finding that is seen as irrefutably valid is that the municipality needs to adapt their approach if they aim to preserve citizen involvement and industry development. None of the informants could point to a wholesome plan or strategy for the new municipality — neither for the development of the bluegreen sector or for climate actions. The findings point to a lack of systematization of measures — both concerning citizen involvement, industry development for the bluegreen sector, and environmental actions.

This lack of systematization needs to be addressed. The suggestion made by this thesis to provide a platform for bluegreen sector can contribute to the municipality being perceived as a holistic unit.

Collection of information and processing it using digital tools will also contribute to the municipality exploiting their resources as efficiently as possible, thus reducing waste and preserving the available competence.

In summary the findings point to a need for wholesome strategy for the municipality to promote industrial entrepreneurship for the bluegreen sector. Industry development will contribute to increased viability for the sector, and increased profits for each actor, as well as emission reduction and industry optimization.

In order to achieve optimized operations in the new municipality the municipality needs to understand it's own competence and key stakeholders. Heightened silo organization of the municipality can undermine and waste talent and competence.

Smart city technology can help the municipality achieve this. This thesis points to one suggestion for utilizing technology in collecting and processing information, to improve municipal servitization of citizens in the bluegreen industry.

The thesis makes a suggestion for data collection, processing, and distribution. The digital tool suggested in this thesis is one approach to increase communication and collaboration between key stakeholders in the bluegreen sector.

Digitalization has enormous potential for improving information collection and processing. If digitalization is implemented well, the municipal ability to create focus and systematization will increase, enabling them to serve their citizens better.

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Appendix A

Intervjuguide

Problemstilling

NO: *Hvordan kan Smart By teknologi hjelpe Nye Stavanger forvalte landbruk og havbruk på en måte som ivaretar mål om reduserte klimautslipp?*

EN: *How can Smart City technology help New Stavanger manage aquaculture and agriculture in a way that ensures the goals for reduced greenhouse gas emissions?*

RQ1 – How can New Stavanger build services and communication between the municipality and aquaculture and agriculture?

RQ2 – How can smart tech reduce unwanted environmental impact from agriculture and aquaculture?

Kommunesammenslåing

1. Hva tror du vil bli de største endringene?
2. Hva er de største utfordringene du ser i umiddelbar fremtid? På lang sikt?
3. Hva er de største skillene mellom Rennesøy, Finnøy og Stavanger?
4. Hva ser du for deg at blir de største utfordringene i forhold til klimautslipp?
5. Har dere laget en plan? Målsettinger?
6. Har du noen tanker om teknologi som kan bidra?

Forvaltning av fiske- og landbruk

7. Hvilken kompetanse har kommunen på akvakultur og agrikultur i dag?
8. Hvilken kompetanse tror du at blir nødvendig for Nye Stavanger?
9. Hvilken kompetanse ser du for deg at trengs i fremtiden?
10. Hva slags søknader får dere vanligvis inn? Hvordan behandler dere disse?
 - a. Eksempel hvordan en prosess ser ut?
11. Hvilke saker er de mest arbeidskrevende?-Hvilken kompetanse trengs for å løse disse sakene?
12. Hva er behandlingstid?
 - a. Har du noen forbedringstanker?
13. Kan teknologi hjelpe her?
14. Hvilken kompetanse kommer nye Stavanger til å trenge?

Smartby

15. Vet du om noen smartprosjekter i din hjemkommune i dag?
16. Har disse prosjektene hatt noen positive effekter?
17. I hvilken grad tror du at smartbysatsingen har betydning for kvaliteten på tjenestene til den nye kommunen?

Appendix B

This appendix is made as a visualization of a web-solution, and is meant to be read as such. In PDF-format the buttons are active and can be clicked to move about on "the website".

Not all buttons are active, but the pc cursor will show a hand pointing when held over an active button.

List of active buttons:

Start page:

Agriculture
Aquaculture
Citizen

Aquaculture:

Back

Agriculture:

My farm
Applications
Back

The blue green and me:

Back

Agricultural management:

My applications
Back

My farm (log in page):

Log in
Back

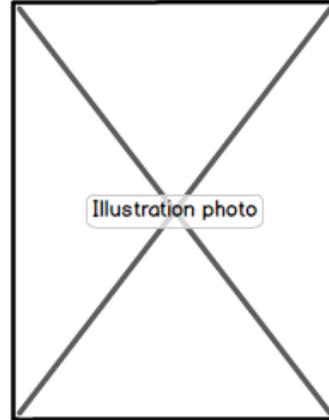
My farm:

My farm
My applications
Data
Compare
Back



← Back **Welcome to the bluegreen sector**

Placeholder text consisting of multiple lines of illegible characters.



Agriculture



Aquaculture

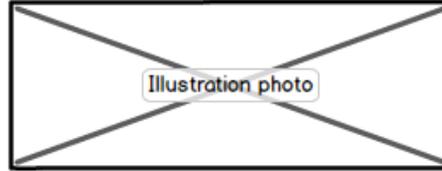


Citizen



< Back **Aquaculture**

Placeholder text consisting of multiple lines of illegible characters.



My facility

Clusters

Share your opinion

Area plans

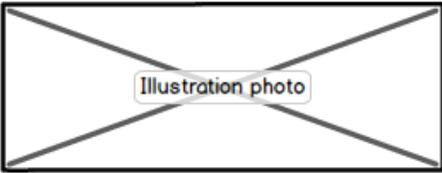


← Back The bluegreen and me

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Track my food

Local food

Climat footprint

Urban farming

Title of something

Other title with something else

Whats happening near you?

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| JUNE 2019 | | | | | | |
|-----------|----|----|----|----|----|----|
| S | M | T | W | T | F | S |
| 26 | 27 | 28 | 29 | 30 | 31 | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 1 | 2 | 3 | 4 | 5 | 6 |



< Back

Agricultural management

What does the municipality handle

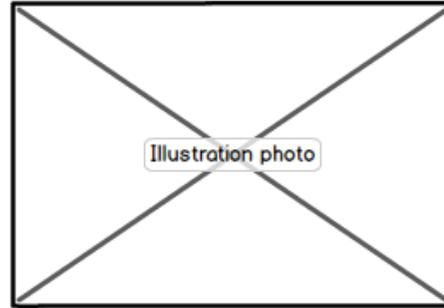
Placeholder text for the first section.

Some key deadlines

Placeholder text for the second section.

Other applications

Placeholder text for the third section.



My applications



[← Back](#) **My farm**

Log in to my farm

Username

Pasword

Log in

[Forgotten you pasword?](#) | [Sign up](#)



< Back My farm

- My farm
- My applications
- Data
- Compare

Information about my farm

| What ▲ | Amount ▲ |
|----------------------------|----------|
| Acres | 24 |
| Infield pastures | 72 |
| Sheep | 264 |
| Sheep arrived at slaughter | 84 |



Map over my farm

Progress towards stated goal



News information

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Read more news

Relevant information for your farm

Other farms that are similar to your have done this..

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Get in touch with the municipality about development

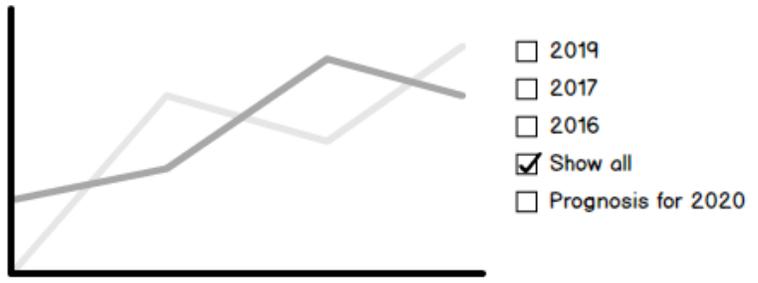
Connect with simiar farmers



< Back My farm

- My farm
- My applications
- Data
- Compare

| Type of animal | Number | Some thi | |
|--------------------------------|--------|-----------|-------------------------------------|
| Sheep | 263 | Something | <input type="radio"/> |
| Suckler cows | 38 | | <input checked="" type="checkbox"/> |
| Acres | 3 | Something | <input type="checkbox"/> |
| Wheat/oats | :) | | <input checked="" type="checkbox"/> |
| Data Grid Docs | | | <input type="checkbox"/> |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |



Development annually

Data according to the specific farm

Your data - your choice

You data is used to build information for the municipality, to share with citizens and with other industry. Your data is the basis for comparisons made between farms.

All information you share with the municipality is your ownership. You can choose what you share, and whom may access it. You can withdraw consent at any times.

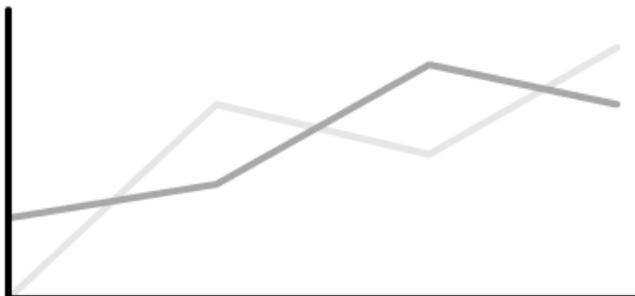
Choose what to share

Why share information?

Placeholder text for 'Why share information?'

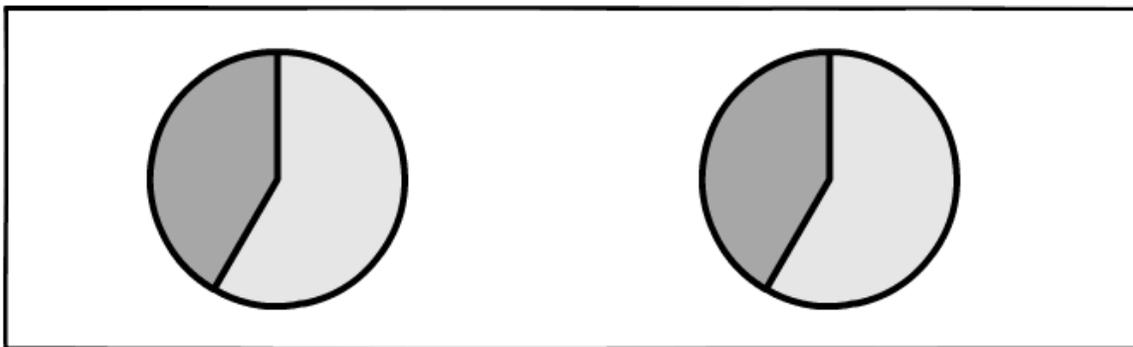
What information has others shared?

Placeholder text for 'What information has others shared?'



Option to compare shared data with national average, regional average and standard average.

Also possible to compare to farms that have enabled sharing data between farms.



[National average](#) | [Rogaland Fylkeskommune](#) | [New Stavanger](#) | [Specific farm](#)

Get in touch with others

Placeholder text for the contact section, consisting of several lines of illegible characters.

Connect with others