NTNU
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Vann forvaltning

Situasjonsanalyse og behov for IT-løsninger i
kommuner

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Master Thesis

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Intitute of Productdesign
August 2015

Water management

Situation analysis and needs for it-solutions in municipalities

Abstract

Easily accessible drinking water and efficient wastewater treatment is the foundation of modern society in relation to health and environment. The water and sewerage system is the infrastructure that makes this possible, but because of increasing consumption, climate change and leakages the current situation is not sustainable on a long term. With technological innovation, it is possible to make the work processes more efficient and information more reliable. The purpose is to make the WS-system more robust and better equipped to cope with future challenges.

The goal of this assignment has been to discover and evaluate the external and internal challenges in the WS-system in order to propose areas of opportunities for technological development.

Process
Methods and approaches from service design have been used to gather insights and analyse data. Interviews with stakeholders, observation of daily operations and workshops have been the most important sources of information for mapping the system and identifying challenges. In the insight phase, a lack of communication between the WS-department and their main customers, domestic subscribers was discovered. The customers have little knowledge about the WS-service, which doesn't correlate to the responsibilities domestic users have, and how important the information they provide to the WS-department are.

The objective of the final solutions is to provide sufficient information to domestic subscribers, in order to make them recognize water and sewerage as a service.

Result
To improve the customer's service experience and the quality of information, new service offerings were suggested in order to give the domestic subscribers information they want, when they need it. The specifications for the final concept are stated in the design brief and the new offerings were prototyped, tested and iterated in collaboration with domestic users, in order to fulfil the requirements. The final result is a proposal for a software solution that will handle the communication on the basis of pre-defined touch-points, and a strategy for how the software can be developed.

Sammendrag

Lett tilgjengelig drikkevann og effektiv rensing av avløpsvann er grunnlaget for vårt moderne samfunn med tanke på god helse og miljø. Vann og avløp er infrastruktur som gjør dette mulig, men på grunn av økende forbruk, klimaendringer og lekkasjer er ikke dagens situasjon bærekraftig på lang sikt. Med teknologisk innovasjon er det mulig å gjøre arbeidsprosessene mer effektive og informasjon mer pålitelig. På denne måten kan VA-systemet bli mer robust og bedre rustet til å takle fremtidige utfordringer.

Målet med denne oppgaven er å identifisere og evaluere de eksterne og interne utfordringer i VA-systemet for å foreslå mulighetesområder for teknologiutvikling.

Prosess
Metoder og tilnærminger fra tjenestedesign har blitt brukt for å samle innsikt og analysere data. Intervjuer med brukere, observasjon av den daglige driften og workshops har vært de viktigste kildene til informasjon for å kartlegge systemet og identifisere utfordringer. I innsikt fasen ble det klart at kommunikasjon mellom VA-avdelingene og deres kunder, private abonnenter er tilnærmet fraværende. Kundene har

lite kunnskap om VA-tjenesten, som ikke samsvarer med det faktiske ansvaret kundene har, og hvor viktig den informasjonen kunder gir til WS-avdelingen er.

Formålet med de endelige løsninger er å tilby tilstrekkelig informasjon til abonnentene, for å få dem til å gjenkjenne vann og avløp som en tjeneste.

Resultat
For å forbedre kundens opplevelse av tjenesten og kvaliteten på informasjonen ble nye tjenestetilbud foreslått. Intensjonen er å gi abonnentene informasjonen de ønsker, når de trenger det. Spesifikasjonene for det endelige konseptet er oppgitt i design spesifikasjonen. De nye tjenestetilbudene ble prototypet og testet i samarbeid med abonnenter, for å oppfylle kravene.

Det endelige resultatet er et forslag til en programvareløsning som vil håndtere kommunikasjonen på grunnlag av forhåndsdefinerte kontaktpunkterspunkter, og en strategi for hvordan programvaren kan utvikles.

Acknowledgements

VA

=

VANN OG AVLØP

WS

=

WATER AND SEWERAGE

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1

INTRODUCTION

This chapter presents the assignment, goals and the motivation for choosing the topic water management.

Why water management?

The United Nation concludes in their water development report of 2015 that there has to be drastic changes in all layers of society related to how water is used, managed and shared (Nations 2015).

Personally I have always viewed freshwater as a renewable resource that will never run-out, but after conversations with researchers and experts working in the water and sewage sector, I realized that this is no longer the case. The fact is that the water supplies are being emptied faster than they can be renewed. According to the 2015 Global risk report (Forum 2015) delivered by the World Economic Forum, water shortage is listed as one of the greatest societal risks in the imminent future.

The summer of 2014 I was completing an internship at Powel, a company that develops software solutions, mainly for the hydropower industry and infrastructure. I was part of a team that were given the task of creating a water management system for the Seyhan Cascade in Turkey. The result was a software prototype that would contribute to fair and efficient distribution of water between sectors as hydropower, drinking water and irrigation. Working on this assignment I realized the complex nature of water conservation and the need for a more efficient system on a global scale, this is a colossal task, but I felt the motivation to continue working within the water sector.

Motivation and goals
The water management system is vast and includes a range of stakeholders, users and processes. With previous experience from mainly user experience and user interface design (UI/UX), I wanted to look at the system in a larger perspective than just from the views of the end-user, which is common in UI/UX.

I was introduced to the service design methodology through previous students at NTNU who had used this approach in their master thesis, and from peers studying at AHO in Oslo.

What appealed to me are the possibilities that service design offer, by going beyond the traditional step-by-step design process.

With this thesis I want to acquire further insight into challenges in the water managements system. By using the service design approach I aim to map the processes and stakeholders related to water management, and also include end-customers at an early stage in process to suggest areas of opportunity for innovation and improvement.

Powel
I approached Powel to inquire if I could write my thesis in collaboration with them. Powel is a leading provider of software solutions for the energy sector, contractors and municipalities. Established in Norway in 1996, the company has grown to become an international corporation with 380 employees, offices in 7 European countries and deliver products to companies in 17 different countries. With the company's background and knowledge of the domain we managed to find a starting-point for my thesis: the Norwegian water industry and challenges within municipalities.

Assignment

Scope
The water crisis is most imminent in developing and water-poor countries, which are currently experiencing long-term drought and population growth. In the subject Design Theory from the previous semester, I decided to write a literature review of existing research on the success rate of western innovation in emerging markets. The conclusion was that the products and services usually failed, since developers had little previous knowledge about the social structure and needs of people in the specific country. Their results were solutions mostly based on assumptions and second-hand research.

In Norway there is already extensive infrastructure in place, this means that the focus can be on the human aspect of the operation through research and direct contact with people who work in the system.

Despite the fact that the country has a rich water supply, a swift search online revealed that there are major problems and deficiencies in the Norwegian water management system such as aging infrastructure and leakages.

Advisors
From the department of product design at NTNU (The Norwegian University of Science and Technology) my assigned advisor was Martina Maria Keitsch who has extensive experience from service design and ecological design.

From Powel my mentors were Tonje Evanger, Business Manager at the Powel User Experience department and Klaus Livik.

Masteroppgave for student Kirsti Strømstad

Vann forvaltning – situasjonsanalyse og behov for IT-løsninger i kommuner
Water management - situation analysis and needs for IT-solutions in municipalities

Powel er en sentral leverandør av programvareløsninger for dokumentasjon og beslutningsstøtte til energiselskaper, entreprenører og offentlig sektor. Powel har 380 ansatte, kontor i 7 land og produktene er levert i totalt 17 land. Selskapet har en veldefinert vekststrategi hvor UX står sentralt.

Kommuner fokuserer i økende grad på drift og vedlikehold av vann- og avløp infrastruktur på grunn av aldrende infrastruktur og konsekvenser av klimaendringer. Samtidig skjer det en teknologisk utvikling som vil gi kommunene nye muligheter for å effektivisere sine oppgaver med VA-infrastruktur. Powel forbereder en løsning som skal tilbys kommunene for slike formål.

Gjennom observasjon, intervjuer og feltstudier vil oppgaven ta utgangspunkt i kartlegging av prosesser og kontekst knyttet til VA tjenester. Med tjeneste design som tilnærming vil oppgaven videre analysere hvordan sosial aksept fra ulike interessenter oppnås i tre dimensjoner: sosio-politisk aksept, aksept i samfunn og markedsaksept. Målet er å skape et utgangspunkt for et fleksibelt IT-system som tar hensyn til de ulike interessenter, klimautfordringer og mulige systemfeil for å gi et solid beslutningsgrunnlag og kort responstid for å utføre målrettede tiltak.

Oppgaven vil blant annet omfatte:
- Feltstudie, intervju og analyse av brukere og brukssituasjoner
- Kartlegging av fremtidige utfordringer innen vannforvaltning
- Prototype og gjennomføring av brukertester
- Konseptualisering av forslag til et digitalt vannforvaltnings system

Oppgaven utføres etter "Retningslinjer for masteroppgaver i Industriell design".

Ansvarlig faglærer:	Martina Maria Keitsch
Ekstern veileder:	Tonje Evanger, Powel
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Utleveringsdato:	27. februar 2015
Innleveringsfrist:	24. juli 2015

Trondheim, NTNU, 6. februar 2015

NN
ansvarlig faglærer

Casper Boks
instituttleder

Water and sewerage dictionary

Abonnementsgebyr, Subscription fee
Anbud, Tender-offer*
Avløp, Discharge
Avrenning, Run-off
Avløpsanlegg, Sewerage system
Avløpsledning, Sewer
Avløpsnett, Sewer system
Avløpspumpe, Sewerage pump
Avløpsvann, Waste water

Fellesledning (kombinertledning), combined pipe

Grunnvann, ground water

Hovedavløpsledning, Main sewer
Hovedledning, Main pipeline
Hovedvannledning, Water main
Hydrant, Hydrant
Hydrostatisk trykk, Hydrostatic pressure
Høydebasseng, Elevated basin

Industrivløpsvann, Industrial waste water

Innløp, Inlet
Innløpssone, Inlet zone
Irrigasjon, irrigation

Kloakkrenseanlegg, Sewage treatment plant
Kontaminert vann, Contaminated water
Korrosjon, Corrosion
Kostra, Municipal-government report
Kum, Manhole*

Lekkasjesøking, Leakage detection

Nedbørsfelt, Catchment area

Oljeutskiller, Oil separator
Overløp, Overflow
Overvann, Storm water run-off
Overvannsledning, Storm water sewer

Pumpehus, Pump casing
Pumpestasjon, Pump station

Renseanlegg, Treatment plant
Regnvannsoverløp, Stormwater overflow
Resipient, Recipient

Selvkost, Cost recovery*
Septiktank, Septic tank
Septisk slam, Septic sludge
Slam, Sludge
Spillvann, Sewage
Spillvannsledning, Sewer
Spylevann, backwash water
Stikkledning, Service pipe, house connection
Stipulert mengde vann, Stipulated amount of water

Tilløp, influent, tributary
Transpirasjon, Transpiration
Trykkreduksjonsbasseng, Pressure-reducing basin
Trykkreduksjonsventil, Pressure-reducing valve
Trykksone, Pressure zone
Turbiditet, Turbidity

Utløp, Outlet

Vannforbruk, Water consumption
Vannforekomst, Water resource, water source
Vannfosyning, Water supply
Vannforurensing, Water pollution
Vannkvalitet, Water quality
Vann og avløp (VA), Water and sewerage (WS)*

The translations are collected from the VA-dictionary by Norsk Vann (Vann 2015)
* Marks where no direct translations were found, but a proper translation have been suggested and used it consistently throughout the report.

Clarification of terms

User-centred: The needs, wants and limitations of the end-user are a focus at all stages within the design process and development lifecycle.

Customer: Are used to describe the WS-departments customers, in the case of this thesis the target customers are the domestic subscribers.

User: Refers to the employees at WS-departments and potential users of Powel's software solutions.

Stakeholder: A stakeholder is a person or organization that has a legitimate interest in a particular service or project.

Holistic: Considering the entire environment of a service.

Touch-point: Any point of contact between a customer and the service Provider.

Service evidence: A tangible artefact related to a service process.

Translations: Quotes from interviews are translated to reflect the original statements in Norwegian.

Photographs: Most of the photographs used in this report are taken by me, if not, the photographer is credited in relation to the picture.

2

DESIGN APPROACH

What is service design and what is the purpose of using it?
In this chapter service design is presented as an approach to innovation along with the process, strategy and methods used for the work conducted during the thesis.

2.1 FROM SERVICE...

A service is an intangible product that occurs in the interaction between a service provider and a customer. The service industry, also called the tertiary sector account for the largest share of employment in advanced economies.

Simplified one can say that the primary industries extract raw materials, secondary industries processes and produce products of these materials, while tertiary industries provide services to both manufacturers and consumers of these goods.

There are a large variety of service providers in a number of different areas whether it is public or private. In relation to water management, the service provider is municipal WS-departments who supply clean drinking water and disposes of wastewater for the public.

Today, nearly 80% of the working population in Norway is employed in the tertiary sector (SSB 2014).

A well-orchestrated service is often the key differentiator that makes the consumer choose a certain brand or company over another (Mager 2008). As we move from commodities and goods to services and experiences, giving people what they want is the formula for a competitive advantage. In addition, trends towards an increasingly digital economy have generated a need for companies to think more creatively about services. And with further depletion of natural resources, we are pressured to do more with less and to derive value from what we do rather than what we have.

But creating a unique sales point is a challenge, making it difficult for many businesses to compete in a global market place. Often business insights of the service provider don't correspond to customer satisfaction, and vice versa, customer insights seldom lead to great business results (Abbing 2010).

So how can we create value for both the customer and service provider?
— This is where Service Design comes in.

...TO SERVICE DESIGN

Innovation is not about the newest technology, it is not about what colour a product has, it is not about driving down costs. Successful innovation is based on creating value for your users. Service design responds to this by placing the user or customer at the centre of the process, making it easy to design your service based on the experiences and needs of your target-users.

Service design is a relatively new field of design strategy, and there is no specific definition of what it is, but here is an attempt at describing it in one short sentence.

"SERVICE DESIGN is a holistic way for a business to improve existing solutions and innovate new ones."

Instead of a clear definition, five principles are commonly used to describe how a service designer thinks when innovating or improving new services. (Schneider, Stickdorn et al. 2012).

1. User-centred: The intention of a service is inherently to meet the customer's needs. By applying a user-centred approach the service become useful, usable and desirable for the client. And at the same time efficient, effective and distinctive from the business' point of view.

2. Co-creative: All stakeholders that influence the service should be included in service design process. Often, the service provider perception of customers' needs doesn't correlate with the customer's actual requirements. It is therefore important to include the customer at an early stage of the process.

3. Sequencing: Services are a dynamic process that takes place over time. And the rhythm of the service has a great effect on the mood of our customers. If the progress is too slow they might get bored, but if it goes too fast they might get stressed out. By looking at the different touch-points and actions the customer experiences during the service timeline, we can create a customer journey in order to iteratively test the service's impact on customers.

4. Evidencing: Service encounters include both tangible and intangible aspects. Designed objects, such as a receipt or queue number are referred to as service evidences because they are physical proof that the service has taken place. Well-designed physical evidences can contribute to a mutual expectation of the service between the customer and service provider.

5. Although a genuinely holistic way of working is impossible, the goal should always be to consider every aspect of the service. The conscious awareness of what customers otherwise perceive subconsciously with their senses can have a profound impact on the experience of the service itself.

" Service design is not limited to a certain sector or technology. The approach examines the operations, culture and structure of an organization for impact on service experience.

—Erlhoff and Marshall, 2008
page 354

2.2 PROCESS

The design process is in its nature non-linear, but it's possible to create an outline of the structure. There are many proposed frameworks made up of several steps, but the mind-set is fairly similar; The structure followed in this thesis is based on the double diamond, proposed by the British Design Council (Council 2015). The double-diamond approach is a simple visual map of the service design process and is divided into four distinct phases.

Within each of the four phases divergent and convergent thinking has been used. Divergent thinking focus on exploring and ideating as many solutions as possible, while convergent thinking is used to analyse and synthesise the insights and find one solution or direction to the given problem (Mager 2008).

1. Discover
This stage is the research phase, where the intention is to discover new perspectives on a particular service. This involves "stepping into the shoes" of the customer, staff, managers etc. in order to see the service from their point of view and develop new insights into the service experience.

2. Define
This is where the insights are visualized into new ideas and concepts, to find out how they could be improved further. In this stage it is important to involve a wide range of stakeholders in order to create holistic solutions.

3. Develop
In this phase the ideas for solutions from the creative phase are developed into prototypes, and tested against the insights generated in the exploratory phase.

4. Deliver
The implementation phase is where the ideas are put into action. In the case of this thesis the delivery consists of four parts.

1. Starting point

What are the main challenges in
todays WS-industry?

diverge

DISCOVER

converge

2. Redefine problem

Who are the main customers of
the WS-industry, and what are
their needs?

diverge

DEFINE

converge

3. Design brief

Lack of information and
communication between
domestic subscribers and
municipal WS-departments.

diverge

DEVELOP

converge

4. Result

Service prototypes.

Planning
A Gantt chart was made in the beginning of the process to plan the activities according to the deadline. The Gantt chart is a type of bar chart that shows the work breakdown structure by illustrating the start and finish dates and the relationships between different activities (Wilson 2003). It is a great tool to outline the work and activities at an early stage. However, as stated previously, service design is not a linear process, which makes it difficult to chart smaller tasks well in advance. The solution was to combine the overall Gantt chart with a scrum inspired method to keep track of minor tasks. The picture below shows the scrum inspired process and the Gantt chart can be found in the appendix.

Strategy
Initially, the mission statement was very wide. In order to begin the discovery phase a top-down approach was used, starting with Municipal WS-departments to look at the WS-system in a holistic way and identify challenges and opportunities. In the second phase the problem statement was redefined with a more narrow scope, using a down-up approach was more useful to identify domestic subscribers experiences with WS-departments.

Who is this report for?
Service design is not limited to a certain field, technology or problem. It is an interdisciplinary approach, which means that there are many different industries one might come across when working with service design. Water and sewerage is not an exception, being an area that service designers might not be intricately familiar with. For this reason, it was important to include an introduction to the WS-industry for examiners, mentors, peers and others who might be interested in reading the thesis that are not directly affiliated with the WS-industry. At the same time it is important that Powel and WS-department employees, who have assisted in research for the thesis will benefit from the results and conclusions. As many are not familiar with terms and processes related to service design, it has been important to explain expressions and results along the way. To make the information and visualisations easy to understand, consistent colours and styles have been used to highlight certain information.

STAKEHOLDERS

Different colors are used to
highlight the various stakeholders.

Blue - Powel

Green -
WS-departments

Orange -
Domestic subscribers

CUSTOMER JOURNEYS

Shapes are used to show
the interactions that happen
throughout the customer journey.

Touch-point

Starting-point

Customer journey

Alternative journey

*In order to keep the information structured colours and symbols have been used
consistently throughout the thesis.*

2.3 METHODS

Conclusions made in the thesis are based on synthesizing insights and creating a hypothesis based on these. The hypothesis have been tested and verified by applying the design and business methodologies explained in this section.

The methods are known tools in service design, the methods were applied systematically to get a deeper understanding and facilitate co-creation.
The phase of the process and the intention of using the methods, either for gathering more data or visualizing the findings was considerations taken into account when selecting which methods to apply.

Discover - initial research

Desk-research
This type of secondary research consists of gathering and analysing information already available in print or published on the Internet.
In the preliminary stage of the mapping the water system, desk research was required to determine what was known already, discovering gaps in information and highlighting hidden stakeholders and work processes.

There is an abundance of organizations worldwide working for awareness about water consumption and tracking the actual value and quantity of available water. The desk research resulted in valuable insight about the global situation regarding current freshwater demand and major external challenges the Norwegian water industry will face in forthcoming years. However these reports are focused on final numbers and results, rather than processes and people operating the water and wastewater systems daily.

Contextual interviews
These interviews are conducted in the environment in which the service or work process of interest occurs. In this way it is easier to also observe the situation and behaviour of the interviewed. The benefit of contextual interviews is that it is possible to gain a more holistic understanding. Unlike traditional interview techniques, the insights generated can be validated and expanded upon by observations of the social and physical surroundings of the service. In order to map the system and processes related to water management it

was important to get first-hand accounts from those who deliver the water and wastewater services. While visiting the municipalities and interviewing subscribers it was apparent that the employees was very dedicated, had a lot to tell and that they appreciated someone from outside the WS-industry showing interest in what they were doing.

Giga mapping

GIGA-mapping is an extensive mapping tool derived from systems oriented design. It is a physical map where all information and insights are documented during the research process. The intention of the map is to help designers systemize large amounts of data and understand complex systems (Sevaldson 2011).

At the start of the research phase the amount of information seemed overwhelming as I had little previous knowledge about the WS-system. By visualizing the data even without a clear system, it was easier to processes the information and manage the complexity. By using GIGA-mapping, the analysis and investigation of relations between different stakeholders, users and departments became more organized. The GIGA-map was the basis for the stakeholder map and delimitation of the thesis in chapter 5.

Questionnaire

A questionnaire is a research tool, which consists of set questions for the purpose of gathering standardized answers that make it simple to compile data (Sudman and Bradburn 1982). This is a way of getting insight into the general attitudes of the public regarding specific topics, in a relatively short amount of time. In the initial phase of approaching domestic subscribers it was important to get feedback from many user segments, rather than in-depth information. The responses were gathered by using channels such as Facebook, e-mail and also by walking around with the survey on a tablet. This resulted in a great variety of answers from different demographics related to gender, age and living situation.

GIGA-mapping is a great way of structuring insights in a complex system.
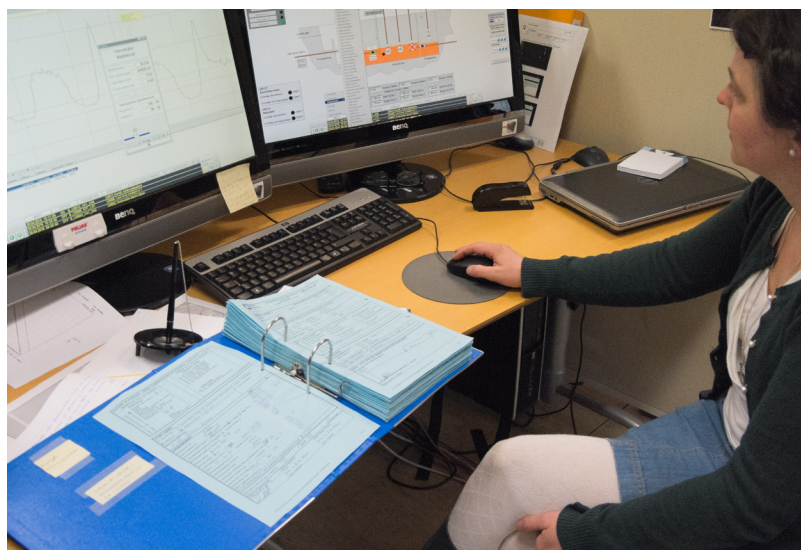
Contextual interviews gives the interviewer provides a lot of information through observation as well as interviews.

Mobile Ethnography
Closely related to "Cultural Probes", mobile ethnography is a type of
ethnographic research that can be conducted anytime, anywhere and without
the researcher being present. By using their smart-phones, the customer can
document their experience of a service with photos and video (Büscher and
Urry 2009).

In this project, it was interesting to get the users perspective on water and
sewage services. A group of people, representing the different customer
segments were recruited for the task. They were given an example and
instruction to take pictures of the touch-points they related to water and
sewerage and send it with a short description within a given date. The
intention was to let them structure the information themselves, so it was
important to keep the assignment quite open.
The result was pictures related to daily routines, fun and play. It clearly
showed how much people appreciate water, but they do not view clean water
as a service and industrial product.

Re-defining the problem statement

Stakeholder map
A stakeholder map is a visual representation of the stakeholders, which is
used to analyse the interplay between the various groups (Mager 2008). The
water industry is a complex system serving and responding to a number
of different organizations, decision-makers as well as being influenced by
external groups.

By structuring the insights from the initial research and relationships between
the stakeholders in the map, it is easy to get an overview of the areas of
opportunity. Based on the needs, interests and relationships between of each
of the stakeholder groups, three solution spaces were identified and are
presented on page xx.

Defining user needs

Personas
Personas are fictional characters that are developed to represent different
customer segments that use a service (Clatworthy 2014). The personas are a
summary of the feedback and insights obtained at the research phase of the
project. In this way, they prove to be a formidable reference in order to make
decisions based on interests, needs and requirements of customers of the
service at later stages in the design process (Schneider, Stickdorn et al. 2012).

Three different personas are represented in this thesis to in order to map the
general experience of the primary users segments during the service journey.
The background for these personas is interviews with customers of water
services, municipalities, questionnaire and feedback from discussion forums.

User scenarios
User scenarios are a short story based on the research data and personas.
The scenarios are used to understand the goals and motivations of the target
users, by exploring the actions they do at particular moments during the
service journey (Schneider, Stickdorn et al. 2012).

Gathering all of the user insights into scenarios makes it is easier to get
an overview of the troubles the users experience. The results from the user
scenarios were used to create the user journey map, define requirements for
the final concept and to brainstorm solutions at different stages of the service.

User journey mapping
This mapping tool is a structured visualisation of the user journey, which
includes the touch-points the user interact with and the experiences of
the user throughout the service (Clatworthy 2014). The user journeys were
constructed in order to summarize the findings from the research phase in an
accessible and intuitive way. By creating the summary, the general pain-points
were identified. By structuring the information in this manner, it was also a
great tool for comparing the initial and the improved user journey that are
represented in the service blueprint.

Concept development

Service Blueprint
A service blueprint is a visual schematic that describes and details each step of the new or improved service (Schneider, Stickdorn et al. 2012). The intention is to conceptualize structural change by clarifying the interactions between service users, digital touch-points and service providers. This includes the front stage activities that impact the customer directly, and the backstage activities that the customer does not see.

The service blueprint shows the relationship between domestic subscribers and municipal WS-departments, but also include the necessary backstage processes that Powel and support process from 3rd party stakeholders. This makes it a recipe for the actual service delivery.

Service prototypes
By creating low-resolution prototypes of the proposed ideas and solutions, the designer can test, iterate and refine the solutions at an early stage in the development process (Blomkvist 2012). The prototype may be a simulation or role-play of the service, tangible artefacts as brochures or apps made of paper. The intention is to improver or discard solutions based on the feedback from potential users and customers.

Storytelling
In order to communicate the service concept, storytelling is an easy and intuitive way of sharing key insights and ideas. By situating the new service offerings in a narrative setting, often in relation to the previously presented personas, the service experience along with the re-defined user journey is conveyed.

By using storytelling to present the final service offerings, it was easier to engage the reader in the improved service and present the benefits of the new service offerings. By making it easier to relate to an actual situation, it was also possible to show how the improved service might affect WS-departments and Powel, and argue for the shared benefits of improving communication.

3

STARTING POINT

This chapter is a short presentation of the water management system and how it operates today. The major external challenges that are affecting the system are also discussed in order to define the focus for the discovery phase.

Water = a service

Human well-being and environmental sustainability are fundamentally interconnected, and at the core of sustainable development is water. From food security to providing energy, water is an important part of poverty reduction, inclusive growth, economic progress and health on a global scale. Today, one-third of the world's population lives in regions with a lack of water. With the current increase in demand for freshwater, we are likely to face a global water deficit of 40%. Meaning that by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity, and two-thirds of the world's population could be living under water stressed conditions (Nations 2015).

A Global challenge
So where is all this water disappearing to? The amount of water on our planet is fixed. But there is a very small part of the world's water repository that is available for human consumption. Only 2,5% of the total amount of water is freshwater, and most of this is captured in underground reservoirs or frozen in glaciers (Oki and Kanae 2006). As a result of human pressures on the environment, climate changes are affecting the water cycle, leading to an altered supply of rainwater. Often making already water stressed areas become more arid. With trends towards a rising population, urbanization, and higher consumption of food, energy and goods we find that our freshwater supply is becoming severely reduced. Ironically, the fact is that there is enough water on this planet to serve the amount of people currently inhabiting the planet. But it is distributed unevenly and too much of it is wasted, polluted and unsustainably managed (Nations 2015).

Service provider
The Norwegian water industry was commenced as a result of population growth, urbanization and industrialization in the 19th century (Vannklyngen 2012). Today the municipalities are primarily owners of treatment plants and distribution networks - on behalf of citizens. It is operated at full cost recovery, which means that a subscription fee is paid by resident's cover the total expenses of producing water, transporting and treatment wastewater. Subscription fee levels are adopted annually in each municipality in conjunction with the municipal councils budget resolution (Vann 2015).

The number of departments and people working in the individual water systems depends on the size of the municipality. This means that the organizational structure varies a lot between big cities and countryside. Challenges faced by each municipality are often subject to environmental factors and conditions such as soil quality, extent of extreme weather and number of houses with private utilities.

From lake to ocean
Supplying clean and safe drinking water to the population is the main goal of the water industry. But there is a great distance and many processes the water travels through before it arrives back into the ecosystem. In order to make this happen, there are a number of important tasks and responsibilities placed on local authorities. To secure high quality of the service it must respond to strict regulations established by the Norwegian superior authorities.

In many ways the water industry is invisible, most activities take place inside mountains or underground. It is difficult to comprehend the extent of this vast system. With approximately 100.000 km of pipes for water and sewage, in addition to privately owned lateral drains and storm water pipes, the length of the main pipe network is equivalent to 2.5 times around the equator.

FROM LAKE – TO OCEAN

1.   2.   3.   4.   5.   6.
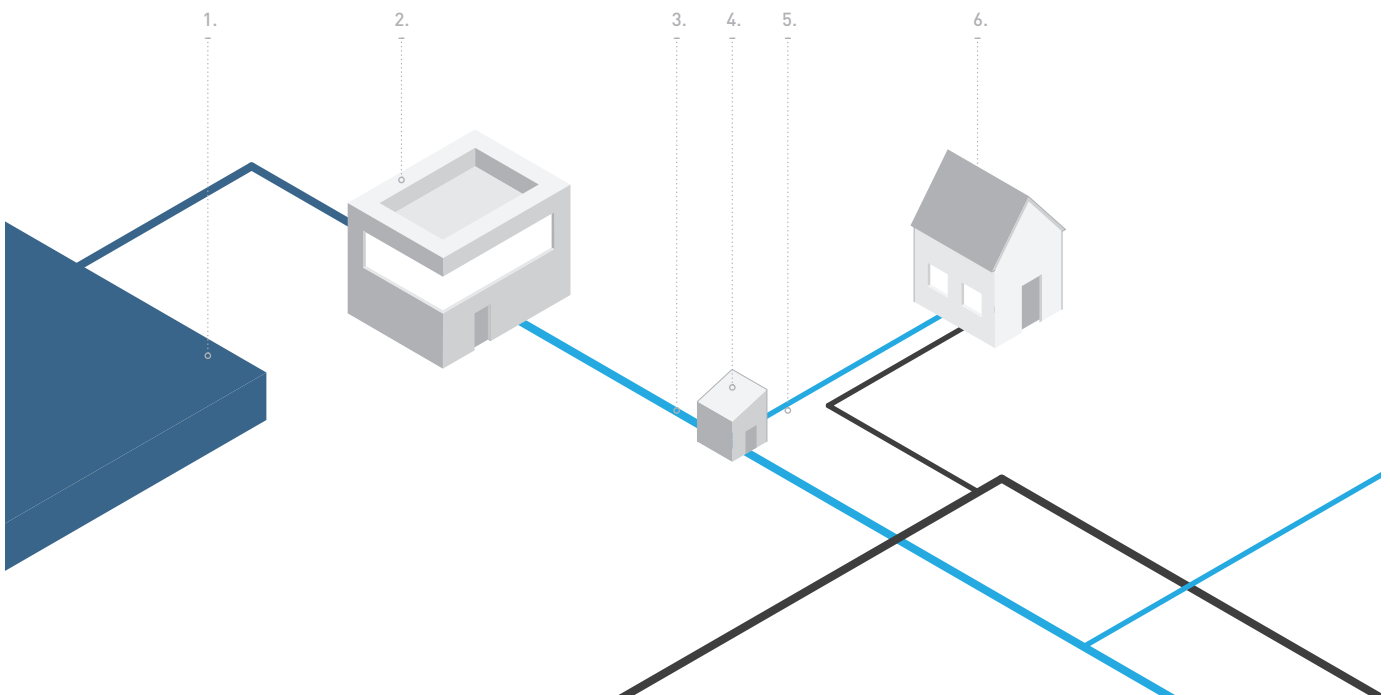
DISTRIBUTION OF WATER

1. Water source: 90% of the water comes from surface water, such as lakes and rivers, while the remaining 10% comes from groundwater sources.

2. Water treatment plant: Removes microorganisms, particles, organic matter and other unwanted inorganic substances and adapt water quality to prevent corrosion.

3. Water mains
There are 41,000 km of water pipes, transporting clean water to households, public buildings, agriculture and industry.

4. Pump stations: Keeps up the pressure for transporting water and sewage.

5. Branch lines: Are pipes that connect a house to the water mains, and are owned by the house owner.

6. Domestic subscribers
Private households.

7. Comercial subscribers
Businesses, industry and public buildings.

7.   8.   9.   10.   11.   12.
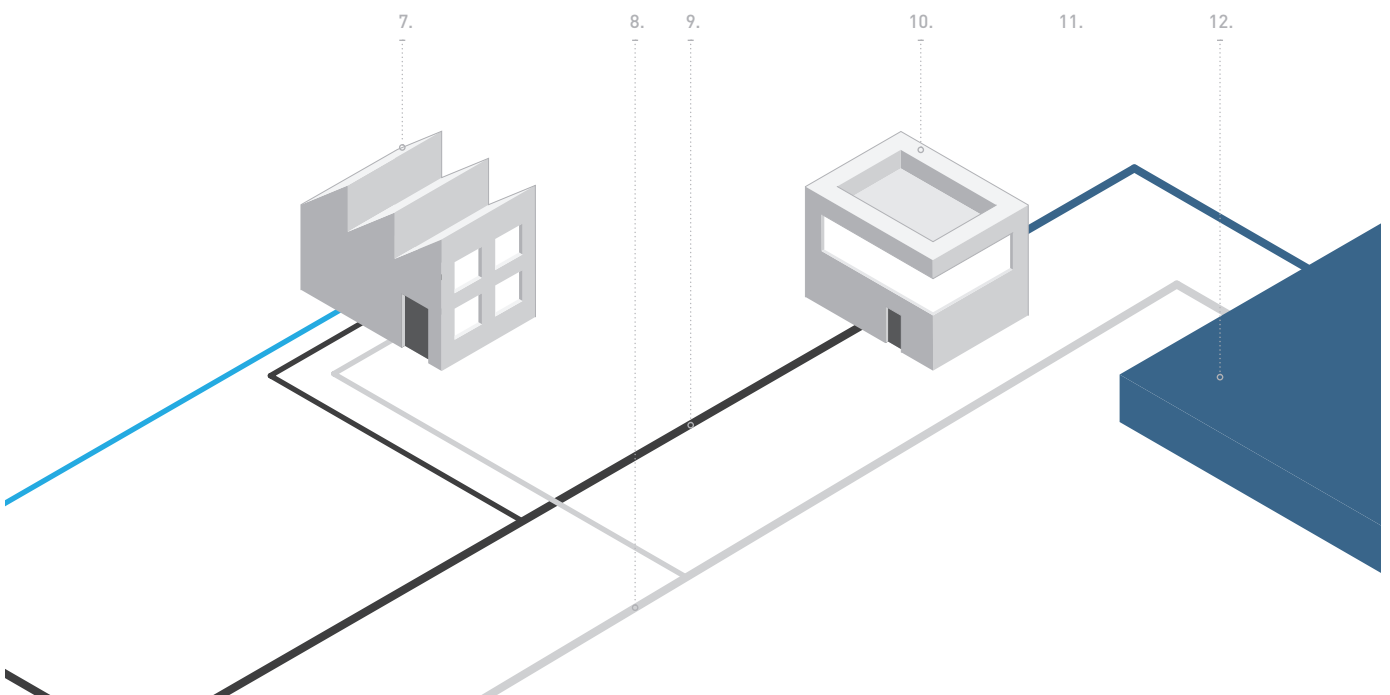
TRANSPORTATION OF WASTEWATER

8. Strom water: Storm water is normally little polluted and transported in separate storm water pipelines and discharged to the recipient without purification.

9. Sewerage mains: Transports sewage to the treatment plants.

10. Sewage treatment plant
The treatment separates the polluted materials and substances from the water before discharging it into the recipient water. This separated material is called sludge.

11. Sludge storage: The sludge is reused as fertilizer in agriculture, green areas or landfills.

12. Recipient
Recipient is a term for water bodies that receive discharges of wastewater, such as rivers, oceans or lakes.

Source: norskvann.no

CHALLENGES
On the WS-system

In the report State of the Nation 2015, created by the Norwegian association of consulting engineers (RIF) the quality of the water and sewage infrastructure was rated critically low across Norway.

In regards to drinking water, all the supplied water across the country is hygienically safe. However, the water treatments in some locations are not satisfactory in regards to the drinking water regulations, meaning that the water quality is vulnerable to contamination from humans and animals.

The sewer systems are in a worse state; only half of municipalities comply with all the requirements for purification. In terms of capacity, the pipe network is very vulnerable, and the quality of the pipes is also fluctuating.

Today the renewal rate of the pipe-network is below the recommended 1% and declining (vann 2013). This means that it will take about 50 years before the quality of the pipelines reach a satisfactory level. This indicates that the WS-industry is not equipped to deal with challenges as climate change and increasing demand.

Aging infrastructure and leakages
One of the major issues of water management today is leakage in the pipe network. It is stipulated that an entire 33% of the produced water is lost due to leakages, and in some municipalities it was registered up to 60%. This is extremely high compared with other European countries, where leakage is registered down to 8% (Vann 2015).

Leakages are costly for society and repairing a pipe is a challenging task. Often it is made very difficult because of undocumented wires and pipes in the ground. Major leakages are also likely to cause great damage on buildings and infrastructure.

There is also the risk of pollution. When a sewage pipe breaks it will have a negative impact on the nearby environment. If a water main breaks, the drinking water isn't likely to become polluted unless there is a vacuum in the pipe. The vacuum occurs when pressure in the water lines drop, as a large

amount of water disappears at once. Then contaminated water will be sucked into the water pipes (Folkehelseinnstituttet).

Lastly it is an obvious problem that a lot of clean water remains unaccounted for. Although there is plenty of water in Norway, the small lakes that make up our water supply are not inexhaustible. A plausible scenario considering the population growth in the larger cities is that water is extracted at a higher rate than it can be naturally replaced.

- Pipe age. Water pipes has an estimated longevity of 100 years, according to the Trondheim WS-department some of the pipes currently in use today dates back as far as 1890.
- The pipe material can contribute to main breaks if the pipe is in soil conditions that cause the material to corrode or crumble.
- Ground and water temperature can contribute to water main breaks when the soil freezes. This freezing may cause expansion and contraction that creates force on the water main.
- Pressure changes in the system can cause main breaks. This usually occurs at points where there is a pre-existing weakness in the pipe. Overall system demands (such as very hot, dry days with high water use) can also cause changes in pressure that lead to main breaks.

Climate change
Climate change refers to any long-term change in earth's climate, including changes in temperature and weather (Pachauri, Allen et al. 2014). In Norway the amount of precipitation has increased by 20% since 1900, much of this occurring after 1980. The annual runoff is projected to increase, as well as an increase of the national average in precipitation of around 20% in the autumn, winter and spring and 10% in the summer by the year 2100 (Oecd).

The experiences municipalities have had with extreme rainfalls in recent years shows that it is very difficult to deal with. Precipitation that runs off on the surface is called storm water. In urban areas storm water has largely been carried away in sewers and separate storm water pipelines, but the pipe-network is not dimensioned to handle such quantities of water. When the full

capacity of the piping system is reached, the water finds its way to the surface. The increase in urban development and more areas with impervious surfaces leads to added pressure on the water mains. This increases risk of flooding and water damage as well as erosion and landslides (Vann 2015).

Climate change also leads to poorer water quality, and potential droughts may affect stability of supply in some areas during the summer.

Example of climate measure:

"The Midgard Snake" is a project of Oslo Water and Wastewater Department that will function as an interruptive drainage system, preventing polluted water from reaching the Oslo Fjord. This tunnel (with a capacity of 50 000 m3) will be both a transport route and a retention reservoir, where water can be stored if the Treatment plant lacks capacity.

Information security
Increasing use of information and communication technology (ICT) in the operation of water and sewerage systems has provided great opportunities for more efficient monitoring and control. But it is also made the WS-sector more vulnerable to new types threats, such as remote manipulation of control systems.

Data and information has traditionally been stored on local computers or in physical archives. By making the information accessible and integrated on different platforms such as home computers, phones and tablets, the industry require well-defined safety procedures.

Results from a survey performed by the Norwegian Food Safety Authority (Mattilsynet 2015) shows that the robustness in operational control systems differed a lot between the 440 waterworks who participated.

It is the owner, whether represented by a board or council, who is responsible for that the water company has the resources and powers necessary to deal with an emergency. But according to the survey, the

majority of water companies believed that the provider of ICT systems safeguard information security.

It might be difficult to imagine what harm hostile elements could do with this information, some examples are:

- Take control of the water supply and physically enter the water treatment plant and poison the water after it has been through purification.
- Shut-off the water supply.
- Sabotage by changing the pressure in the pipe-network, control and destroy pumps. This could cause sewage into drinking water.

A relevant case is the Australian who wanted revenge after a job rejection hacked into the Maroochy Shire, Queensland computerised waste management system and caused millions of litres of raw sewage to spill out into local parks, rivers. (The Register 2001)

Conclusion
These challenges are related to climate and attempted attacks from external forces. They are similar in the sense that they are inevitable, are not under the control of the municipalities or governments and in order to tackle these in a long term, a range of the underlying challenges needs to be solved. In the discovery phase the focus will be on identifying these challenges.
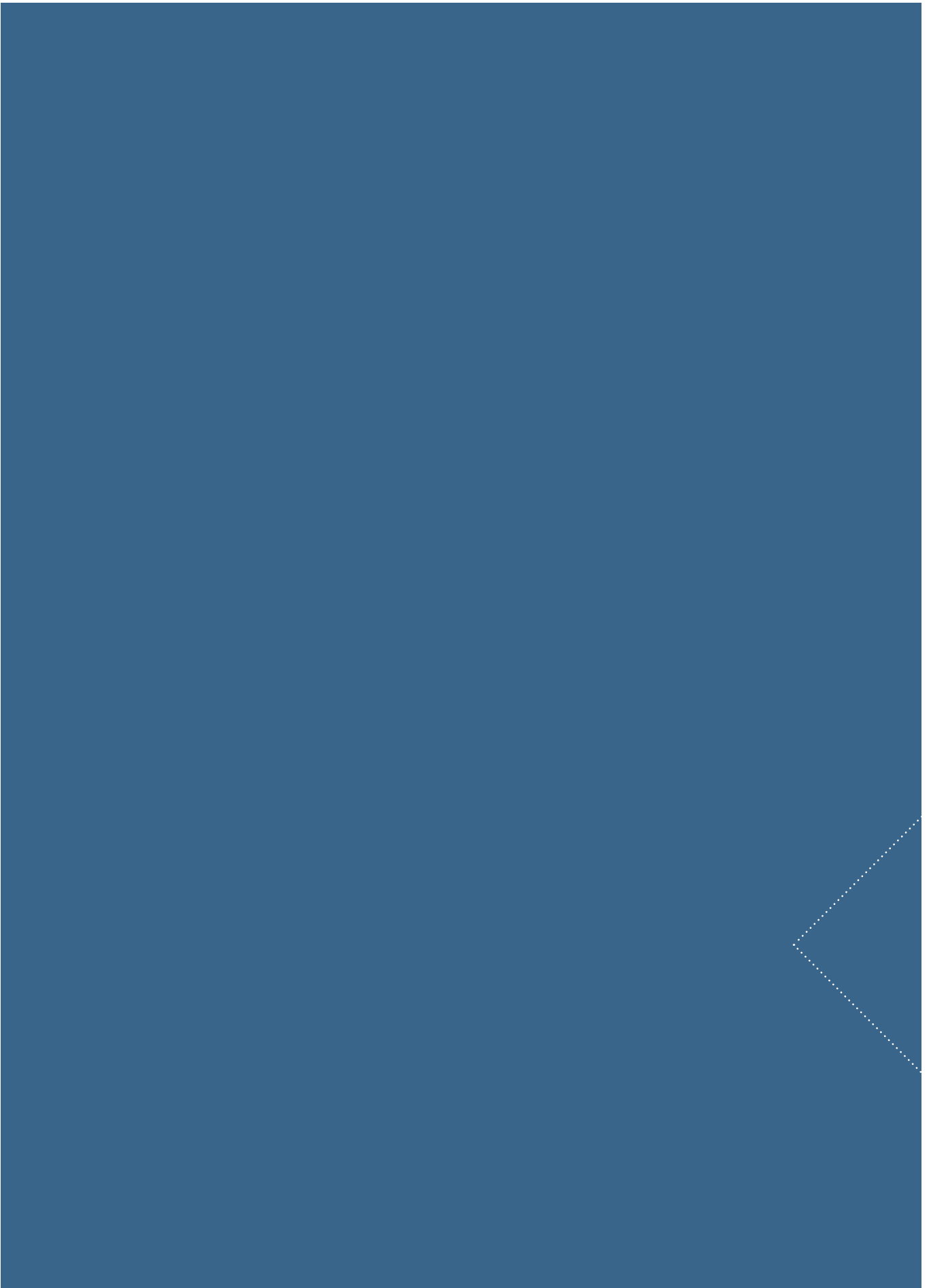
WHAT ARE THE MAIN
CHALLENGES WITHIN THE
WS-INDUSTRY TODAY?

4

DISCOVER

INTRODUCTION

This chapter presents the initial research that was done in order to map the water and sewerage system. In order to identify the main challenges within the system, it was important to understand the tasks, work processes and interactions that take place between the different stakeholders. The main stakeholder groups that are presented in this chapter are based on the service provider-customer relationships that take place within the system.

A map of all stakeholders that were charted during the process can be found in appendix page xx. But in order to limit the final report, the decision was made to include the methods, discoveries and processes related to the stakeholders that are relevant for the final concept and solution, which is presented in chapter 8.

The main stakeholders and associated challenges are presented in this order:

4.1 Powel
Provider of the WS-departments documentation tool, Gemini VA to municipal WS-departments.

4.2 Municipal WS-departments
Operates and maintain the water and sanitation system, providing their subscribers with water and sanitation services.

4.3 Domestic subscribers
The WS-departments main customers of clean water and sewerage services

The research is the basis of the re-defined problem statement and analysis of the behaviour, needs and pain-points of the service provider and customers in chapter 5 and 6.

4.1 POWEL

Powel is a leading provider of software solutions for the energy sector, contractors and municipalities. Established in Norway in 1996, the company has grown to become an international corporation with 380 employees, offices in 7 European countries and deliver products to companies in 17 different countries.

Their core focus lies on providing user-friendly systems to help companies work smarter in regards to both business and the environment. By incorporating new technology and UI/UX in their solutions, they focus on mobility and increasing the use of their solutions in the field on smartphones and tablets (Powel 2015).

Powel and Water Management
Water management is a relatively new business area for Powel, whose background is rooted in the hydropower industry. In 2006 the Gemini Company merged with Powel and today Powel delivers Gemini VA (WS) to about 300 municipalities and municipal companies in Norway. This constitutes 80-90% of the market, but they haven't been successful in expanding their market for the last 10 years.

Mapping
The foundation for good water management is based on the municipal WS-departments knowledge of location and condition of the distribution system. Before the digital age, pipes were measured and drawn by hand. As technology has evolved, GPS is used to document the location of the pipes and they are drawn onto a digital map based on these coordinates. Despite the obvious progress from pen and paper, the accuracy of the maps is not precise. This is one of the greatest causes of frustration for several stakeholders in the water industry and is one of the challenges discussed later on.

Gemini VA

The Gemini Software was commenced in Bergen in 1977, and was a response to a call from the WS-industry for a tool to systematically document the pipe-network. Today Gemini VA is used to document infrastructure and other central tasks related to planning, operation and maintenance of water and sewerage pipes. The development of the software was done through collaboration between municipalities and the research facility, Sintef.

Additional functionality was developed in order to address maturity issues, and to describe the pipe-network more accurately. The greatest improvement was the base map for drawing the pipes directly into the map, and the diary-function where it is possible to log the history of different incidents such as leaks on a pipe.
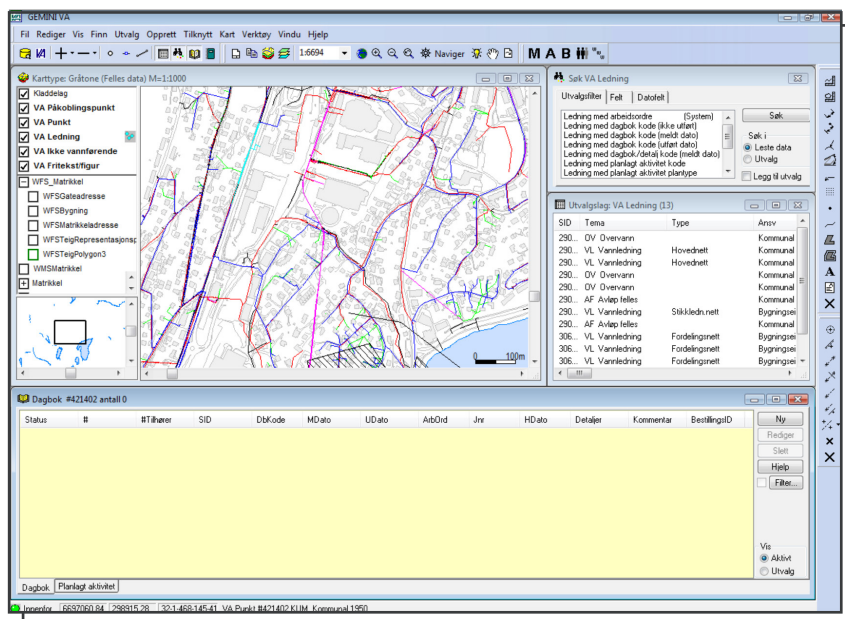
Gemini VA screenshot: The legend and overview map to the left of the window. Search and List dialogues right and Diary (history) at the bottom.

The Gemini portfolio consists of several programs that solve specific tasks.

Gemini VA
The map, where a few expert users have permission to draw and add new pipes, pumps, branch-lines, manholes etc. directly into the map. The operators have access to view the map, but not edit.

Gemini Sanitary
Keeps track of dispatched maintenance-claims on private branch lines.

Gemini Message
Registers warnings from the public and logs them directly into the map.

Gemini Alert
By selecting an area on the map, this module fetches phone-numbers from the National registers and notifies all WS-subscribers in the selected area in cases of water-pollution or water shut-off.

Gemini Conservation
Monitors pollution from buried oil tanks.

Gemini Insys
Monitors industrial emissions, such as grease separators, pollution etc.

Gemini Portal
Powel's first step towards progressing the Gemini portfolio is the Gemini Portal solution, which makes the Gemini VA map available through a cloud based solution. By connecting to the cloud, Gemini Portal makes the map accessible on a mobile or tablet through the web-browser. This is a great benefit for operators who work in the field. They can access the map from any location and add information in order to continuously update changes and work that has been done.

Conclusion
Gemini VA is an important tool for Norwegian WS-departments in order to manage infrastructure for water and wastewater. In the next section, the challenges that WS-departments struggle with are discussed. Although most WS-employees are very fond of this program, the most common feedback was that the new updates had made it too complex and cumbersome to use.

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^^ Based on interviews with the founder of Gemini, sellers in Powel and participation on the Gemini VA conference.

"Gemini was a success because we had a commercial focus from day one and managed to included many municipalities in the start-up phase.

— Steinar Muri, founder of Gemini VA
interview, 16.04.2015

CHALLENGES
For Powel

Lacking customer approval when developing new programs and features.

There is not a good correlation between what the municipalities need, and the solutions they work with.

The Norwegian market is saturated.

Innovation drive has stalled and Powel has to renew Gemini VA if they are to retain their position in the market.

4.2 MUNICIPAL WS-DEPARTMENTS

In the initial research contextual interviews was used to get a broad perspective of the WS-departments and water management system. By the initiative of Powel and help from acquaintances, contact with WS-departments was established. Norwegian municipalities are very diverse in terms of size, population, geography and environment. This is also reflected in WS-departments, which vary widely in how they are organized, what resources they have at disposal and challenges they face. For these reasons it was important to visit different types of municipalities to get a comprehensive picture of the main challenges.

Trondheim is one of the biggest cities in Norway, but 10,000 years ago, after the last ice age, Trondheim was below sea level (Løvø 2006). As a result, the ground consists of quick clay, which is highly unstable and a huge strain on the pipe system. In comparison, Bærum is a slightly smaller municipality than Trondheim, with a different environment. To contrast the bigger municipalities, it was necessary to visit a small municipality, as the resources they have available are quite limited in comparison. Sør-Odal is a densely populated municipality that is adjacent to Glomma, Norway's longest river.

In preparation for the visits an interview guide was created. To analyse and compare the interviews goals and criteria that were important to gain an understanding of the system were defined. Work processes and communication between the actors within the municipality were the emphasized.

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^ Interview guide, appendix page xx.

GOVERNMENT

COUNTY

MUNICIPALITY

TECHNICAL AGENCY

WATER AND SEWAGE AGENCY

STATS

Inhabitants: 185000

Water pipes: 800km

Sewage pipes: 1200km

Trondheim

Trondheim is the third most populous municipality in Norway and the third largest city, situated on the south shore of the Trondheimsfjord in Central-Norway.

Leakage and infrastructure
Trondheim is one of the municipalities that are experiencing most leaks. This is due to the quick clay that is the foundation of the city. The city is very old, and so are the neighbourhoods, because of this there are many old pipes and areas where the sewage and storm water is not separated, contributing to overloading of sewerage system. Even though they have a good understanding of the quality of the pipes, there is still difficult to know what happens underground.

Software workflow
One of the major issues is the software workflow. It is possible to access most kinds of data in the various programs, the problem is that the programs do not communicate. One can find values and information from a certain year in one document, but then you have to look up the values from other years by accessing separate reports. This is very time-consuming and getting an overview of trends and developments is close to impossible. It's the history that is of importance if the numbers are going to be used as the foundation for planning and decision-making.

Communication
Communication internally is difficult because of how they are organized and located in different places all over Trondheim. Regarding the public, when receiving a message, the response time is quick and the problem is solved quite fast. But because they are not good at following up the inquiry when it's fixed, they often get a bad reputation and experience reluctance from the public in later occasions.

"Today we make our own versions of Gemini to show the necessary data. But we still struggle with presenting the information we want from the different Gemini programs in one place."

Manager,
Customer Service,
21.04.2015

"We try our best to meet requirements set by the government. But it's difficult to find motivation to put a lot of effort into something other municipalities don't not care about. Then what is the point?"

Operations Manager,
Water Network,
06.05.2015

Operations Manager,
Sewage Plant,

Bærum

Bærum experienced similar challenges as Trondheim, such as aging infrastructure, difficulty in detecting leaks and capacity to cope with sudden heavy rainfall. When visiting Bærum, group interviews with the entire operations- and planning department was conducted instead of individual interviews. The result of bringing more participants into the conversation was a deeper insight into challenges met during daily operations. During a walk-through of the Gemini software and the tasks it was used for, it became clear that employees had different ways of working with the program. This sparked discussions of what the actual intention of various functions within Gemini was. It revealed that the vast number of options made it chaotic to create and retrieve information.

Options
The employees at the operations department agree that Gemini is a great tool to keep all the workers informed about changes and on-going activities. The planning department is mostly responsible for updating the map and drawing new pipes according to new construction. The drawings are based on Sosi-files, which is the documentation of the build created by the entrepreneur or consultant. The operations department relies on these maps for daily operations; they use it as a decision-making tool and overview of for example closed hatches or maintenance on the WS-mains. They are also dependent on the Gemini Alert to send messages to the public related to temporary water shut-offs or pollution of drinking water.

In the latest Gemini update there has been additions that offer various alternatives in how to perform a certain task. This makes it difficult to retrieve information since it can be saved in many different formats and locations.

Manual additions
It is difficult to update the Gemini map with temporary changes, such as water shut-offs. Due to the size of the Gemini map and effort to sign into the software for every minor change the process is time consuming. Their solution is a gigantic wall-map, where distinctive coloured pins are used to mark events in the map. Because the updates happen manually, they also have to use paper forms and print maps to plumbers and leakage detectors who are working out in the field.

Employee,
Water and Sewerage Network

"I think Powel has tried to accommodate too many requests, instead of creating a product that has defined standard. It ends up being a mess."

Operations Manager,
Water Network,
28.04.2015

"It's a program I'm very fond of, at least as it was... do you hear that Powel?"

Employee,
Water and Sewerage Network,
28.04.2015

Department Manager,
Water and Sewerage Network

Employee,
Planning and Investments

Sør-Odal

The organization and daily operations are very different from larger municipalities. Due to limited resources in regards to finance and manpower they rely on technology. Instead of hiring more people, they try to increase efficiency and shorten response time by digitizing their systems. This means that the operators can access the operating systems from multiple platforms, and even control the systems from home.

Scattered settlements
Since it's a small municipality with scattered settlements, about half of the residents are not connected to the water and sewage mains. Pollution and emission are more difficult to keep track of when houses are independent and one of their goals is to get more houses connected to the sewerage system. Connecting to the municipal water and sewerage mains is expensive, but with the initial cost and maintenance of a private well and septic tank, there is little to save regarding costs on the long term. The recipient for the treated wastewater is Glomma, but since there are other related facilities further up-stream; it is difficult to measure how much of the pollution they are responsible for.

Unreliable maps
The WS-employees repair most of the leakages themselves; the greatest challenge related to repairs is the information about location of other types of pipes, wires and infrastructure. The maps provided are rarely correct, and because the municipality are liable if they break some of them, the owners of various types of infrastructure have to be contacted in order to verify the locations of these. Water leaks usually happen at night or in the weekend, because the water pressure increase in the pipes since there is less consumption. At these times it is even more arduous to get a hold of the proprietors.

* Inhabitants by 1st of January 2015 (SSB 2015).

"Over the last 1.5 years we have replaced 11-12 km of water pipes, and we have experienced a drastic decrease of leakages. We also notice that we need to produce less water since we have replaced the pipes. "

"There are no politicians who stand up to fight for WS, I guess schools and health are hotter subjects."

**Department Manager,
Technical Department,
30.04.2015**

"Make sure the pins in the wall map is actually removed!"
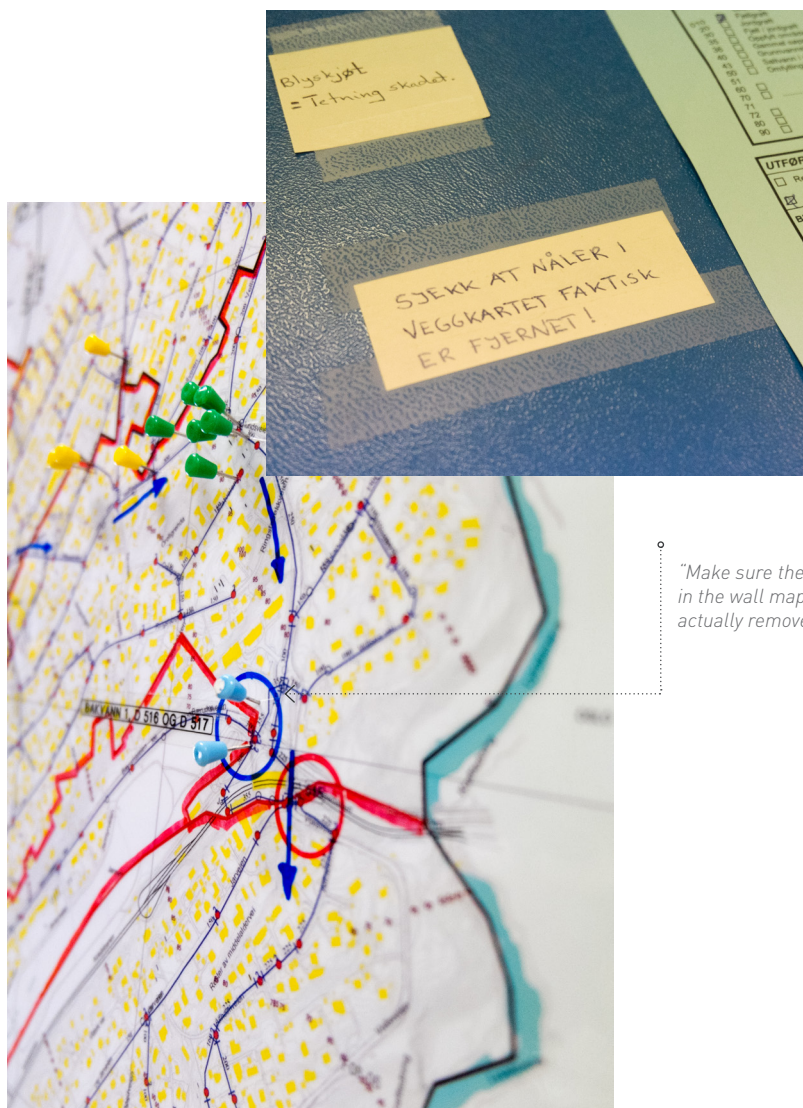
Some municipalities make use of huge wall maps to get a better overview of incidents and daily operations.

Hypothesis from interviews and observation
Small municipalities have a greater challenge keeping track of emissions and pollution because a larger percentage of inhabitants aren't connected to the WS-mains in comparison to larger municipalities.

How the computers systems are operated is very dependent on the individual user, because there are so many options and ways to perform a task. This makes the system complicated and unreliable.

One of the main reasons it is difficult to detect leakages is because the municipalities don't have a record of how much water is used and where it goes to, they just have an overview of how much is being produced.

There is insufficient knowledge and focus on VA in the Parliament and population. Some of this may be related to VA's resistance towards promoting themselves and communicate with their customers.

Workshop

After visiting the municipalities the insights were summarized with several hypotheses, and it was important to test and rate these in accordance to importance and accuracy.

Gemini VA-conference

The Gemini VA Conference is an annual event arranged by Powel. It takes place in Trondheim, and invites people from a broad range of Norwegian municipalities working in the WS-department, and entrepreneurs from various companies who are using, or interested in investing in Powel's solutions. This is one of the few occasions where WS-workers from municipalities all over the country gather to be introduced to new products and exchange experiences. This setting was an ideal opportunity to verify insights from the research, refining problem areas and discover underlying challenges.

Approach

The AT-ONE workshop method (Clatworthy 2014) was used as inspiration when planning and facilitating the workshop. In order to create discussions and make as many people as possible participate it was essential that it was easy for people to understand the purpose of the workshop, and make it effortless to contribute. The starting-point was a huge poster that depicted my interpretation of the WS-system and stakeholders. To get feedback there was created notes where an idea, challenge or a like could be written and given a grade between 1-5. The purpose of the scale was to see how important it was perceived by the individual, and to encourage ideas on all levels, big and small. The notes would be attached to the board with pins, the same they use in daily operations to highlight the events on the map.

Number of participants

- VA: 17
- Entrepreneurs: 4
- Anonymous: 13

In total, more than 11 municipalities was represented in the responses and discussions.

The "WS-world" workshop resulted in many interessting discussions.
Finally we got over 80 responses.

Key findings

Better information flow and collaboration
Make necessary information available for the people who need it, for example entrepreneurs need information about the location of water mains before they starts digging in that area.

It was also important to make these systems intuitive and easy to use, so you do not spend a considerable amount of time on learning it.

For better data quality it was important to access the necessary data when you need it. For example an operator working in the "ditch" could access the map on a tablet, and insert the correct information directly when the work was being done.

Improve data quality by more efficient ways of documenting
Making more processes automatic and digitalized. The amount of paper being used and the current need for the operation managers to manually plot the data in the map afterwards are inefficient, and may lead to loss off data.

Gemini VA should have fewer options; today the systems are too flexible, which makes more room for human error and personal customization. By focusing standardizing functionality dedicated to work processes, the systems could be used as a tool by others than the "expert users".

Suggestions for new functionalities in Gemini VA
- Simulations and calculations
- Image processing in Gemini Portal
- 3D-maps and augmented reality (AR) maps
- Leakage listening documented directly in Gemini VA
- Return button
- Street light overview
- Register water-backlash
- Register ground-drilling and terrain
- Synchronise data and import information from other software

*The most common feedback was regarding conficts, and uncertainty
related to data quality and sharing information.*

Conclusion

The challenges discovered at the initial research matched the feedback
from the workshop. In addition there were direct suggestions on improved
functionality in the Gemini VA portfolio. There was also an increased interest
towards collaboration and communication between different sectors and
departments, this is likely a result of people meeting at the conference and
found value in exchanging of experience and practices.

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^For templates and results see Appendix page xx

CHALLENGES
Within the WS-system

1   Software workflow
The IT-solutions offered today is often fragmented with poor or non-existent integration. This means that the information does not flow between the subsystems which makes it difficult and time consuming to obtain. The programs are also packed with functionality, which are not intuitive and very time consuming to learn. This result in the addition of various manual methods of documenting and monitoring, because these practices are different from person to person the data is often lost or misplaced on a post-it.

2   Data Quality
Varying quality of gathered data is related to many of the other identified challenges, such as lacking software integration, poor communication between different departments, absence of resources and individual reporting styles. The result is a software and map that is not trusted by the workers, leading to increased manual methods of collecting information. In the end, planning and maintenance is not conducted in an optimal and socioeconomic manner.

3   Communication
Information and feedback to customers is often absent. This is a drawback for customers and may cause the WS-department to get a bad reputation. The communication internally and with external partners is often oral and based on the use of paper notes. This makes room for misunderstandings and errors.

4 Recruitment

The average age of engineers in municipalities is currently quite high, combined with a decline to WS based studies, this may lead to lack of necessary expertise in the near future.

5 Organisation

The main objective is to deliver clean water and there is little initiative to reduce water consumption. The general belief in Norwegian society is that there is more than enough water

6 Attitudes and culture

The main objective is to deliver clean water and there is little initiative to reduce water consumption. The general belief in Norwegian society is that there is more than enough water.

7 Economy

The WS-system is based on a cost recovery model, this means that regulations give municipalities the right to collect water and sewage fees from subscribers, but it is not allowed to charge more than what is required to operate the service (Vann 2015). This is not ideal for innovation, as long-term planning is problematic. The secure flow of money also result in lacking incentives to improve operational efficiency.

4.3 DOMESTIC SUBSCRIBERS

Public services that are full- or partly funded have traditionally been basing decisions on economy and regulations without regard to the people in the system. The WS sector provides a service that everyone is life dependent upon, still it seems as most people take it for granted. Insights from interviews and observation show that the attitudes of domestic subscribers correspond with the attitude that the WS-sector was promoting.

Although the WS sector sees this as a comfortable situation for their customers, this may also pose some issues. Their operations will have little transparency, and operations that might not be beneficial can continue for a long time before an intervention. Municipal WS-departments receive little feedback from customers, regardless if they are pleased or dissatisfied with the service. Accordingly, the feedback they receive is not representative of the general opinions of their customer base. This may lead to a lack of incentives to streamline planning and operations instead of requiring higher fees.

Hypothesis investigated in this chapter
- Domestic subscribers don't relate to water as a service.
- Domestic subscribers don't know their responsibilities regarding water conservation.

Research methods
The initial research of domestic subscribers was conducted with a survey. The results were supplemented by desk research and interviews.

The questions for the survey were prepared to get feedback on these topics:

- Water and sewage fees
- Information
- Knowledge about personal responsibility

This chapter introduces each topic and presents the results and insights from the survey.

SURVEY PARTICIPANTS

There was a total of 110 people who replied to the survey. It was important to show how people live and how the different types of housing and ownership matters are represented in the survey answers. Such as a landlord has more responsibility than a tenant, and should therefore have more knowledge about WS.

Living situation

3%

OTHER

26%

RENTING

21%

DETACHED HOUSE

6%

TOWNHOUSE

44%

APARTMENT
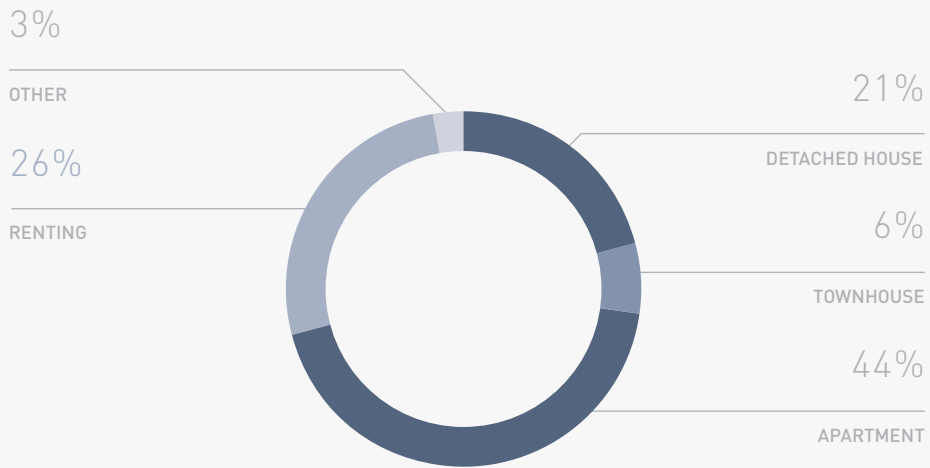
WS-fees

All homeowners must pay municipal taxes for water and wastewater services. These fees are based on water consumption, and there are two different ways to calculate these fees.

Water meters
A water meter measures actual consumption based on the water flow through the branch line into the house. The municipality may require that some or all of their subscribers' annual consumption shall be based on measured consumption (2015), but the practice varies between the different municipalities.

Use of water meters have a higher initial cost for subscribers because the subscriber has to pay for installation, inspection, and replacement. The cost of installing the water meter may be between 1000 and 5000 NOK depending on the municipality.

Estimated by residence area
The alternative to a water meter is to estimate the consumption based on the area of the residence. Use of water meters gives a fairer fee system, since the correct stipulation to area is difficult (Vann 2015).

Houses that are not connected
Houses not connected to the WS-mains pay fees to the municipality for emptying private septic- and slurry tankers. Emptying the tanks and transporting the slurry to a sewage treatment plant is the responsibility of the municipality, this is usually done once every two years or when needed (2013).

CALCULATED CONSUMPTION

These graphs show how the various residences calculate their
consumption and how they pay WS-fees.

Houses

36% — WATER METER
24% — ESTIMATED
16% — NOT CONNECTED
24% — DON'T KNOW
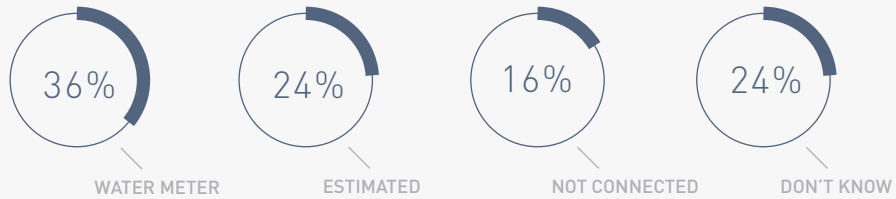
Apartments and townhouses

8% — WATER METER
6% — ESTIMATED
46% — INCLUDED IN RENT
40% — DON'T KNOW

Renting

50% — INCLUDED IN RENT
50% — DON'T KNOW
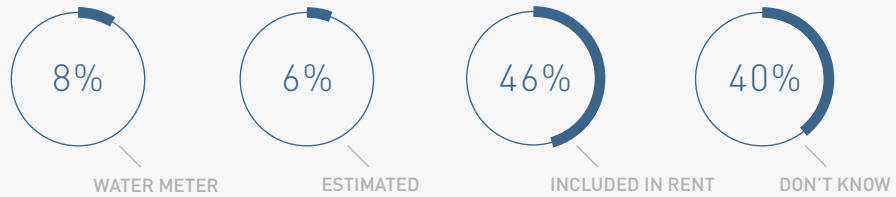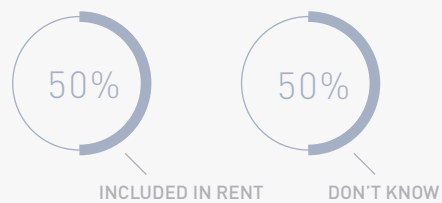
Information

In 2010, The Consumer Council performed an analysis regarding the service and knowledge level of technical sectors in the 100 largest, as well as a random sample of 50 medium-sized municipalities in Norway (Forbrukerrådet 2010). In regards to WS, the information on the following matters were analysed on the municipal sites.

• What is the annual WS-fee and how is the fee calculated?
• Is it posted information about the connection fee for water and sewage?

The quality of information and response time was graded for each municipality, and for the entire survey the maximum score was 100 points. The national average was as low as 56 point, and the total scores ranged between 88 – 24,5.

Municipal websites
During the research, the same approach was applied in order to test the quality of information on the websites of Trondheim, Bærum and Sør-Odal. The test was executed by inviting domestic users to visit the sites and try to find the given information. They would give a short feedback on their first impression, and rate their impression of the time it took to find- and quality of the information on a scale between 1-10. The result showed that there is still a huge gap related to the amount, quality and availability of information in the different municipalities.

A summary of the feedback and screenshots of the WS welcome screen is presented on the following pages.

INFO

These graphs show the distribution between those who have actively sought information on WS. And who has received details from WS-department and why.

Searched for information regarding WS

7%

YES ▲

93%

NO ▲

- To aquire water meter.
- Observe when water was available.
- Wanted to paddle through a tunnel.
- Water restrictions.
- Pollution/bacteria in water.
- Connecting to municipal water supply.
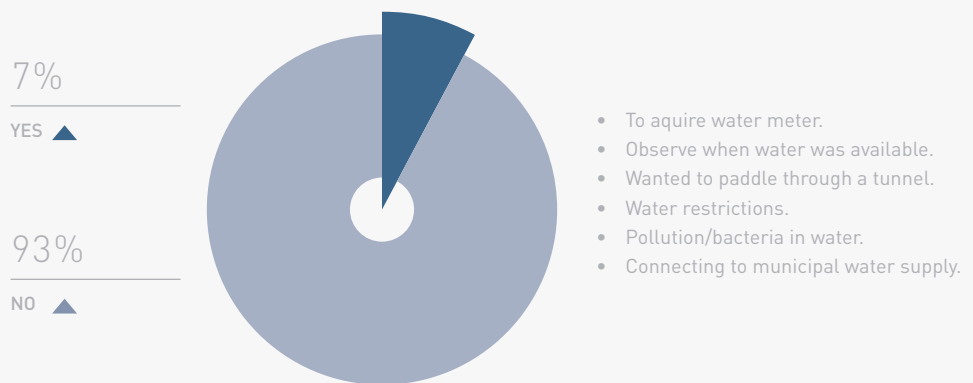
Recieved information from WS-department

19%

YES ▲

81%

NO ▲

- Installing water meter.
- Polluted drinkingwater.
- Water shut-off.
- Maintenance.
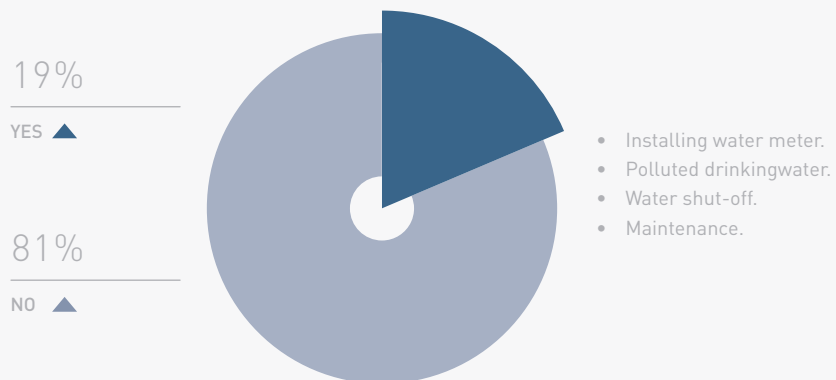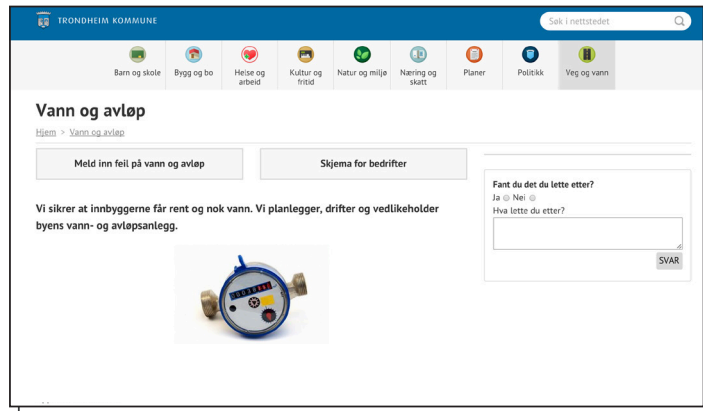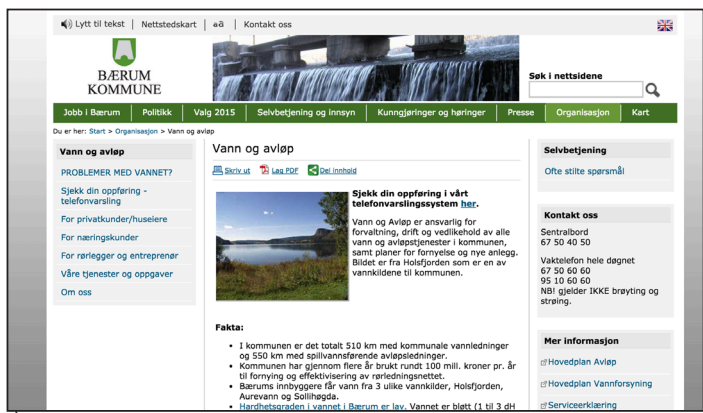
1. Trondheim

2. Bærum
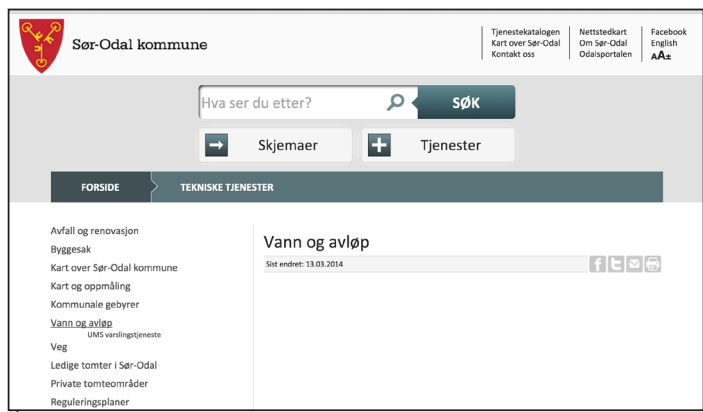
3. Sør-Odal

1. Trondheim
You enter the WS-subject page after two clicks and are immediately presented with the option to report an observed problem. The menu on the bottom is divided into subjects regarding WS, which it's easy to navigate between. If you are looking for in-depth information you are redirected to external pages. This can be a bit confusing if you are trying to relocate specific information, because the options are quite similar.

2. Bærum
This site was more old-fashioned than the others, but after just one click you arrived directly to the WS-page. There was a short introduction to WS, and the rest of the information was concise. A plus was the instruction manuals. Unlike Trondheim the site was very influenced by one-way communication, there was no invitation for residents to make contact.

3. Sør-Odal
The first impression if the site was that they had made some effort into the design. But after a closer look, it took four clicks to get to the subject page, and then the page was empty.

"Picture of pen and paper"

Bilde av kulepenn og søknadspapir

- Har du spørsmål om byggesaker, kontakt oss
hjemmesiden vår - følg denne linken - Byggesa

- Vil du møte en byggesaksbehandler, er det lu

Knowledge and attitude

Feedback

The general perception of clean drinking water is that it is an unlimited source. And the production and distribution of water goes unnoticed and is not acknowledged as a commercial product. Although the water industry is slowly gaining more attention from politicians and subscribers, the WS-industry has been at a standstill in regards to innovation, new technology and recruitment for the last decades.

In the results from the survey, the number and demographic of participants respond well with the distribution nationwide. Despite this, the results for how water consumption is measured and how much people pay in fees do not give a realistic picture. This was because most of the respondents had no clue that they were even paying for WS-services. This uncertainty itself is an interesting finding; because water and sewage is something we all pay for.

"The industry might also be a bit at fault, one is so preoccupied with ones subject and think it's so much fun that you forget everything else."

- interview Sør-Odal, 30.04.2015

Mobile Ethnography
The intention of mobile ethnography was to gain user-structured documentation of the touch-points related to water and sewerage services. As expected in advance of the task, the pictures were of daily routines, hygiene and good times. It showed that in people don't regard water and sanitation as an industrial product and service. All of the participants showed sensations, focusing on social gatherings, well-being, fun, play and getting closer to nature. None of the participants documented any touch-points related to the service, as paying fees or finding information online.

Water is one of our greatest resources and the feedback from the mobile ethnography show that people are dedication to water. These factors make it plausible that by increasing the general knowledge about what clean drinking water entails, it would generate more excitement and sense of responsibility towards water conservation.

MOBILE ETHNOGRAPHY
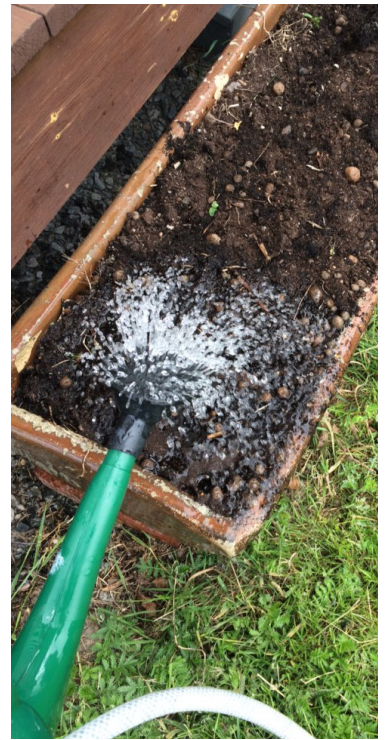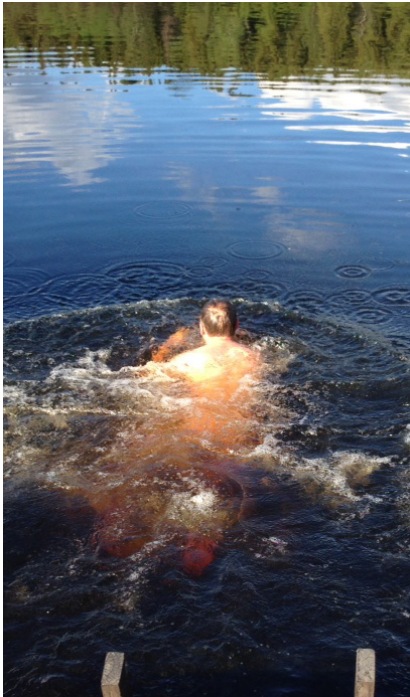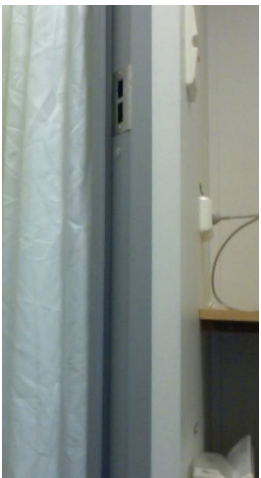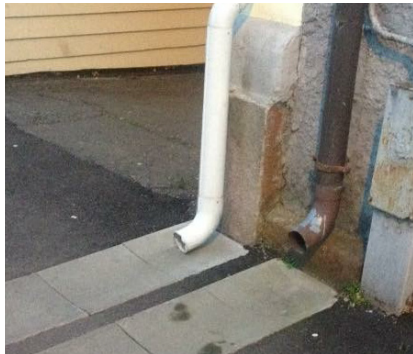
Customer segments

Customers can be segmented into distinct groups based on needs, behaviours and demographics; the customers in this case are the subscribers of WS-services (Osterwalder, Pigneur et al. 2015). The customer segments represent the archetype for the service and are used to create the customer personas, which will be presented in chapter 6. As a result of the questionnaire and interviews, the customers are divided into groups based on these variables:

• Type of residence.
• Connected to municipal water and sewerage system or not.
• Manner of measuring water consumption.

Primary users
These are customers that live in a detached house that are connected to the municipal water supply. They pay their water and sewerage bill directly to the municipal WS-department, and are divided into two groups according to how their consumption is measured. House owners with water meters are usually more aware of the water-service and because they have a better overview of their consumption compared to house owners with estimated consumption.

Secondary users
Apartment complexes have a water meters that measure the total amount of water consumed by all residents. This expenses are therefore be distributed equally among all residents and paid through the common expenses of the complex. The residents have no clear overview of their individual consumption and not direct contact with the WS-department. Houses that are not connected to the water and sewerage system, although they make up a small part of the population, they are usually to blame for the highest per cent of pollution. They have the most contact with WS-department, as they are responsible for emptying their septic tanks on a regular basis.

Tertiary users
Are people who are not yet customers, it may be young people who rent or children living with their parents. They are included in the customer segment, because they are up-coming customers.

KNOWLEDGE

Low   Medium

**PRIMARY
USERS**

Houseowner *

Houseowner with
water meter

**SECONDARY
USERS**

Apartment owner

Unconnected*

**TERTIARY
USERS**

Tenant
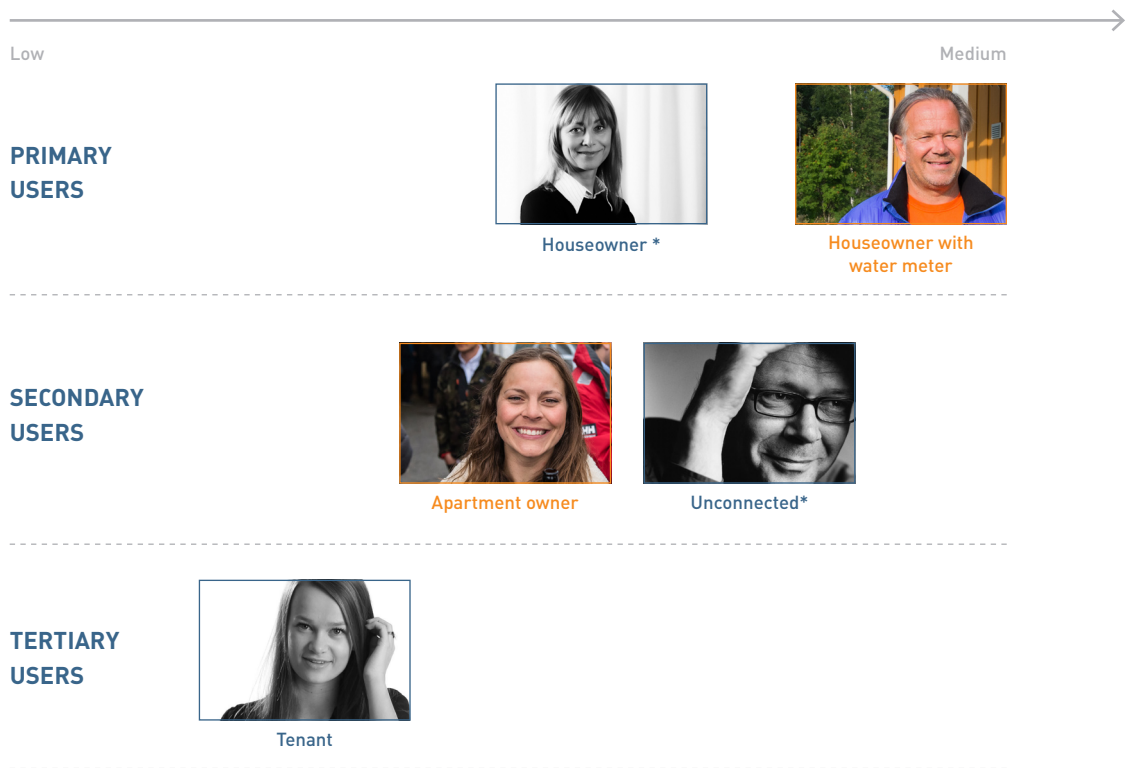
*Photos from Norden.no

Conclusion

The Norwegian WS-industry is a natural monopoly that is entirely financed by the subscribers, both domestic and industrial. The fees are adjusted each year and set to cover all costs for operations and maintenance. Consequently, WS-departments have no economic incentive to invest in innovation. The WS-employees are truly dedicated to their work, but there is no facilitation for change. The risk is that municipalities keep increasing fees, rather than investing time and effort in innovative solutions to increase efficiency.

By establishing a transparent relationship between customers and municipal WS-departments, people might become attentive towards the service and share their opinion about the product they are paying for. There are also minor adjustments domestic subscribers could do in order to improve the system. For example, by reducing water consumption the stress on the pipe network could be dramatically reduced, thus decreasing leakages. Or if just a few people installed smart meters, it would be a great aid for WS-departments on leakage detection.

CHALLENGES
Customer relationship

1 Ignorance
Most people don't know how much they pay in WS-fees, and many are not even aware that we pay for water in Norway. When a customer don't know what they are paying for they don't have any reference of whether they pay for a good service or if they are overcharged for a service that does not measure up.

2 Acceptance
The trend towards WS-fees is that they are increasing (SSB 2015). If the fees continue to rise, there is a great chance that subscribers will oppose the fees. Because of the cost recovery system municipalities operate under, the subscriber still has to pay the fees. This might lead to a bad relationship between the WS-department and their customers, which is a problem. The WS-department often depends on cooperativeness from property owners for maintenance of pipelines and messages about errors from the public for daily operations.

3 Unsustainable consumption
Norway is a water rich country, but that does not mean that unrestrained consumption is sustainable. Drinking water is mostly extracted from small sources, such as lakes with a limited capacity. Along with climate change and population growth in urban areas, the WS-departments might face a challenge in providing enough water in the long term.

5

REDEFINED PROBLEM STATEMENT

INTRODUCTION

Service design is about creating value for the customers. To accomplish this it's important to understand the challenges, needs and desires of the stakeholders. Summarizing the relationships and challenges between the identified stakeholders from research phase in a stakeholder map makes it easier to see the opportunities for innovation and improvement. In the map on page xx, the core stakeholders with direct relationships have been included. There are additional stakeholders who influence the system such as the media, government and decision makers that were taken into account, but in order to create an intuitive visualization, only the stakeholders relevant for the summary was included.

*Full stakeholder map with external influences is found in appendix.

In this chapter the needs of the main actors, based on the insights from the research are presented, along with the corresponding opportunity spaces. The intention of re-defining the problem statement is to narrow the scope and choose one direction for the user analysis.

STAKEHOLDER MAP

DIRECT

Powel
software provider

CORE

Entrepreneurs
builds new pipes

1

2

Fire department
Dependent on water access

WS-Department
operates and maintains WS

Plumbers
maintenance

3

Analysis center
analyzing water samples

Domestic subscribers
customers of WS-services

Comercial subscribers
customers of WS-services
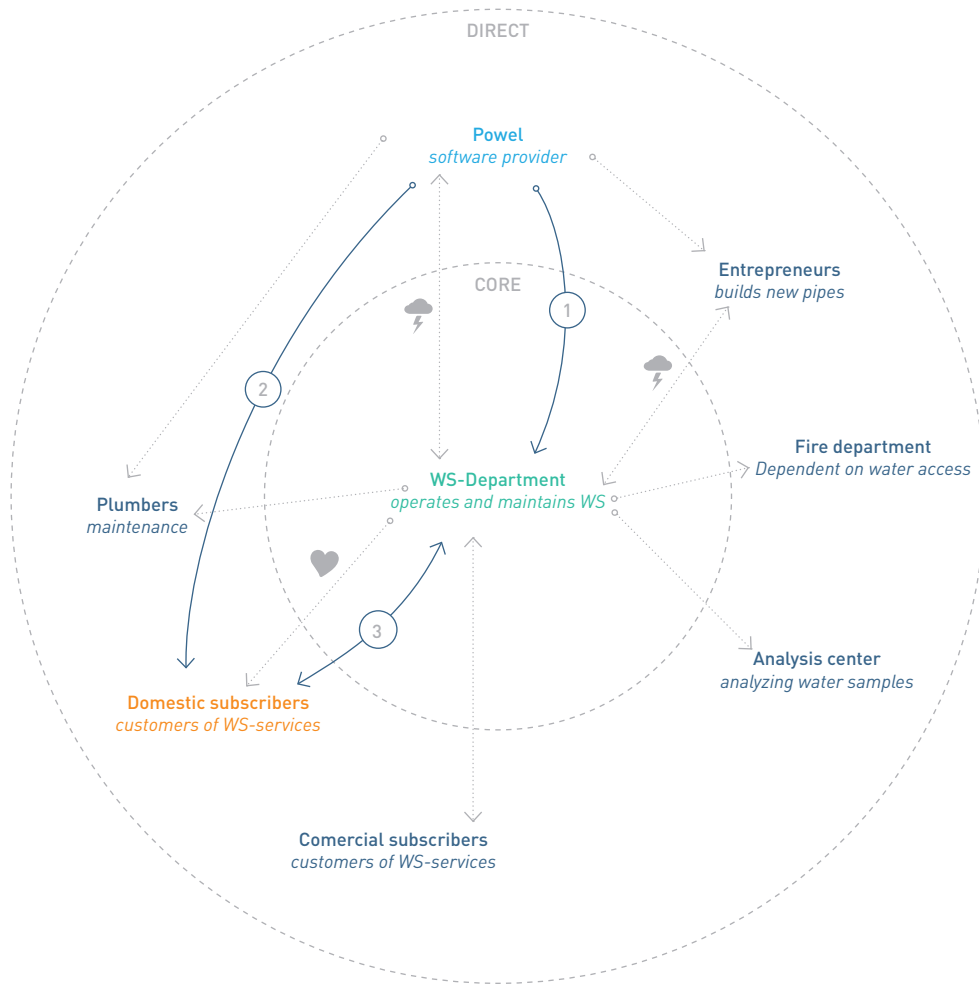
♥ Good relation
⛈ Potentially challenging relation
∘┈┈▷ Relationship
⟶ Opportunity

RELATIONSHIPS BETWEEN WS-DEPARTMENTS AND...

Powel

Although WS-departments are happy with many aspects of the Gemini applications, the recent updates have made the work processes more difficult for the users. Many feel that Powel isn't listening to their needs when developing the software, municipalities desires fewer options and seamless integration between applications.

Subscribers

WS-departments set high standards for themselves in order to deliver reliable WS-services to their subscribers. Because of external challenges, the fees are likely to rise. Municipalities need to get a better overview of the private-branch pipes and where the produced water is going to prevent leakages and reduce water production.

Entrepreneurs

The municipality has many tasks and it is difficult to follow-up on inquiries. Some find that entrepreneurs take liberties, such as connecting to the water-network, starts digging before the permission is approved. Entrepreneurs in turn vote municipalities are far too slow to give digging permits, and incoherent information from municipal-employees they have been in contact with.

IDENTIFIED OPPORTUNITY AREAS

1. Workflow
In order to save time, many of today's tasks could be automated by retrieving the information from a cloud solution. By focusing more in cloud based information it would also be easy for employees to access information on the go, immediately update changes and easily transfer data between different applications.

2. Smart meters
By introducing smart meters in households, municipalities will receive real-time information on water consumption. This will regulate the production of water based on demand and quick detection of leaks. It will also lead to a more just fee system for subscribers.

3. Communication
By improving the information to their customers, the municipality will gain a better customer relation and improve the quality of their data by making it easy for subscribers and entrepreneurs to notify and report. Side effects could be reduced water consumption, more efficient customer service and fee system and leakage reduction.

EVALUATION OF OPPORTUNITIES

The benefits of the three different prospects are presented and evaluated in regards to these factors:

- What has the greatest impact in terms of solving several of the identified challenges?
- Does it already exist in the market?
- Is there a market potential?
- How does it correspond with the assignment?

The intention is to choose one of the directions in order to narrow the scope prior to the secondary in-depth studies of potential customers.

1: Workflow and data quality
Today the WS-industry is a fragmented environment with different practices and preconditions. The regulations and requirements from the government are becoming increasingly strict, but with out-dated infrastructure and manual working methods, it might be an impossible task to meet the requirements.

The WS-industry needs a common framework for water management. This is a great challenge, and the solution is not likely to come from the government. Management authorities consist of different departments who are responsible for overseeing different parts of water management but don't communicate well. Other public policy issues such as school and health usually overshadow the general political interest in water.

Powel has the ability to create a computer system that also set an industry standard by meeting the actual needs of municipalities and focus on intuitive systems that can be used by everyone. Here are some of the potential benefits an improved workflow:

- More efficient system. By making the system faster and easier to use, employees can use their expertise on other tasks than documentation.
- It will be more reliable, because information is continuously and correctly updated and make it easier to create long-term sustainable investments.
- By focusing on a cloud solution information will be more accessible and

easier to transfer, in this way.
• Increase flexibility in terms of potential municipal mergers and implementing new sensor technology.
• Ensure implementation capability, which will enhance the reputation of municipalities, increase recruitment and improve the organization.

Evaluation of workflow and data quality
This is an important solution that is the premise for sustainable water-management. There is nothing like it on the Norwegian market, and we have to look to countries as Singapore, which have created a smart city where all information is cloud-based and gathered from various sensors.

Some of the pitfalls in this solution are the involvement from the water sector. It will be important to integrate the potential customers of this solution in an early stage, in order to continuously document the users needs and requirements. With "The Internet of Things" (IoT), it is easy to get caught up in the limitless amount of data and information available, instead of focusing on what information the users actually need.

2: Smart meters
A smart-meter is usually administered with Advanced Metering Infrastructure (AMI), which are systems that measure, collect, and analyse water usage, and communicate with the metering devices on request or on a schedule. Each smart meter contains a processor, non-volatile storage and communication facilities, which enable a two-way communication system that lets the utility and customer receive and react to real-time information, such as price signals and usage.

Today most pipes renewal and maintenance on the pipe-network are based on detected leakage history. Ideally the replacement should be based on the state of the pipes, and take place before a number of leakages appear. The reasons for why this isn't happening is a combination of uncertainty regarding where the pipes are and what state they're in, but it is also closely related to one of the main issues, that municipalities don't know where the produced water disappears too.

Installing smart meters and sensors throughout the system to getting a better overview of water consumption, is a praised solution that would benefit both the municipalities and subscribers.

- Track water consumption in real-time.
- Rapidly discovering leakages.
- Accurate billing.
- Adjust water-production to demand. This would reduce the strain on the distribution-network, which will reduce leakages. In turn less water would be wasted, which will reduce cost and the risk of pollution.

Evaluation of smart meters

A number of producers are developing smart-meters with corresponding software solutions. But they offer little or no adoption to existing control systems, making the market weak and fragmented (Robles, Alcarria et al. 2015). The lack of standardized interoperability between the various software solutions and smart-meters may result in poor control and monitoring of water distribution networks, and also prevent their evolution and necessary improvements.

As mentioned in the workflow and data quality section, municipalities are notorious for using numerous software solutions that aren't interoperable. If smart-meters were to be incorporated it is important that the metering infrastructure is in place, and communicates with the existing solutions.

Even though water-meters aren't that widespread yet, experiences from gas and electrical smart-meters show that there are challenges in the smart-grid related to privacy and security (McDaniel and McLaughlin 2009). To manage the energy in the smart-grid, customers are required to share information about how they use energy and thus exposing them to privacy invasions. Because they are also connected over a vast network of computerized meters and infrastructure, they become vulnerable to scalable network-borne attacks such as manipulating water costs or fabricate generated water meter readings.

3: Communication
From the discovery phase I recognized three main aspects of challenges within the communication area.

1. Today the different departments are isolated from one another. This results in poor communication internally within municipalities, and between the WS-departments and governing authorities. Improved communication is essential for planning and increasing efficiency.

2. Communication between municipalities and entrepreneurs represent a mutual bad relation, leading to protracted application processes and incomplete data.

3. Interaction between municipalities and subscribers are influenced by prejudices and ignorance.

The first and second aspect is closely related to the issues mentioned in workflow and data quality. So this section focuses on the relationship between municipalities and subscribers.

The water management system is a calculation with many unknowns, is it possible to eliminate some of the unknowns without having to install smart meters in every home?
House owners have uncertainties regarding legislation and their responsibilities as subscribers. This may result in unpleasant and costly incidents, such as an ageing branch-line rupturing and filling your basement with sewage water. In many cases, the subscribers expect to be informed about necessary information, but the WS-industry claim it's each subscribers responsibility to look it up themselves. From the research phase it was clear that many subscribers didn't even know that they were paying for water and sewerage services, and they was certainly not aware of the consequences of consumption and private responsibility.

Many leaks occur on private-branch lines and they may take a long time to detect because municipalities have very poor overview where they are,

what condition they are in and the load on each. A door-to-door campaign conducted in Tromsø also revealed that many households connected to the mains were not paying the service. More communication with the citizens would make them get a better overview and fairer system.

- Increased transparency gives more feedback from consumers and creates incentives for municipalities.
- Better overview of water consumption/leakages.
- More information about private branch lines.
- Better overview of water fees and easy access to relevant information for subscribers.
- Less stress on the water mains.

Evaluation of communication

By creating a new strategy for customer interaction between municipalities and subscribers, Powel would also improve they relationship with municipalities. Making the municipal users part of the development process and continue the collaboration in order to apply new updates and implement innovative solutions.

The water industry is a monopoly where customers have little influence, but are required to be connected to pipe network and pay fees that are determined by the authorities. The communication opportunity focuses on investigating the potential for increasing data quality for the WS-industry by rising awareness for subscribers. Increased awareness can cause people to put more pressure on local authorities to improve the service, so it is important that the municipalities see how increased customer involvement can benefit them as well.

" ...[in service design] you will always have to cope with dilemmas and paradoxes. Since you cannot pay attention to every aspect, insight or point of view, you will have to make decisions according to your budget, resources and the views of your clients.

—Schneider, Stickdorn et al. 2012
page number 127

CONCLUSION

After this thesis was started, it became clear that Powel had been funded by Innovation Norway (Powel 2015) in order to develop a new software solution for the water sector, Powel VA. The intention is to utilize the possibilities of IoT (internet of things) and information in the cloud to help utilities and municipalities overcome limitations in governance, finance and decision-making to tackle their specific challenges. This solution corresponds directly to the "workflow and data quality" opportunity, which means that I may use this as a starting point for a final concept. After a meeting with Powel mentors, we agreed that it would be counterproductive for me to work on this in parallel with Powel considering my limited timeframe.

Water meters are likely to be a great part of sustainable water management, but many questions arise which need to be resolved. There has to be governmental regulations regarding responsibilities for maintenance, privacy and security. There should be clear guidelines for who's paying for the smart-meters and installations. And how much impact on the environment and economy will they have?

To be able to compete in a future smart grid market, Powel has to take smart-meters into consideration. One way of entering, or setting the standard for the Norwegian smart meter market is to offer low-cost high quality smart meters directly to consumers. Powel's business model could be inspired by "the PlayStation business strategy" where game consoles are sold without profit, and revenue is collected by selling games. In the same way, Powel could expand their market and profit on their software solutions from both municipalities and subscribers. The premise for this solution is better encryption of data and information, as well as seamless interaction between different software. This is beyond my expertise and resources.

By focusing on a dynamic software solution for allowing seamless communication between municipalities and subscribers, subscribers would gain a better understanding of WS as a service and be more susceptible to changes as increasing fees and gradually developments such as implementation of new technology and smart meters.

The inherent culture, values and norms of WS-departments, as well as organizational structure are important challenges for evolving beyond the antiquated technology municipalities are relying on today. By using sophisticated technology to create a customizable and simple front-end solution to communicate with their subscribers, Powel could promote a service mind set within the WS-organization.
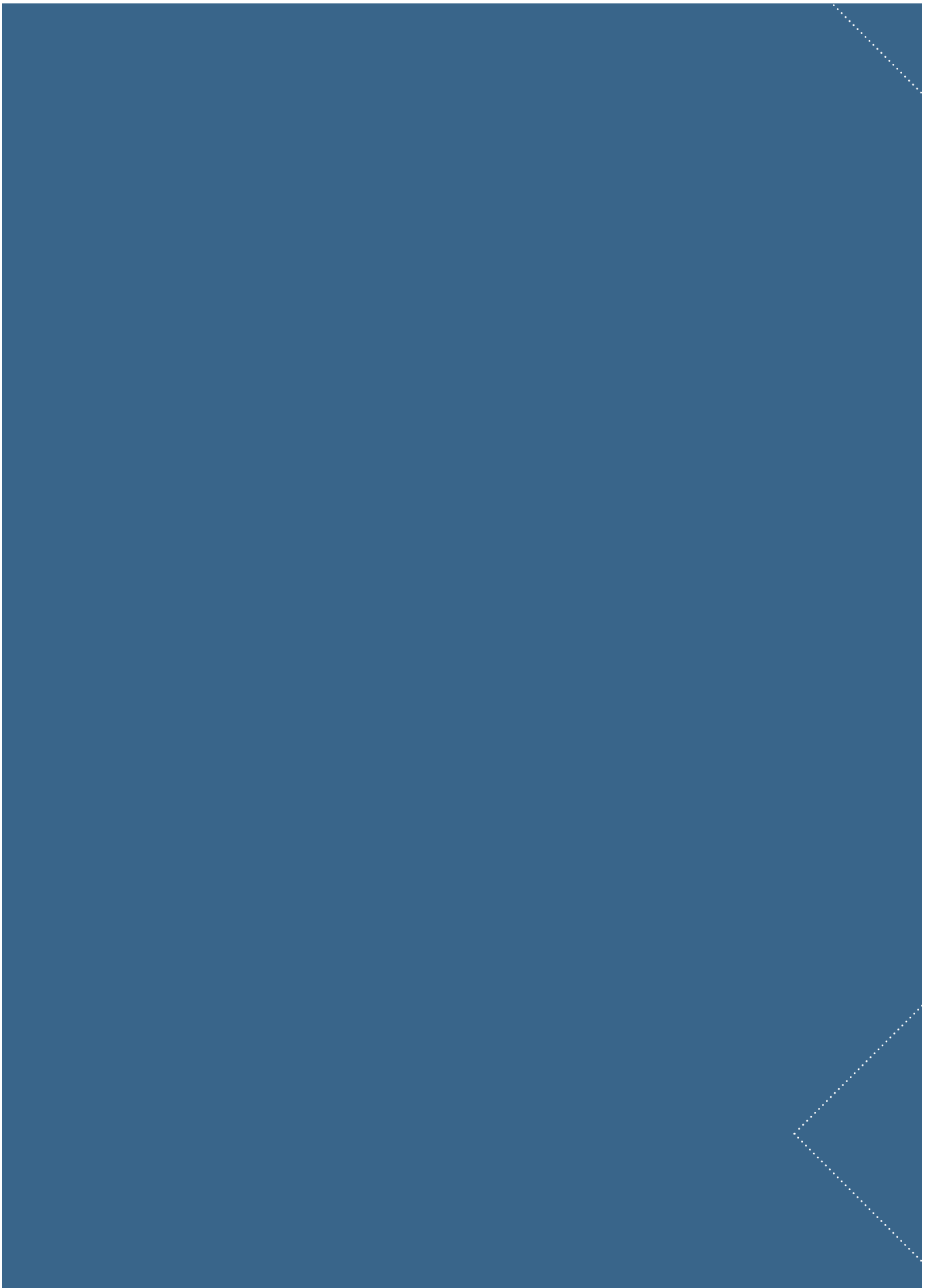
WHO ARE THE CUSTOMERS
OF THE WS-INDUSTRY,
AND WHAT ARE THEIR
NEEDS?

6

DEFINING USERS NEEDS

INTRODUCTION

Based on the re-defined problem statement in the previous chapter, the insights from the research phase are used to construct more detailed descriptions of the target users. The intention is to analyse the motivations behind the users behaviour and identify their needs, goals and pain-points along the service journey.

This chapter consists of two parts.

1. The subscribers. Who are the users, and what do they need. The intention is to map and understand what information is important to send to the subscribers, and when it should be transmitted.

2. The other part is to understand who the municipal users might be and what their needs, requirements and expectations of a potential software solution might be.

6.1 DOMESTIC SUBSCRIBERS

The personas are a representation of three of the customer segments established in chapter 4.3. They are based on interviews with WS-subscribers, municipalities, questionnaire and online forums.

Primary customer
1. The seasoned house owner

Homeowners are usually adults from 40 and up. He/she has lived in the house for many years and their kids are growing up. There is a great chance that they had to build their own branch lines and connect to the municipal water and sewerage network. They live with this comfortable and did not look at WS-fees as a great expense, but do not have a good overview of what the fees is used for. Their greatest concern is high water quality, so they trust that the municipality will charge what they need to provide clean drinking water.

Secondary customer
2. The apartment proprietor

After living in an apartment for few years, they are looking towards upgrading to a house and maybe establish a family. The WS-fees are embedded in the apartment expenses, which includes central heating, Internet and so on. This means it's difficult to keep track of how much they pay. The fees are determined by a water-meter in the apartment complex. This means that the total water consumption is divided between all the flats, no matter how much each apartment use.

I think that we are very lucky having clean water in Norway, but we waste more water than many other countries. I could be willing to pay more for clean water, if I know that the money is used wisely.

I am she who has no idea how much goes to the VA and I think I pay too much. This is because all WS-fees are divided equally between all the apartments in our building.

Olav (58)
The seasoned house owner

After his wife passed away from cancer, Olav decided to keep living in the big villa that he inherited from his grandfather. As he enjoys having a lot of space, rather than moving into a smaller apartment in the city as his kids encourages him to do. Olav has a lot of friends and last year he got a dachshund called Susi.

He recieved a letter from the Municipal Water and Sewage agency a month back, recommending him to install a water meter. Olav don't have any problems paying the bills, so even if there is a little to be saved, he doesn't really see the benefits of going through the trouble of getting one.

Needs
He has to get further information about the benefits of installing a smart meter. Not only for him, but the value it has for the municipality.

Goals
He wants to contribute to causes that benefit his local area.
Wishes to live at home, and be independent for as long as possible.

Concerns
That his friend and family will look at him as helpless, if he's not able to keep up with new technology and demands.

Technology
He is starting to get a hang of the tablet he got for Christmas. He finds it a bit difficult to hit each button, but it works okay because he can enlarge the text and icons. He had a smartphone, but it was to small and cumbersome, so he swapped it for a senior phone that he use frequently to both text and call.

Ingrid (29)
The apartment proprietor

For the last five years Ingrid has lived in a small apartment with her boyfriend in Oslo. The apartment is part of a cooperative, the fees for various municipalities are shared equally among all the proprietors. Although she thinks that the fees are a too high, she does not feel committed enough to figure out what the fees are for and how they are distributed.

In the weekends the family loves hiking in the woods, Ingrid thinks it's important that her daughter get used to playing outside from an early age. Sometimes the hikes take a bit longer than expected, and Ingrid wonder if the rivers they pass are safe to drink from. She is especially worried about her daughter when they have to take a sip from natural streams.

Needs
A way of determining the amount of water the small family use, and help to see if there are leakages in the building. This might explain why the bills have increased.

Goals
Save money.

Concerns
She is annoyed that price for municipal services is equally distributed between the resident. She is under the impression that her neighbour uses more water than she does.

Technology
She has a smart phone that she takes everywhere. Uses both the phone and computer everyday all bills are paid online. She is also eager on social media as Instagram, Facebook and Snapchat.

User scenarios

The water and sewerage service is a life-long journey starting from the day you are born. Events as learning to swim, experimentation with cooking and buying your first house are just some of the moments where the WS-services play a vital role. During the research phase various events have been documented and user scenarios evaluated, as the picture on page xx illustrates. All insights regarding the touch-points, emotion and user-experience of each event has been mapped during the process. The scenarios are sorted by relevance, frequency and how they relate to each other. During the final analysis I chose to disregard unexpected and onetime events such as connecting to water mains and reporting infrequent errors.

The intention of these scenarios are to understand the needs of the subscribers in relation to what type of information they need, when it has to be delivered and how it should be transmitted in order to improve the WS-service. In this sub-chapter, the user-scenarios in relation to the experience of the user/users before-during and after each event will be represented through illustration and text and summarized in a user-journey. The user scenarios will also be used in the concept development to describe the final solution and improvements.
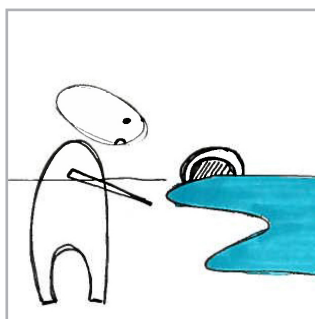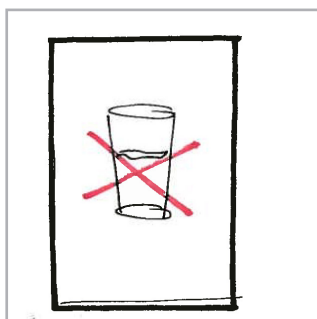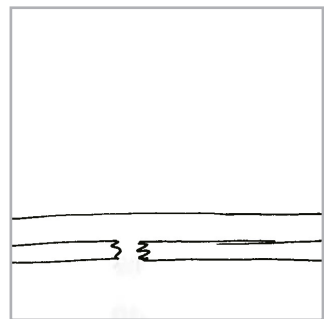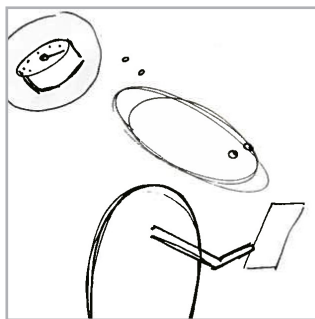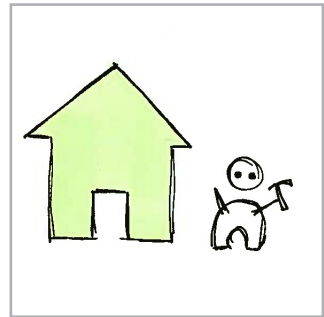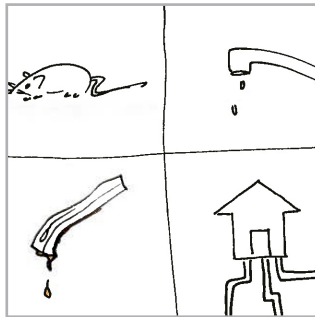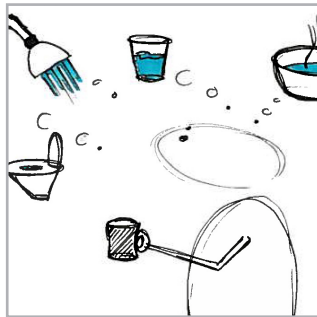
1. Daily routines
2. Knowledge
3. Build house
4. Paying fees
5. Installing water meter
6. Leakages
7. Alert
8. Observation

1: Routines

"When I shower, I turn off the water when I'm soaping up. It saves warm water, but it also keeps from washing the soap off right away."

Seasoned house owner: *With an estimated consumption he doesn't worry about how much water he spends. But he is keen on saving energy; since the bills can get expensive, and it's quite easy to save.*
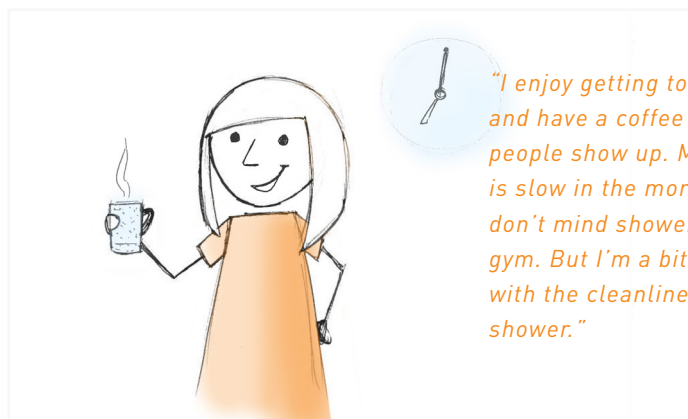
"I enjoy getting to work early and have a coffee before people show up. My boyfriend is slow in the morning, so I don't mind showering at the gym. But I'm a bit concerned with the cleanliness of the shower."

The apartment proprietor: *Hes main priority is efficiency; there is not a lot of time between work, training and socializing so she has to keep on the go. She is most concerned with saving time.*

2: Water meter claim
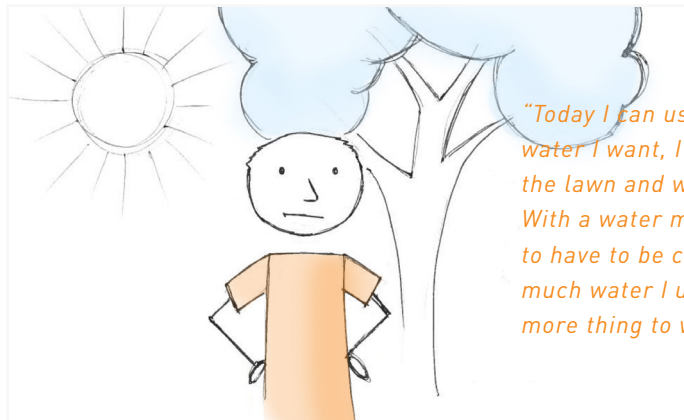
"Today I can use as much water I want, I like to water the lawn and wash my car. With a water meter I'm going to have to be careful how much water I use. Even one more thing to worry about."

Seasoned house owner: *Their requirements are clean water from the tap and well-functioning sewage services. They do not see the point of spending time and money to install water meters.*

3: Installing water meter

"I finally found the number for a plumber who could install it, but he was quite busy and didn't have a lot of time available. He wasn't very helpful, and now I have to take time of work to wait for him."

Seasoned house owner: *In order to get the best offer on the installation, he calls all the plumbers in the area. It's a time-consuming task, but he gets a quite cheap offer from one of the plumbing companies.*

"The plumber left in a hurry, and didn't explain what I have to do now. I guess he takes care of all the formalities?"

Seasoned house owner: *Lack of information makes him frustrated and unsure whether the job is done properly.*

4: WS-fees
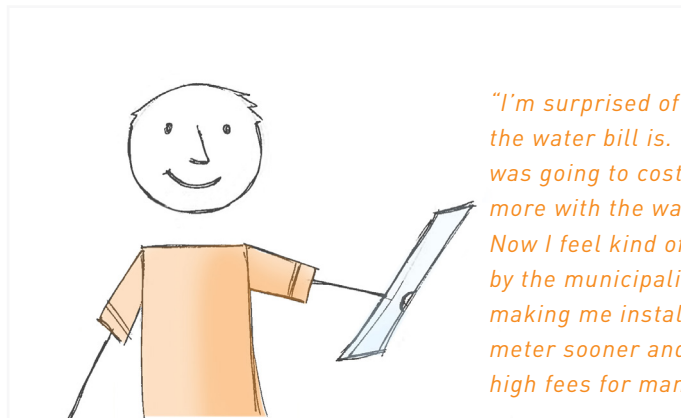
"I'm surprised of how cheap the water bill is. I though it was going to cost me a lot more with the water meter. Now I feel kind of tricked by the municipality, for not making me install a water meter sooner and pay such high fees for many years."

Seasoned house owner: *Read the water meter and receives bill. Doesn't mind the details on the bill, but pays the fee on his online bank.*

"The bills are included in the general fees, but I don't think it's a fair system. I think our neighbour upstairs uses a lot more water than us, and we have to pay for his overuse."

The apartment proprietor: *It's hard to keep track of their consumption in an apartment complex.*

CUSTOMER JOURNEY

Service provider: **Municipal WS-Departments**
Customer: **Domestic Subscribers**

I'm not sure if a water meter will pay off for me.

If more people had water meters, the billing system would be more fair.

The water quality is very good in Norway.

Contact plumber

2.

Daily routine — Buying house — Without meter — Recieve claim — Contact plumber — Pay invoice

1.

Water meter renewal

With meter

---
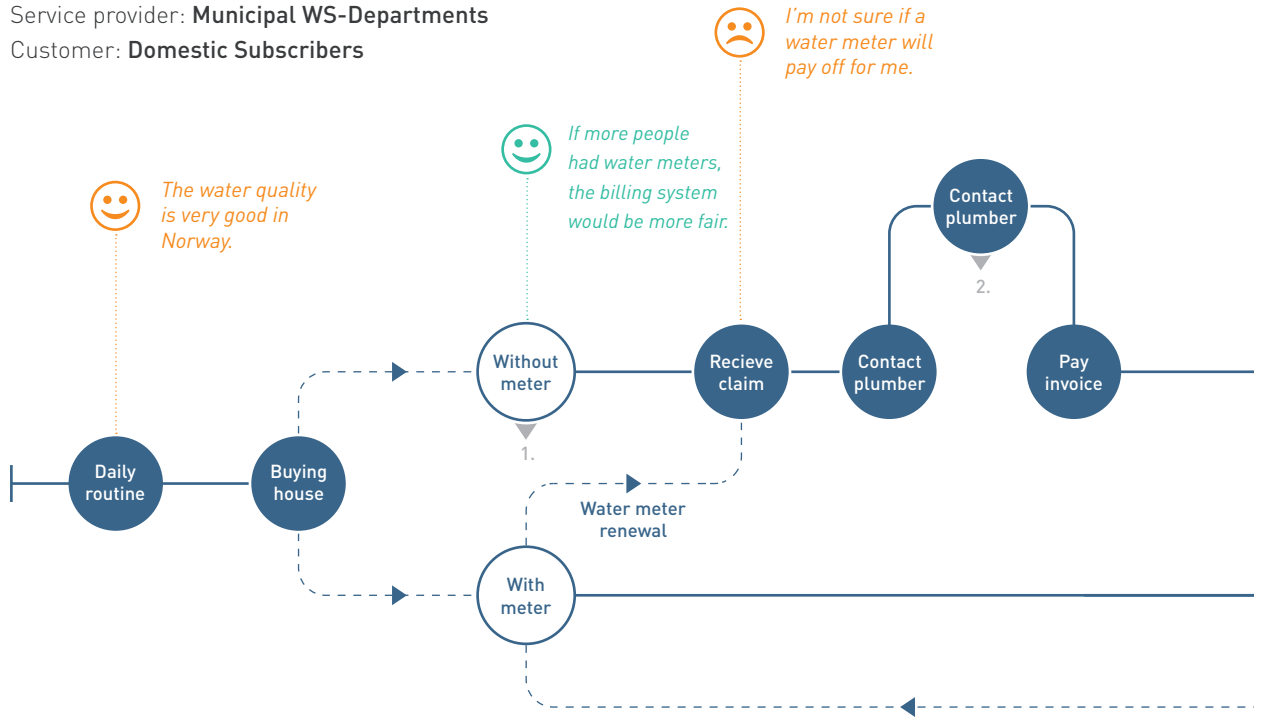
1. WATER METER

Old houses often don't have water meters and the consumption is estimated. Many municipalities advice or require all subscribers to install a water meter.
The water meter has to be replaced every 10-15 years.

2. PLUMBER

Subscribers are not alowed to install their own water meters and have to hire a plumber. Theese plumbers are independent from the municipality. The plumber visits the house for an inspection before he collects the water meter from the municipality, and returnes to the house to instal it.

3. READ WATER METER

The subscriber recieves a meter reading card, he has to physicaly check the value and send the number to the municipality. This number shows consumption and is the basis for the billing.
With estimated consumption you simply recieve and pay the invoice.
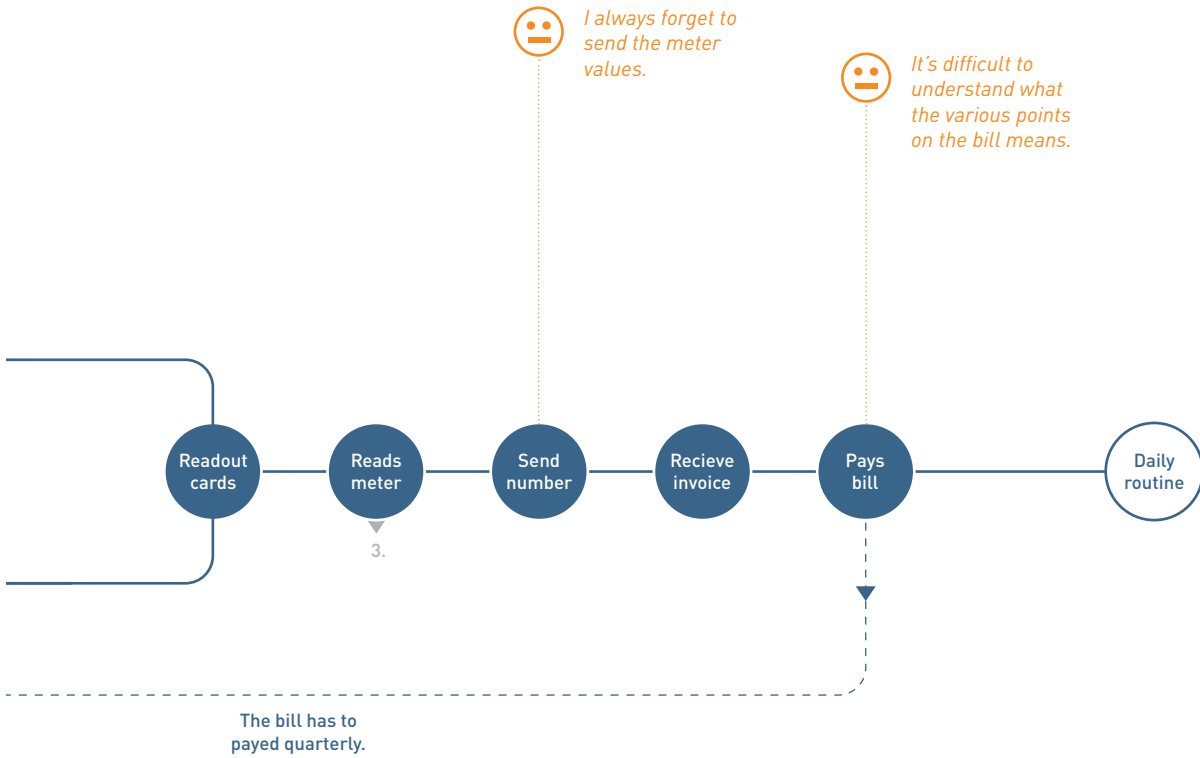
I always forget to send the meter values.

It's difficult to understand what the various points on the bill means.

Readout cards

Reads meter

3.

Send number

Recieve invoice

Pays bill

Daily routine

The bill has to payed quarterly.

CUSTOMER SERVICE

Some municipalities have Expert users who don't need assistance to install the programs.

UNEXPECTED EVENTS

Unexpected events are not included in this description of the subscribers user journey in order to limit the scope. They are briefly discussed in the user scenario section.

Touch-points

The pervasive definition for a touch-point is 'any point of contact between a Customer and the Service Provider' (Schneider, Stickdorn et al. 2012). By looking at the different touch-points and actions the customer experiences during the service timeline, the insights can be summarized in a customer journey and the pain-points can be identified and used as requirements for the concept development. Here is an overview of the most common touch-point between the municipality and subscribers.

1. Phone   *2. Mobile*   *3. Website*   *4. Face to face*

5. Mail   *6. E-Mail*   *7. Facebook*   *8. Brochures*

1. Phone call: *To get in touch with the customer service.*

2. Text message: *If the water is contaminated, or there it's going to be a water shutoff, subscribers are alerted with a text or a pre-recorded message.*

3. Municipal website: *Have much of he information about fee's, regulations and operations. In some municipalities, the public can also report problems that are directly inserted into Gemini VA.*

4. Face to face: *If there has been an accident or something has to be repaired a plumber or service engineer is dispatched.*

5. Mail: *When leaks on private branch pipes are discovered, the owner will receive a notification of maintenance. There are also a number of applications that are sent by post.*

6. E-mail: *But it's getting increasingly common to send applications online.*

7. Social media: *Such as Facebook, is used to update the public about planned renovations and development.*

8. Brochures: *There are a number of brochures produced by various municipalities to guide residence on for example "how to treat excess grease from cooking" or "what not to flush down the toilet".*

Pain-points
A pain-point is a problem, real or perceived by the customer. A pain-point
might be a negative emotion that the customer experiences before, during or
after the service journey, such as undesired costs and unavoidable risks.
(Osterwalder, Pigneur et al. 2015). The intention of identifying customer's
pain-points is to recognize opportunities for innovation and create solutions
to those pain-points. By addressing the challenges, needs and the pains, you
create value for both your customer and your business.

PAIN-POINTS

Marketing
There is extensive information about the WS-service online on various Norwegian sites and municipality homepages. But this is of little consequence, as subscribers neither know where to look or what to look for. vvv

Understanding
Water is an old service, but it is not viewed as a service. Information provided on the website and other touch-points such as invoices are presented in terms and units that the customer does not relate to.

Poor feedback
If you observe a leakage or other errors you can report directly to the WS-department in your municipality through a range of channels. But the municipalities don't give any feedback to the customer, leaving the customer to wonder if the if inquiry was taken seriously and if the problem was fixed. The uncertainty might make them not report the next time they discover a problem.

Attitude
The general perception among the public in Norway is that water is an unlimited resource. It is taken for granted that we have access to clean drinking water straight from the tap.

Quality of information
Close to all municipalities in Norway has a website with information about the water and sewage service. The great issue is that the quality of this information varies a lot between each municipality. And many of the sites are difficult to navigate.

6.2 MUNICIPAL WS-DEPARTMENT

One of the challenges discovered in the research phase was the variation in how the different WS-departments are organised. The number of subdivisions and employees within each WS-department varies throughout, in small municipalities one person may responsible for the same tasks as three employees in a big municipality. For this reason I have chosen to describe the main interaction points that WS-departments have with subscribers, rather than creating personas for specific users.

Customer service
In small municipalities, customer service is divided between all the employees. In larger municipalities customer service might be it's own division, which receive inquiries from subscribers who is calling the WS-department directly, they receive e-mails, various application forms and messages that have been sent through the Gemini message application on their web-site. Some municipalities also offer an online chat service. They are also responsible for supervision of industry, entrepreneurs and follow-up's on private branch-lines.

Fees
Are responsible for registering subscribers, get an overview of how subscribers calculate their water consumption, dispatch meter reading cards and invoices.

Water and sewerage network
When a problem is reported, either by operations or by subscribers through customer service, the plumbers and maintenance workers are dispatched to the area to solve the problem. They have the most face-to-face contact with customers. They usually don't have editing permissions in Gemini VA, but they need access to view the map to get an overview of pipe network and receive notifications from the other subdivisions.

Operations
They are in charge of supervising the pipe-network, and are usually not contacted by subscribers, unless by accident. But they are responsible for sending alerts regarding water-shut off or polluted drinking water. Experienced in working with Gemini melding and VA.

PLANNING
Investment and impovement plans.

SEWAGE NETWORK
operational monitoring and maintenance of sewage pipes.

WATER NETWORK
operational monitoring and maintenance of water pipes.

CUSTOMER SERVICE
operational monitoring and maintenance of sewage pipes.

Needs
- Intuitive user interface
- Standardized options and tasks
- Possibility to customize solution with Powel
- Better follow-up and customer service

Goals
- Reduce leakages
- Reduce stress on system
- Better overview of pipe-network
- Sustainable water management

Concerns
- Security and breaches
- Don't trust that the data is complete

Motivation
- Provide a better service to subscribers
- Better work environment

Technology
- Access and enter information from different devices
- Seamless integration between software's

CUSTOMER JOURNEY

Service provider: **Powel**
Customer: **Municipal WS-Departments**

Decision makers are not the same as the users of the software.

We enjoy the Gemini WS conference. It's a good way of getting in touch with other WS-departments.

Use Gemini → Powel Sales (1.1) → Gemini VA conference (2.) → Want further information → Phone/E-mail → Powel Sales (3.) → Recieve offer → Consider buying → Purchase

Don't use Gemini → Word of mouth (1.2) → Gemini VA conference

Recieve offer → Doesn't buy
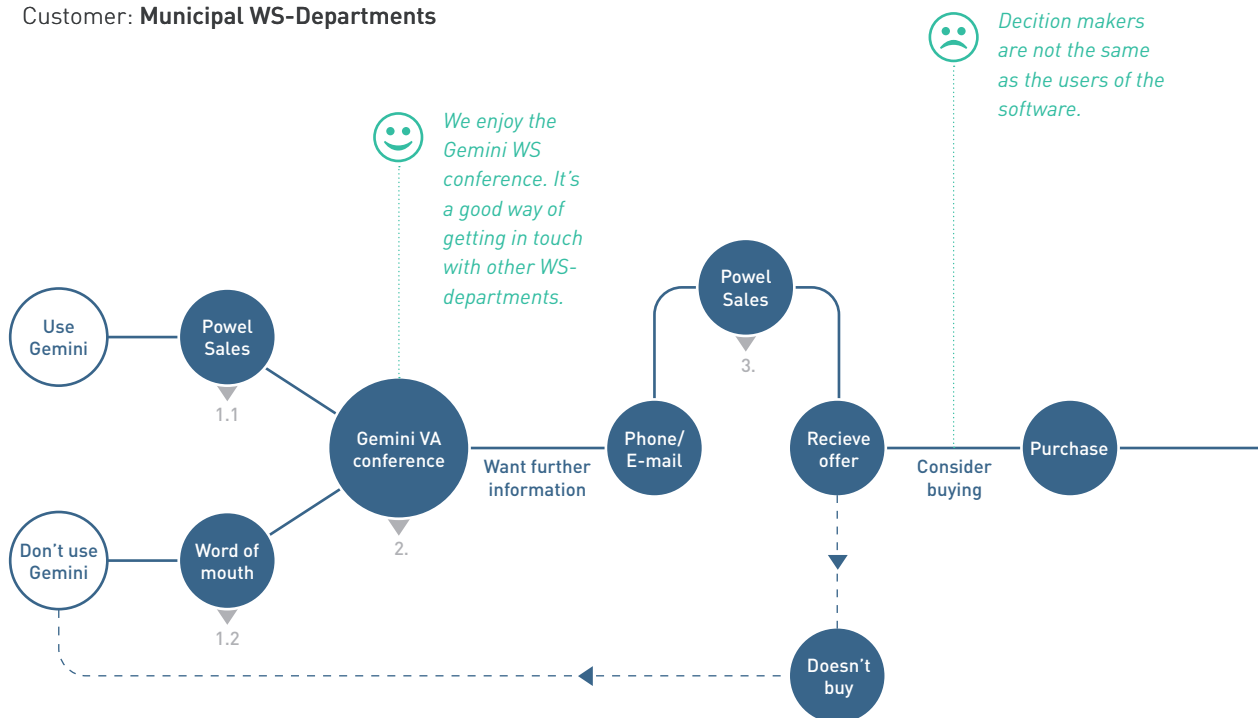
1. RECOMMENDATION

1.1 Sometimes the customer has been recommended the Gemini VA solutions from WS-Departments.

1.2 Consultants and sellers who are visiting customers to hold courses or install products and can often recommend Powel products if he sees there is a need.

2. USER CONFERENCE

The Gemini VA is the greatest event for WS-departments and entrepeneurs a year. Read more about it on page xx.

3. POWEL SUPPORT

Municipalities that want info about different products they have heard about send e-mail or call Support at Powel. Support then pass the request to the sellers so they may establish contact with the customer.

We need expert users because Gemini is very advanced.

Expert users may result in poor knowledge and workflow for other users.

The new updates has made Gemini harder to use.

It doesn't seem like Powel has very good internal communication.

Expert user

4.

Solution setup

Customizes adaptations and configurations

Install system

Training session

Final payment

5.

Issues with applications

Powel Support

Phone/ E-mail

Acquires personal routines

Software update

Powel updates

6.1

Request adaption

6.2

4. EXPERT USERS

Some municipalities have Expert users who don't need assistance to install the programs.

5. POWEL EXIT

When the municipality has accepted the installation they will pay the final invoice and the consultant is finished.

6. UPDATES

6.1 Powel regularly introduces updates and improved functionality in their applications.

6.2 Many municipalities want a custom setup of the software items such as maps or functions. They can hire one Powel consultants to assist with customization.

PAIN-POINTS

Decision makers
In most municipalities the customer and user are not the same. The customers are those responsible for planning and investments, they decide whether to purchase new software solutions or not. The users are the employees at the WS-department, and it's not a given that they have a lot of impact on the decision makers. Today the main part of marketing goes directly to the end-user, but it is also important to market the solutions on a larger scale. The decision makers might be interested in cost reduction, efficient work processes and employee motivation rather than an intuitive interface.

Expert users
Some municipalities have designated expert users for the Gemini software. This means that they don't need as much assistance from Powel if problems arise. That WS-departments need expert users to operate the software is an indication of the software being too advanced and very little intuitive. In the intended workflow for Gemini, all WS-employees should be familiar with the basic functionality and use it as the main tool for documenting.

Leading by example
It is important that Powel has a positive relationship to their customers to strengthen the credibility of their solutions. Due to little feedback and slow customer service some municipalities are under the impression that Powel has poor internal communication and inefficient routines.

Updates and development
The WS-department users are not satisfied with many of the recent Gemini VA updates. They are under the impression that Powel implemented too many requests without consideration their actual needs.
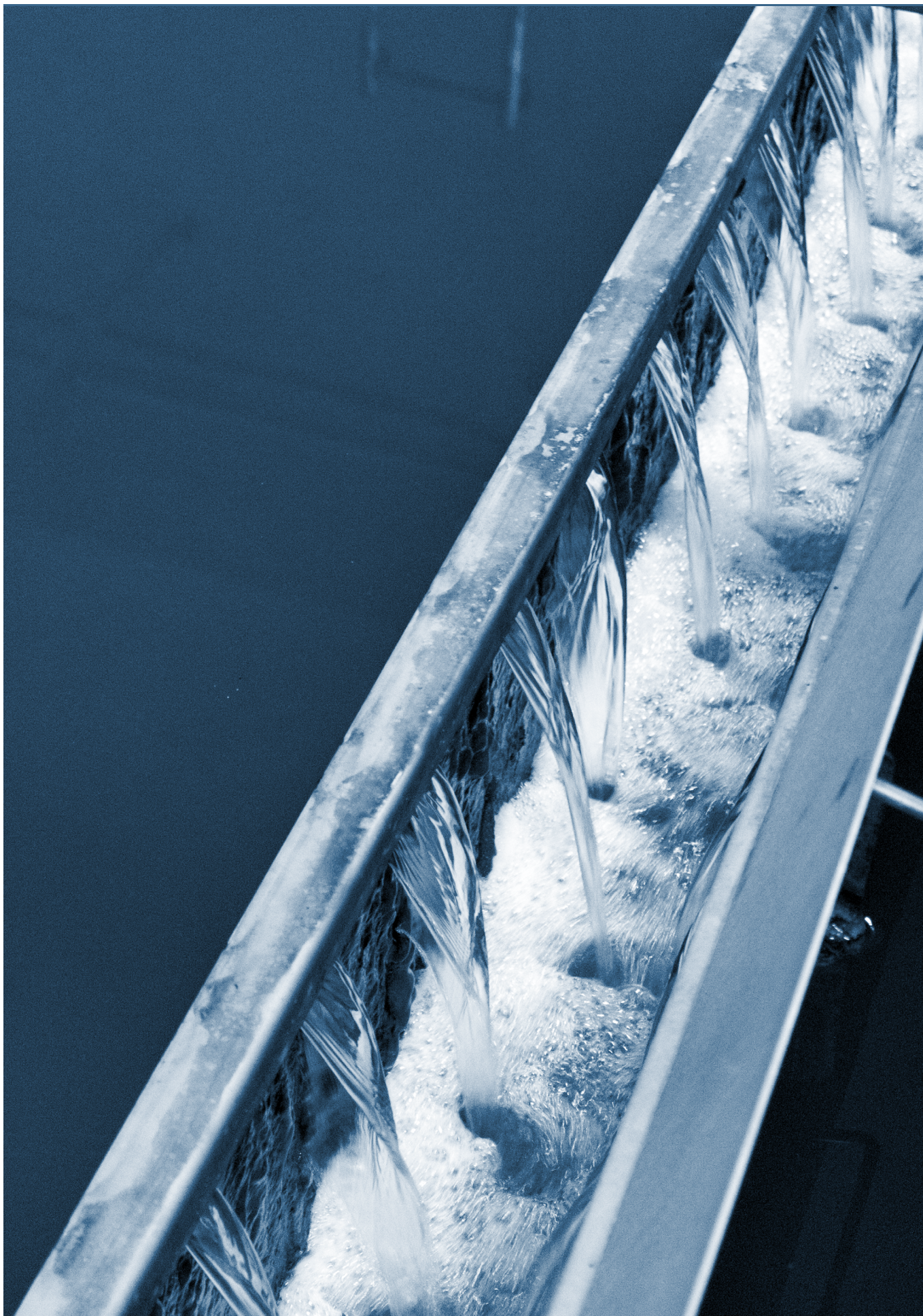
7

DESIGN BRIEF

A design brief is a project-planning document that specifies details of the final outcome. In this chapter each stakeholders goals and needs are presented along with the service vision and requirements for the final solution.

Powel
Powel currently delivers the documentation software Gemini VA to municipal WS-departments in Norway. Gemini VA is used to map the water and sewerage pipe-network and document incidents related to the WS-system, such as leaks and maintenance. This makes Gemini VA an important tool for planning and operating the WS-system. As the focus on sustainable water management increase on both a national and international level, Powel aims to set the industry standard and promote their solutions in international markets. By incorporating cloud-based technology they want to provide intuitive software solutions that are accurate, accessible and facilitate seamless collaboration between different sectors.

Municipal WS-Departments
The WS-department is responsible for the entire WS-system, from producing and transporting water to maintenance of pipes, supervising potential pollution, respond to domestic subscribers, collecting fees and so on. Their main goal is to provide clean drinking water to their domestic subscribers, but this is becoming increasingly challenging with stricter demands for efficiency, antiquated technology and time consuming work processes.

Domestic subscribers
Domestic subscribers are house owners connected to the municipal WS-network. Customers of the WS-service have little knowledge about the service despite the fact that it is operated on a cost recovery system. Meaning that the municipality determines the fees annually so that customers pay for everything.

Lack of information and communication
WS-departments are facing significant challenges when it comes to the
major investment needed to keep up with the maintenance backlog in the
pipeline. The cost will be bestowed upon the subscribers and to achieve social
acceptance for these necessary increases in fees, it is important that their
customers are taken seriously.

Today there is a gap in the relationship between WS-departments and their
customers. The WS-department tries to make the WS-service effortless and
comfortable by making the service practically invisible. As a result, the general
public have little or no knowledge about water and sewage as a service and
might have little understanding for future changes.
This doesn't correlate to the responsibilities domestic users have in regards to
their own private-branch lines, how they can take small measures to reduce
their consumption and pressure on the system and save money on their
annual WS-fees.

Mandatory functions for municipal WS-departments

Must
- Intuitive to learn software system for municipalities.
- Flexible by making it easy to update and integrate new innovation and technology.
- Compatible, with existing software and with different municipalities.
- Make information and communication seamless.

Should
- Be engaging and fun to use

Could
- Help making long-term investments that would pay-off in the long run.
- Reduce stress on the pipe-network, hence reduce the frequency of leakages.

Mandatory functions for domestic subscribers

Must
- Information has to be easily available and understandable.
- Make communication reliable and trustworthy.

Should
- Establish a new perception of water as a service
- Increase knowledge about branch-lines, their location, state and responsibility.
- Reduce the cost of WS-services for domestic households.

Could
- Encourage more people to get educated and want a career in WS
- Reduce water consumption.

WS-department's need

The WS-department lacks support from the public and
don't know how to introduce and explain how small
measures taken by the public can benefit both them
and the WS-department.

Domestic subscriber's need

The public doesn't acknowledge water and sewerage
as a service because the information provided by
the WS-department is difficult to understand and
subscribers doesn't relate to it.

SERVICE VISION

Creating a mutual beneficial connection between
WS-departments and customers by improving
the customer experience through engagement,
information and support.
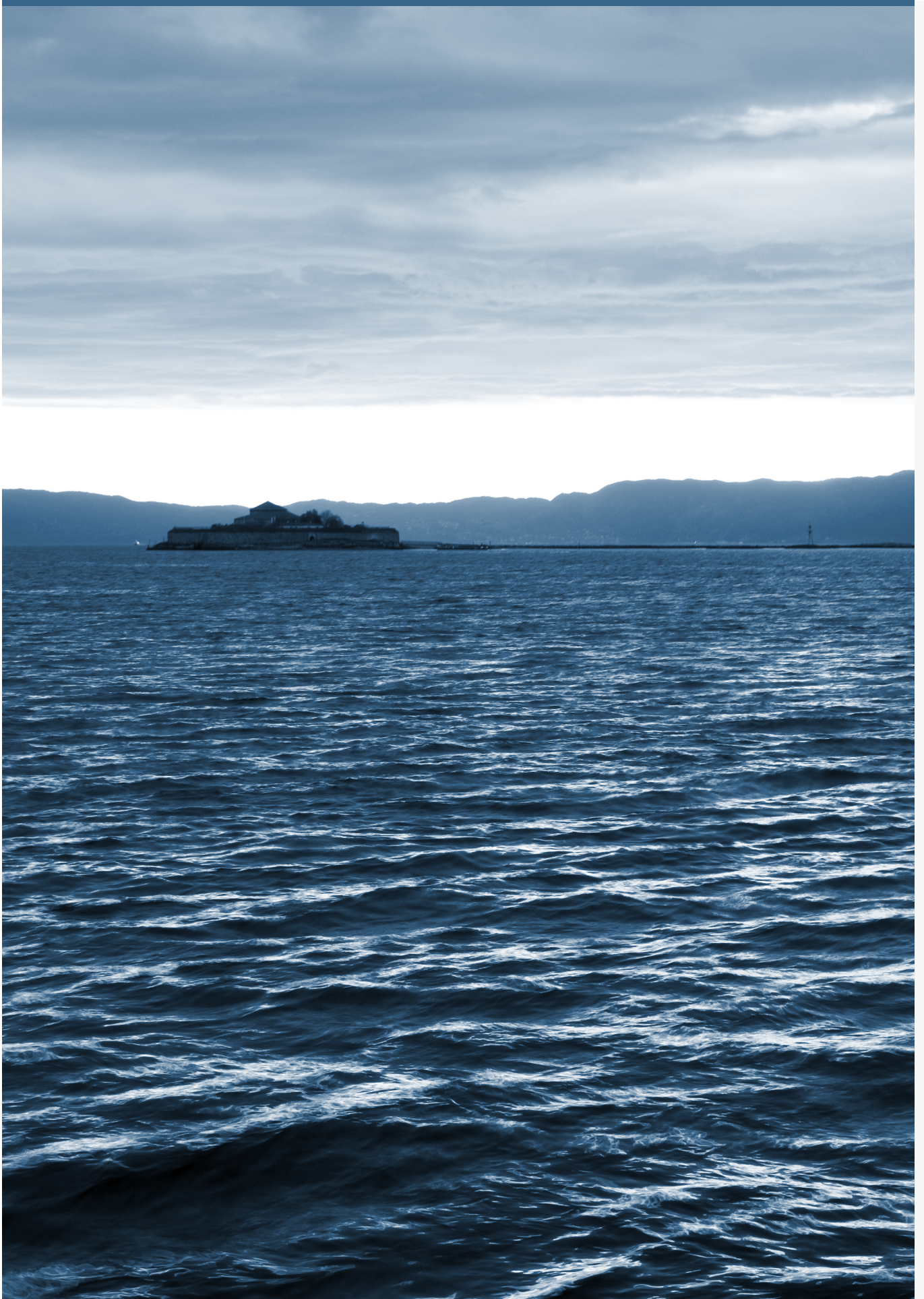
8

CONCEPT DEVELOPMENT

INTRODUCTION

In this chapter the final concept and development will be explained. The concept consists of three parts. The first is the idea for a software solution that facilitates seamless communication between municipal WS-departments and domestic subscribers. The other is a strategy for how the software should be developed and an outline of the time/resources it that would be required to do so. Finally, the improved customer journey with corresponding touch-point that solves the pain-points discovered in chapter 5 will illustrate the benefits and potential of developing such a system.

The chapter begins by introducing the software concept and the strategy for how it could be developed. The concept development phase and final outcome will be described subsequently by following the suggested development strategy.

Introduction to concept and solution
An improved service will consist of many solutions and improvements throughout the user journey. These will provide the domestic subscribers with the right information at the right time, through the appropriate channels.

To realize the upgraded service, Powel must facilitate for communication between WS-departments and domestic subscribers in a way that provide mutual benefits for WS employees and subscribers.

8.1 POWEL SUBSCRIBER

Powel Subscriber is an extension of Powel VA, which will replace the separate software systems that is used to communicate with domestic subscribers today, such as Gemini melding, Gemini Warning, billing systems etc.

The software system will be seamlessly integrated with existing software's and apply pre-defined user journeys to automatically update the information needed from different locations, such as National Registry (Folkeregisteret), Powel VA, operations software, new regulations etc.

Modules for minimal viable solutions
Respecting that all municipalities have different preconditions, needs and budgets, the software would be designed in modules. By creating the initial software as a minimal viable solution, small municipalities with lower budgets could gain entry and get used to the solution before investing in additional functionality over time.

A minimum viable product (MVP) is a term related to product development and refers to low-resolution prototypes that just have basic features that allow the solution to be deployed and tested (Ries 2009). The intention is to get a high return on an investment with low risk. This idea correlates to the intention of the modules, which only have the absolutely necessary functionality to perform the intended task.

This would also be a benefit for Powel, since they could launch the initial solution quite quickly and collect revenue that could be used for further development.

One of the main requirements that were established in the design-brief was flexibility. The module system would make the solution flexible to each municipality's needs, but also to adopting new innovation and technology, such as a module for smart water meters.

Outcomes

Powel

For Powel, the main outcome is a strategy for further developing this software and initializing new modules. The strategy is described on a timeline to show which activities that should take place. This could be an indicator of how much time and resources they would have to invest into this project, if it were to be taken further. One aspect is efficiency, in terms of the project timeframe. By providing a clear staring-point and materials to structure the initial research phase, mapping the needs, propose and test solutions this should be manageable in a short amount of time.

The other aspect is co-creation. By focusing on customer value and iteratively test MVP-prototypes it is possible to establish a solid solution framework in the early stages of development. Co-creation and iteratively testing increases market acceptance of the final solution, before a large time- and monetary investment is made in programing and software development.

WS-department

The final result for the WS-department is a program with an intuitive interface and condensed functionality. The functionality should include:
- Receiving notifications when the program find data that needs to be updated and verified.
- The possibility of adding/removing actions in the user journey.
- Getting summaries and feedback on the data provided by customers.

The software development of this solution is besides the scope of the thesis and not undertaken. But the role of the municipality in the concept development is presented in the development strategy and subchapter 8.3: Further development.

Domestic subscribers

Domestic subscribers would, without much effort, notice that they become increasingly aware of water and sewerage as a service and educated in their responsibilities as subscribers. Reminders and information will become easy to understand and access. Even the processes of registering information will be less time-consuming, more reliable and enjoyable.

1. CONCEPT

Powel develops the functionality for different modules in collaboration with WS-departments and domestic subscribers. The functionality is based on what information WS-departments have to know and what type of information subscribers want to receive.
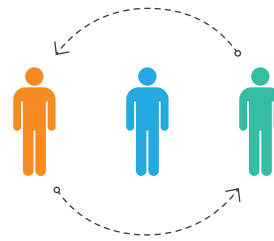
2. MODULES

The system consists of different modules. Each municipality receives and offer from Powel based on which modules they want to purchase.

Paying fees	Construction	Environment	Projects
Alerts	Water meter	Obervation	Prevention
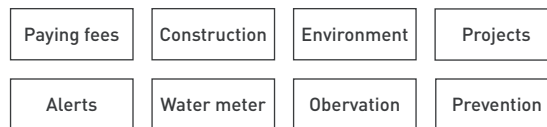
3. CLOUD AND IOT

The modules are connected to the cloud, and get continuous information and updates that it uses to send messages.
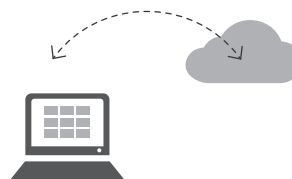
4. COMMUNICATION

Subscribers receive messages and their replies are received by the system, which sorts the data and makes it available to the WS-employees.
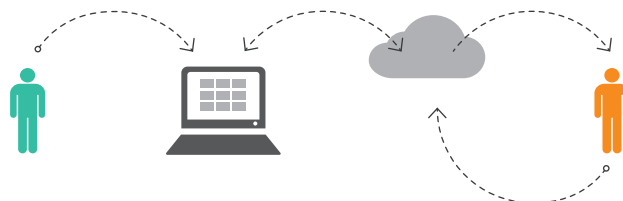
8.2 DEVELOPMENT STRATEGY

The graphic timeline on the subsequent page is a suggestion of how Powel could approach the development of a new module. By involving users and customers at early stages they can to iterative test the modules and reduce risk of product failure. This is not a rigid path, but an indication of the resources and time it would take to develop a successful product. The strategy takes into consideration that Powel use the insights and results described in this report. Therefore, the scope of the research will only extend to identifying needs and pain-points related to the individual module.

DEVELOPMENT STRATEGY

PHASE	Starting point	Discover user needs	Define offerings
ACTIVITY	1. CONCEPT	2. REQUIREMENTS	3. WORKSHOP
SUPPORT PROCESSES	Discover need / Make a deal	Planning / Contact workshop participants	Initial user journey / Brainstorm / Low resolution prototyping
PARTICIPANTS			

Define module

Develop software

4. TEST

5. PROTOTYPE

6. TEST

7. FRAMEWORK

Iterate
offerings

Service
blueprint

Iterate
prototype

Activities

1. Starting point

The starting point is a discovered need of the WS-department or domestic subscribers. This could be done by the Powel salesperson who observe and talk with WS-departments or by customers approaching Powel with a request.

This would only be the initial development of a new software module. When the module is already in place, there is only minor customization for new WS-departments. Powel would also be responsible for evaluating the services and further update and improve them together with municipalities.

2. Initial customer meeting

It is important to establish what the municipality actually wants, what their situation is and their budget. To develop the module, Powel has to know what type of information the WS-department need from subscribers, as well as what kind of information they give customers today and how they give it.
In this stage it is important to focus on the WS-department actual needs, instead of what they say they want. As seen with Gemini VA, the WS-departments thinks that the program has gotten more difficult to use after numerous updates done at the request of customers. The results from this report and the identified challenges and pain-points could be used as a reference.

3. Workshop with domestic subscribers

By inviting domestic subscribers to a workshop, Powel can in a short time map their experience of the service today relating to questions such as:

- What are the pain-points?
- What information do they want?
- When and how do you want it?

If possible, some WS-department employees can be included, this could spark interesting discussions and provide a new perspective for both the WS-department and domestic subscribers. The result of this workshop should define the requirements for the solution and be the foundation for brainstorming and prototyping new touch-points.

4. Testing service-prototypes
This could be done in a workshop setting, inviting domestic subscribers. But to do more iteration and save time, this could be done remotely by sending the prototypes to selected participant and enclose a feedback form.

5. Create interactive prototype for municipalities
When making interactive prototypes, Powel uses Axure, a tool that let you create quick and simple click-through mock-ups, but also advance to highly functional prototypes (Axure 2015). This means that the initial testing would be a simple interface where the focus would be on the functionality, making it as intuitive as possible. But in later phases, the prototype could be made to resemble the finished product, but in a short amount of time and without any coding.

6. Test prototypes with WS-department
The prototypes include the pre-defined user journeys that have been made according to the insights from the workshop. The other is an interactive prototype of the software that would be provided to the WS-departments.

7. Create framework together with program developers
How long time it will take to develop the program depends on the resources and expectations of the final product. How experienced are the developers, how big is the team and how much is the budget?

8. Implement
In the implementation phase, the module is installed by Powel, which also provides tutorials and support.

Concept presentation
The concept development and solutions created in order to improve the WS-service done in this thesis is also presented in the same order as the proposed timeline.

8.3 CONCEPT DEVELOPMENT

The process of concept development that is indicated as a strategy for Powel is used to describe the development of service offerings for domestic users. Below is a summary of the results from the first three phases.

1. Concept
Although ideas for various modules sprung from the ideation phase, as mentioned in chapter 5, it was decided that the scope would be narrowed to include the two modules water meter and fees.

2. Requirements
The requirements for the software interface and functionality based on the identified needs and pain-points of WS-departments are listed in the design-brief on page xx.

3. Workshop – domestic subscribers
The requirements for the service offerings based on the identified needs and pain-points of domestic subscribers are listed in the design-brief on page xx.

The phases that follow the definition of service offerings are related to the software and have not been developed in this thesis. The scope of the concept development and solution has been limited to the service offerings for domestic subscribers. This is the groundwork for the final outcome and required functionality of the potential software, Powel subscriber. The offerings and user journey also illustrates the benefits and effect the program will have.

Define module

1. CONCEPT

2. REQUIREMENTS

3. WORKSHOP

4. TEST

5. PROTOTYPE

6. TEST

7. FRAMEWORK

Brainstorm

Low resolution
prototyping

Iterate
offerings

Service
blueprint

Illustration: The parts that are presented in the development of the modules
"water meter" and "WS-fees" .

Brainstorming

The creativity technique brainstorming was applied to come up with solutions for the identified pain-points that is described in chapter 4.x Brainstorming may be done both individually or in a group, but the intention is to be open-minded and free-thinking in order to spontaneously come up with as many solutions as possible. These should not be restricted by factors as quality and feasibility (Wilson 2013).

To keep an overview of the context and challenges during the brainstorming, the user journey was used during the process. By having the user journey as a backdrop for the brainstorming it was easy to structure the ideas right away, it also worked as a trigger for new ideas.

Although there weren't a structured workshop in the ideation phase, the user journey made it quick and easy to explain the problems and purpose of solutions. Friends, family, co-workers and fellow students were invited to discuss and come up with ideas. This was very helpful for generating more ideas, discovering hidden benefits and potential pitfalls of the solutions.

Structuring and synthesizing
From the big batch of ideas, it is necessary to synthesize and find the ideas that were worth pursuing. The first step was grouping the ideas that were fairly similar and remove the ones that were unfeasible to implement. The second step was systematically critique each idea and concept. Through this evaluation all possible downsides and problems regarding the solution comes up, which forces us to think harder and generate better ideas because we push ourselves to work around opposition (Nemeth, Connell et al. 2001). In the end the ideas were boiled down to just a few solutions to the current pain-points of the service, these were prototyped and tested.
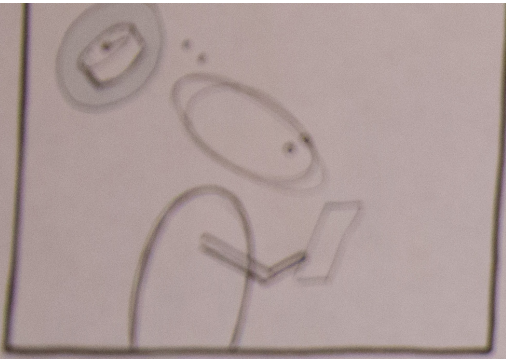
Skjelden

TALE
R DET
BRUKER

Package
"How-to-kit"
included when
recieving the
watermeter

Vann måler   lang sikt
                    → m. og u.
                      vann-måler
kalkulator.   → samfunns
                    messige
                    forhold

med   med miljø
kostnad   gevinst
i dag +
på lang   med fordeler
sikt.   for kommunen.

"Smart
klubb
Det du
gitt dir
noen a
(ex. ny

Lage sk
som og:
som et
for å t
mengder
Shared-\

Low resolution prototypes

By making fast and simple sketches on paper, exploring the type of information and how it could be presented in an efficient and intuitive way was a quick process. In the low-resolution prototypes the main focus was on the content. This was important in order to fulfill the requirements of the design-brief regarding accessible and easy to understand information.

Since it was also interesting to test possible solutions for layout, some samples were created digitally using Adobe Illustrator. Even though they look more realistic, there was no clickable functionality included in the prototypes.

1. Initial ideas for feedback texts and registering water meter value by taking a picture with a smartphone.

2. Suggestions for the proccess of ordering a plumber.

3. Different layout suggestions for the invoice, which displays previous consumption and trends.

1

1. Locked screen

2. Message

10:00

P Trondheim VA
......

<

< Trondheim VA ⓘ

Vi har registrert
at du har installert
vannmåler. Du
vil herved bli
fakturert etter
forbuk.

Send

< Trondheim VA ⚙

Hei, da er det på
tide å registrere
vann måler.
slik gjør du:
1. Ta bilde ved
å trykke på
kamera i
venstre hjørne.
:

Send

Plasser nummer i
[ruten]

1 2 3 4 5 6 0 0

<

Om igjen   Bruk
bilde

2

1.

Order Plumber ✕

⚲ owner   🏠 property

name | surname   house no
phone | mobile   prop no.
adress

Next

3.

Order Plumber ✕

Payment
                    1500,-

Details

BACK   NEXT

2.

Order Plumber ✕

▦ Calendar

Month ▽

selected

15.08.15

BACK   NEXT

4.

Order Plumber ✕

Confirmation   THANKS
                        FOR
Receipt   ORDERING
○ SMS
○ E-mail
○ Print

3

LOGO

water
consumption

SUM

LOGO

water
consumption

TIPS

LOGO

water
consumption

other
other

SUM
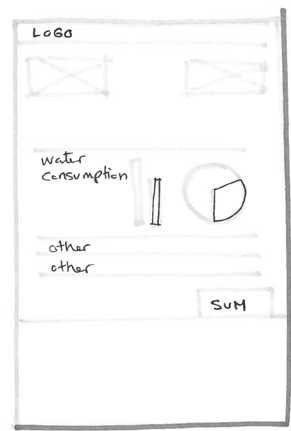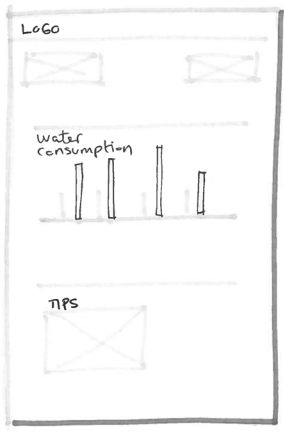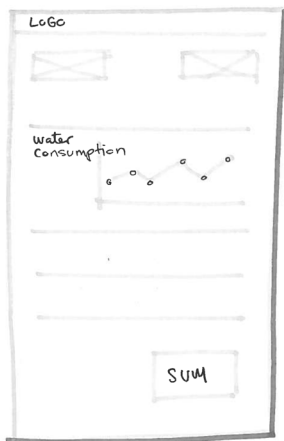
TEST

To test the prototypes, the desktop walkthrough method was used to simulate the context related to the different touch-points and physical evidences. By creating a small-scale model of the service environment, the service prototypes are placed in a tangible set-up. This allows the workshop participants to analyze and discuss the touch-points and service journey.

A list of materials and prototypes, together with the feedback from the workshop is listed in the appendix.

Key findings
- Very positive to less manual work
- Think the content and channels for information is good
- It could be even easier for the customer to relate the service if there were a bit more details on how doing the different actions would affect them. And bring the numbers down to a scalable level, ex showers per day.

Motivation based on installing water meters to help municipalities wasn't as important. The general feedback was that the subscribers had little interest in knowing that the municipality doesn't have a good overview of water withdraws. It was more important that installing a water meter would benefit the subscriber.

The consistent comparison to how the electricity-service operates reinforced the impression of low knowledge of water and sewage in relation to the corresponding services.

Feedback on service offerings

REMINDER

What is the
consequence of not
reading the meter?

You should be able to
choose to be notified
one more time.
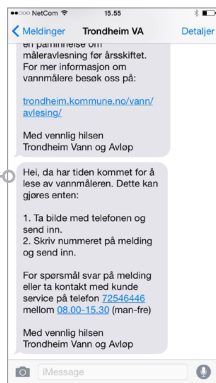
INVOICE

Tips are good!

Bring the numbers into a scalable
level, such as showers per day.
Maybe there could be saving tips!

ORDER PLUMBER
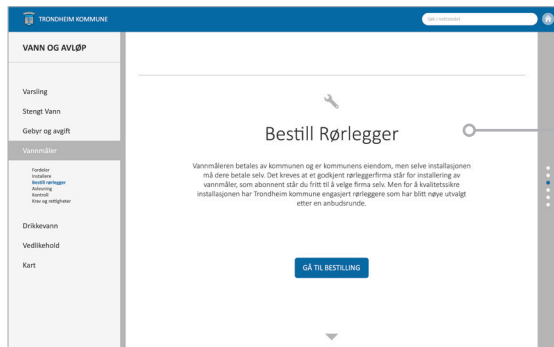
It should be possible to see the
total cost of getting a water meter
and how much you could save
before ordering an installation.

BROCHURE

The font is too small and difficult to read.

The plumber should inform the domestic subscriber about the future course of the service and help those with special needs. For example older people without a smartphone.

Illustration of how a house is connected to the WS-system, makes it easier to relate to the service.

This is the most important page.

METER READER

This philter isn't possible without downloading an app.

Which led to this solution. A simple sticker that will make the water meters recognizable to the OC3.

New service offerings

In the design brief, the most important requirements were that the information has to be easily available and understandable. And the communication with municipalities has to be reliable and trustworthy.

The main focus when developing the new service offerings was therefore to keep the information short and concise. In order to make the information easy to understand, WS-industry specific terms and expressions were left out in favour of explanations that were easier for the general public to relate to. The tone was slightly informal so the message would be experienced as more personal for the customer.

For each action or effort the subscriber is asked to do they are informed of the intention of performing the task and the consequence of not replying. An example is the reminder to read water meter: the subscriber is informed that it is important in order to calculate the consumption. If the water meter isn't read, the bill will be based on estimated consumption and cost xxxx NOK.

If the subscribers choose to follow up the request by reading the water meter and send the values, they immediately receive confirmation and result of their effort. The feedback from the WS-department is an important part of building trust between the domestic subscribers.

The illustrations and graphic elements are kept simple. On the printed materials the layout is airy and the important information clearly highlighted. The results can be seen on the preceding pages.

New touch-points
Throughout the research phase, many of the domestic users compared the WS-service to the service provided by power suppliers. This became part of my inspiration for the concept development.

1. Invoice
The current invoice is very technical, and impossible to understand in terms of how much water you have used. To see the trend in water consumption, detect potential leakage and to be able to plan how much you can afford

to use, the consumption is visualized as a bar graph. The invoice is easy to read and highlights the most important information. There are also tips and comparisons to consumption, so it is easy for the user to know how simple measures can be taken to conserve water.

2. Sticker
The water meters have to be standardized for the computing system to read them properly from a picture. The sticker makes sure that the right numbers are read, and instructs the subscriber in how to take the picture.

3. Order plumber
The order plumber service is a new proposed service offering. As of today, the subscriber has to contact the plumbers directly and arrange the installation. This can require a lot of effort, since the different plumbing companies varies in price and quality. To ensure the quality and price of the installation the municipality can arrange a deal with the best local company. In this way the service may be paid for in advance, and the subscriber can avoid unforeseen costs.

4. Plumber
When installing the water meter, the plumber makes sure that the customer are informed about the responsibilities, the course of the service and measures they have to take. If there are customers with special needs, the plumber should make sure that they get the service adapted to their requirements.

5. Brochure
The brochure is complimentary the information letter, which is a standard letter written by Norsk Vann. The intention is to inform domestic subscribers about the installation of water meters. Today the brochure offers quite technical details and the listed benefits doesn't provide enough incentives for installation compared to the cost and effort the subscriber has to go through. The new offering is easy to understand, gives clear information about the benefits, the actions and the responsibility of the user and clear direction to where it is possible to acquire more detailed information.

LOGO

✉ Adresse 11
0000 Byco

📞 00 00 00 00

NAVN NAVNESEN
ADRESSE 11
0000 BYEN

Fakturanr:	00000000
Kundenr:	000000
Org.nr:	00000000AAA
Fakturadato:	00.00.2015
Betalingsfrist:	00.00.2015

■ MÅLT VANNFORBRUK

1. periode 2014-2015

Ditt vannforbruk i m³

2014 ———
2015 ———

Stipulert forbruk

2015 --------

Totalt: 6000 kr
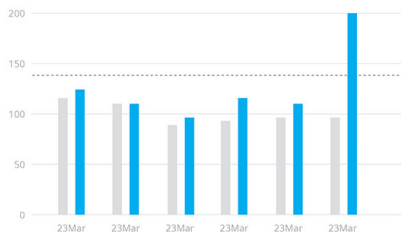
(bar chart: 200, 150, 100, 50, 0 — 23Mar, 23Mar, 23Mar, 23Mar, 23Mar, 23Mar)

TIPS

• Dersom du har fått et plutselig økt forbruk uten at det er noen klar grunn kan dette være tegn på at du har en lekkasje i huset.

For å se hvordan du kan søke etter lekkasjer gå til www.trondheim.kommune.no/lekkasje

• For å slippe å få papirpost kan du enkelt opprette e-faktura i din nettbank. Du vil fortsatt få informasjon om ditt forbruk på E-post.

• Har du spørsmål, kontakt vår kundeservice eller søk på våre hjemmesider.

Beløp

2826,24
-2929,28
4993,92
-5176,00

212,00
351,50

xxxx

xxxx

xxxx

lt: 6500 kr

Blankettnummer
6450805342

Belast konto		Kvittering tilbake

	Kundeidentifikasjon (KID)	Kroner	Øre	Til konto	Blankettnummer
H			< >		<6450805342>

2

Ta bilde her
[ ] m³

3

LOGO

Bestill Rørlegger

Vannmåleren betales av kommunen og er kommunens eiendom, men selve installasjonen må dere betale selv. Det kreves at et godkjent rørleggerfirma står for installering av vannmåler, som abonnent står du fritt til å velge firma selv. Men for å kvalitetssikre installasjonen har Trondheim kommune engasjert rørleggere som har blitt nøye utvalgt etter en anbudsrunde.

BEREGN KONSTNAD

| Pers i husstand | Postnummer | Bolig areal | Byggeår | **BEREGN** |

GÅ TIL BESTILLING

4

●●●○○ NetCom 🛜 17.04
‹ Meldinger   **Trondheim VA**   Detaljer

2004

Lest 15.12

Ditt forbruk har økt siden forrige registrering. Dette kan være et tegn på lekkasje, for mer informasjon om lekkasjesøk besøk oss på
trondheim.kommune.no/ vannskade/

Fakturaen vil bli tilsendt i begynnelsen av januar.

Med vennlig hilsen
Trondheim Vann og Avløp

📷 iMessage

Ola Nord
Rørlegger

For spørsmål om vannmåler ring meg på:
Mobil 936 827 382

5

VANNMÅLER
En informasjonsbrosjyre fra
Trondheim kommune

STORYTELLING

WS – A CUSTOMER FOCUSED SERVICE

Storytelling is a tool to communicate the purpose and benefits of the new service offerings by placing them in the intended context. In this section, the service offerings are presented as touch-points on the customer journey.

The improved customer journey is presented through two scenarios, corresponding to the scenarios and customer journey in chapter 5. The initial scenario shows the acquisition and installation of a water meter. The second shows how the service progress after the water meter has been installed in relation to reading the meter and paying WS-fees.

The story follows Daniel, a character based on the previously established personas and customer scenarios. Daniel just bought his first house, he fits in the primary user segment. The area of the residence is used to estimates the water consumption. As he is quite young and a new house owner he is inexperienced, and doesn't have a lot of knowledge about the WS-service and his responsibilities as a house owner.

Introduction
Daniel is a 29-year-old architect, born and raised in Trondheim. A couple of months ago he purchased his first house together with his girlfriend of four years. He is quite active and they love to travel, which they do quite often. He wanted to get a house because he enjoys building and creating his own solutions, but building a house from scratch seemed as an overwhelming task at the moment.

▲

Because the water consumption is estimated by residence area, Daniel thinks that the WS-bills will get quite high. It is a big house, and they are rarely home.

Last week ha saw a notice in in the regional newspaper 'Adresseavisa' where they mentioned some of the benefits of installing water meters, and he thought this seemed like a good idea.

Installing water meter

▲

A week later he received a letter from the WS-department in Trondheim. He remembered the article he read and was surprised that they delivered the information so fast.

Daniel opens the envelope; he sees the letter and brochure. The letter looks quite formal and long, so he puts it away in favour of the brochure.   ▶

The brochure is easy and fun to read, and he would like to see how he could benefit from getting a water meter.

▲

He sees that there are more information on the municipal website.

After putting on a kettle of coffee he find his computer and visit the municipal website. He enters "water meter installation" in the search bar, and is directed straight to the information on water meters.   ▶

▲
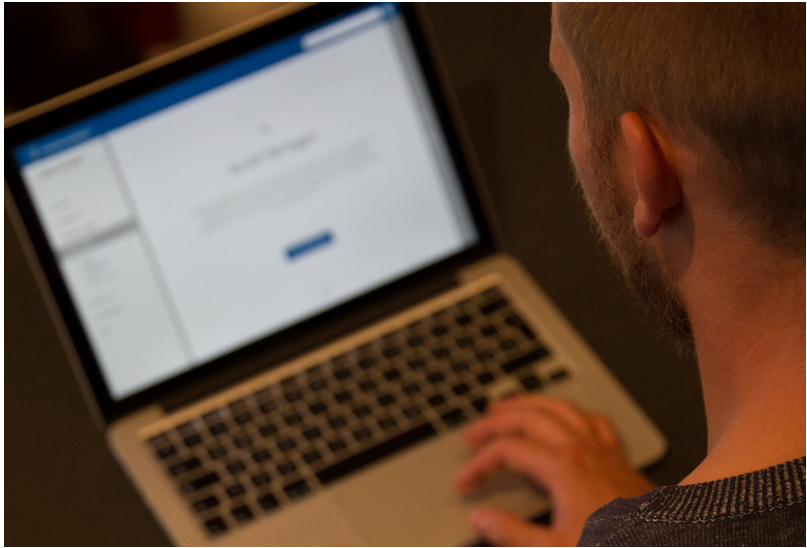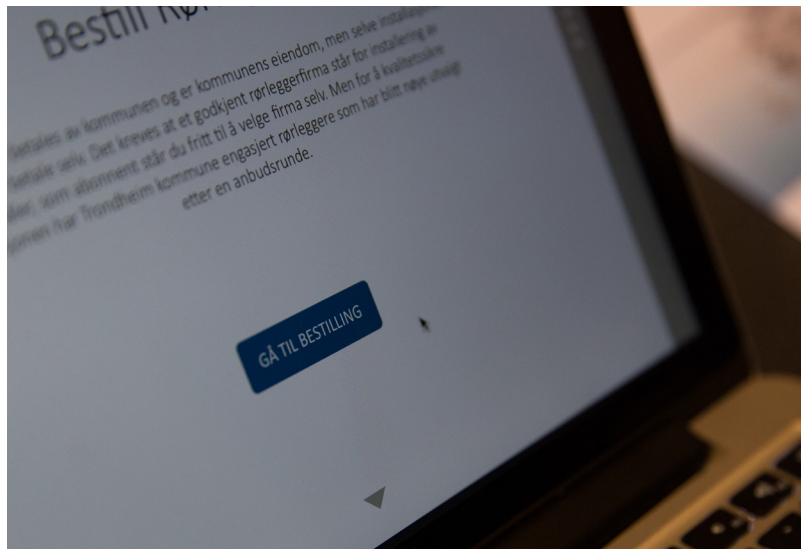
*He finds a direct link to ordering a plumber. Usually he doesn't trust these
kinds of services without checking for various offers. But it is stated that you
may use any licenced plumber for the installation, the plumber service offered
by the municipality have been subject to a tender-offer. This means that the all
competitors were evaluated and the cheapest offer was chosen.*

*The submission form is fast, he likes that it is possible to choose a time and   ▶
date for the installation and that it's a fixed price that he can pay in advanced.*

1. Enter details

2. Choose time and date

3. Recieve confirmation

1

BESTILL RØRLEGGER   ✕

VELKOMMEN   EIENDOM   TIDSPUNKT   BETALINGSINFORMASJON   BEKREFTELSE

EIER

| Fornavn | Etternavn |

| Telefon | Mobil |

| Adresse |

| Postnummer | Sted |

EIENDOM

| Gårdsnummer | Bruksnummer |

❮ Tilbake   Neste ❯

2

BESTILL RØRLEGGER   ✕

VELKOMMEN   EIENDOM   TIDSPUNKT   BETALINGSINFORMASJON   BEKREFTELSE

TIDSPUNKT

| Dato 📅 |

Velg klokkeslett

○ 08.30
○ 12.15
○ 13.00

   Neste dag ❯

❮ Tilbake   Neste ❯

3

BESTILL RØRLEGGER   ✕

VELKOMMEN   EIENDOM   TIDSPUNKT   BETALINGSINFORMASJON   BEKREFTELSE

*Betalingen er registrert. Rørlegger Ola Nord fra Rør Rørleggerfirma
innstallerer vann måler hose deg den 10.10.2015.*

TAKK FOR DIN BESTILLING

Ønsker du kvittering?

○ Tekstmelding
○ E-post
○ Print

❮ Tilbake   Lukk

"The meter is installed according to the municipal regulations, and I've tried to place it so it's easy to read. I'm going to send a verification of the installation to the to the. When they have registered the installation you will receive a confirmation on your phone.

You will also have to read the meter four times a year, but you will get a reminder when it is about time. Now it's as easy as taking a picture of the meter or just write the number as an answer to the SMS. If you need more information just look at Trondheims website."

◄ The plumber arrives on time and installs the water meter. It's quite fast and when the installation is complete, the plumber gives Daniel a short summary of the done work. He also informs Daniel of what he has to do to read the meter properly and how often.

▲
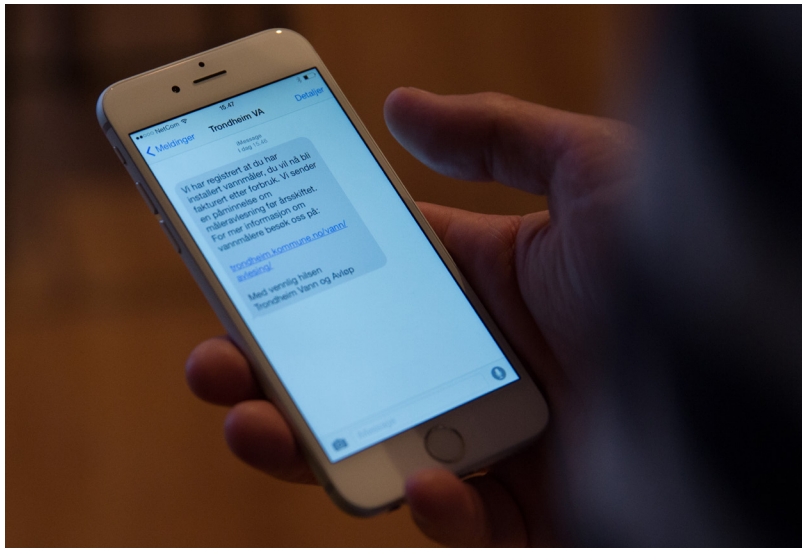
When the municipality has registered the installation, Daniel receives a
confirmation by text.

▲

Daniel thought that the installation was quick and easy. Because he received an overview of the final costs before he decided to install the water meters and the plumber was punctual he experienced the service as reliable and efficient. The information provided by the plumber was concise, and since he will get reminders when it's time to read the meter he doesn't have to worry about forgetting it.

Paying fees

▲

As promised the reminder is given in time for reading the water meter. He received the message as he got home from work, and he decided to get it over with right away, and heads down to the basement.

The text instructs that he has three options, to send a text with the values, send a picture of the meter or call customer service. He decides to take a picture, as he thinks it's the fastest option.   ▶

▲

As promised the reminder is given in time for reading the water meter. He received the message as he got home from work, and he decided to get it over with right away, and heads down to the basement.

▲
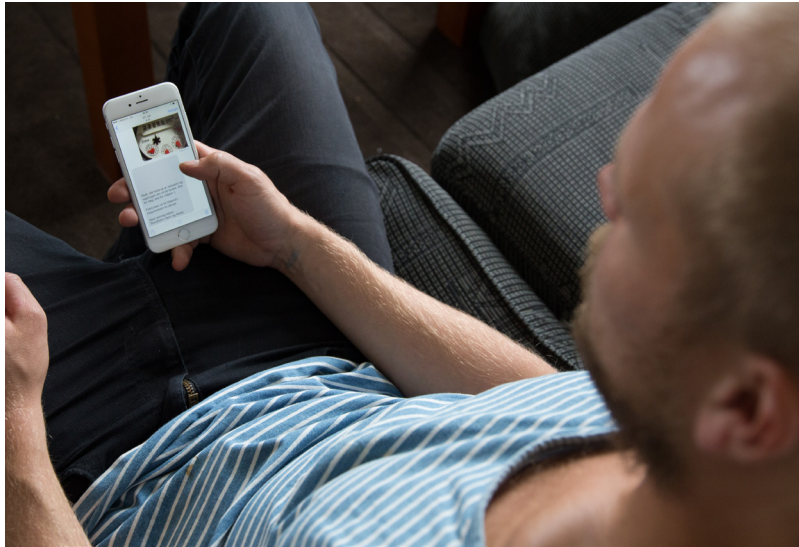
*He instantly receives a confirmation that the values are registered, the
message also gives some feedback on his consumption and estimated price.
It seems as his consumption has been reduced a lot after installing the water
meter, and Daniel is pleased.*

◀ *The text instructs that he has three options, to send a text with the values, send a picture of the meter or call customer service. He decides to take a picture, as he thinks it's the fastest option.*

The text instructs that he has three options, to send a text with the values, send a picture of the meter or call customer service. He decides to take a picture, as he thinks it's the fastest option.

▼

Customer reflection

Daniel is pleased with the new service. He appreciates that he understand the invoices, and that he is beginning to relate to how much water he uses compared to what he pays. Water is important, and although he sees himself as an environmental conscious person, it is good to know that you can contribute just by taking small measures.

He even sees the Trondheim fjord in a new perspective.

SERVICE BLUEPRINT

Service provider: **Powel and Municipal WS-Departments**
Customer: **Domestic subscribers**

Phase
This describes the phases that the domestic subscriber goes through during the service.

Physical evidence
These are the tangible touch-points that the domestic subscriber encounters along the service journey. This may be forms, applications, products, physical locations and so on.

User action
This is the customer journey, or the steps that customer hasto take to access the service.

Line of interaction
This is the point where domestic subscribers and WS-departments interact.

Front stage
These actions are face-to-face actions between WS-employees and domestic subscribers.

Line of visibility
Beyond this line, the domestic subscriber doesn't see what happens in the service.

Backstage
This is all of the actions that the domestic subscribers don't see, but are required to produce the service.

Line of internal interaction
This separates the WS-employees from the support processes.

Support process
This are the activities carried out by external partners in in order for the service to be delivered.

If the service blueprint poster
is gone, there are a smaller
version in the appendix.

8.4 FURTHER DEVELOPMENT

In chapter 4 the scope of the assignment was narrowed in order to continue the research and come up with a solution. The goal was to improve the service for domestic subscribers, thus the focus throughout the concept development has been on showing the outcome and increased value for domestic subscribers. At the same time, service design is a holistic approach, meaning that it is important to show what measures and processes that have to happen in order to develop and implement the new service offerings. For this reason, the roles and actions that has to be taken by Powel and WS-departments has been clearly stated, but instead of specific solutions, a proposed plan for further measures and development has been suggested.

The next step towards creating the interface for WS-departments would be closer collaboration with software developers and workshops with WS-departments that focus on communication with domestic subscribers.

Additional aspects
There are some aspects that would be useful to access for further development, which has not been deliberated upon in this thesis. To deploy the proposed development strategy it is necessary to look at the internal organization of Powel. If they have the necessary resources and establish who's going to be responsible for the new tasks. Another aspect is marketing, in the research phase it appeared as if the initial marketing was satisfactory. But it is based on long-term customer relationships and little competition in the market, which might be a challenge if Powel intends to move into highly competitive international markets. Lastly, governmental agencies are subject to strict regulations when procuring goods, services, construction, or other benefits to state, municipalities. Without having a clear indication whether or not the new Powel VA will fall under these purchase conditions, it is still an important aspect to consider.

Developing the software

The idea of the software is based on constraint programming, which allows developers to describe what they want to do, and then rely on a mathematical solver to figure out how to actually do it. It's this underlying technology that would enable Powel Subscriber to perform a lot of the communication with domestic subscribers seemingly autonomously. The technical features and requirements of the software development are not specified in this thesis. But after conferring with programmers at Powel, the proposed concept is viable.

Workshops are an important part of co-design and provides great feedback if they are properly planned.

Example

Solution framework example
The solution framework would include all the insights, requirements and architecture of the interactions. This should be created in collaboration between the design team, software developers and executives at Powel in order to concurrently decide on time and budget.

On the following page a rough example of how the "fees module" framework could be presented. This example is a rough sketch of how the solution might look, it has not been prototyped, tested or developed, but is intended as an inspiration for further development.

Communication:
This describes how the communication takes place, through what media and alternative actions.

Information:
This defines the background information that has to be provided on the municipal website.

Interface:
This would be based on the interactive prototypes created and tested with WS-employees. It would show the needed functionality of the software and how an overview of the data provided by consumer would be shown to the WS-employees.

1. Define recievers

House owners in municipality x

Estimated consumption   Water meter

2. Define communication

Reminder

Answer   No answer

Text
Picture
Customer service

Confirmation

Invoice
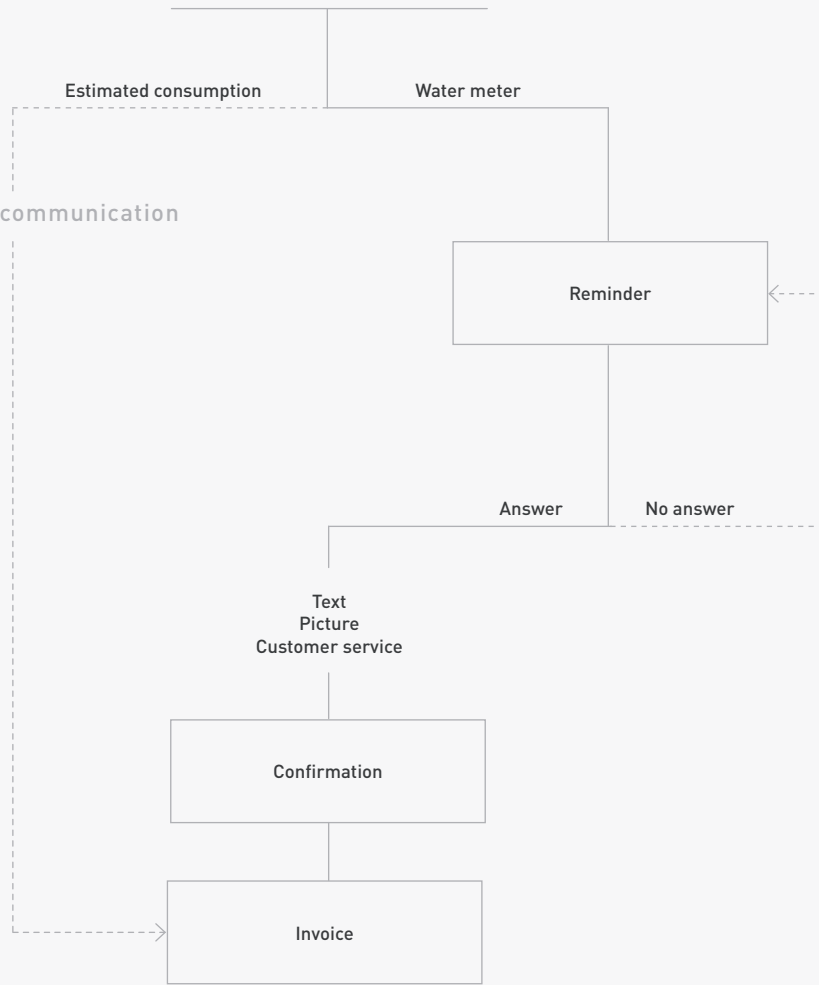
8.5 REFLECTION OF SOLUTION

This subchapter summarizes the initial insights and challenges and how the new solution might have a long-term impact on these. The immediate benefits for the main stakeholders are also presented.

Powel
Powel's initial goal was to increase customer gratification, set the industry standard with their software solutions and expand to international markets. The proposed concept, Powel Subscriber is a flexible solution that can adapt to new markets and innovation. The proposed strategy would lead to user-centred solutions with a stronger customer relationship and loyalty.

The greatest benefit for Powel is an increased probability of market acceptance for new solutions, products that are valuable and desirable for their customers.

Since Powel Subscriber is based on modules, it's an evolving system that Powel could continue making a profit by introducing new modules, even if the Norwegian market becomes saturated.

WS-departments
The aim of municipal WS-departments is to deliver clean drinking water to their subscribers and meet the requirements set by the government in terms of quality and safety.

The solution would provide a structured way of delivering necessary and automatically document the data and feedback. With intuitive visualization and notifications, municipal employees will get a better overview of their paying customers, their facilities and branch-lines.

By working closer with Powel, WS-departments will have a greater influence of the final solutions and make sure they correspond to their needs. The solution would reduce the workload by moderating manual documentation and give employees' better overview and might offer a sense of accomplishment.

Domestic subscribers

There are various initiatives subscribers can take to reduce the municipal WS-fees and ones impact on the WS-system and environment. Subscribers are interested in getting this information in an accessible and intuitive way.

By making the information reliable, relevant and easy to understand, people will become aware of the WS-service and their responsibilities as subscribers. With the new perspective on WS-services, subscribers can be important contributors to efficient water management by providing accurate information and giving municipalities knowledge of actual water consumption.

The main benefit for consumers is that easily acquired knowledge can help to avoid unforeseen and potentially costly incidents such as leakage. It also offers the possibility to schedule water consumption according to budget.

Ripple effect

The starting point for the thesis was the external challenges the WS-industry is facing, aging infrastructure, climate change and information security. In the discovery phase the internal challenges that makes the WS-departments unequipped to deal with these challenges was identified as: cumbersome workflow, poor data quality, deficient communication, lacking recruitment, alternating organization and attitudes towards sustainable water management.

These challenges are intricately related, to deal with these challenges WS-departments are dependent on better knowledge about the state of the system and reducing the amount of time WS-employees spend on manual tasks. But incorporating and adapting new work processes to such an intricate organization is difficult.

Powel Subscriber offers an entirely new way of approaching domestic subscribers that will be perceived as a seemingly simple, yet effective system by it's users.

The software makes it easy for WS-employees to see immediate benefits of automating and standardizing tasks. Investing in systems that enable

employees to focus on important jobs that require skills and knowledge, rather than repetitive tasks that can easily be done automatically provides a better work environment and more effective water management. The ultimate goal for Powel Subscriber is to become the stepping-stone towards innovation and advantageous use of technological aids in the WS-industry. In the illustration on the next page, a possible consequence of hoe the development of Powel Subscriber may influence other challenges within the WS-system.

Potential pitfalls
The difficult workflow that many municipalities are experiencing is the result of a vast amount of different programs and applications they work with today. Most of the programs aren't integrated and developed only to solve a specific task. So is the solution to improve work processes to introduce yet another software?

Powel Subscriber will be an extension of the forthcoming Powel VA; it will replace many of the programs today. The software will handle most tasks automatically, and information such as important notifications from the public will appear right in the Powel VA map. All of the complex back-end programming would be handled by Powel and of no concern to municipalities.

Obsolete jobs
By automating many tasks currently done almost manually, many fear that their jobs will become redundant. The intention of atomising documentation and notifications is to free up more time and re-define jobs. In this way, the knowledge and skills of employees can be put to better use, for example consulting entrepreneurs, align maintenance work with other departments, faster response to any leaks and so on.

By providing the employees with engaging tasks that utilizes their knowledge rather than their time, the work environment would be improved and the industry as a whole could become more attractive to students and young professionals.

Security and hacking
Today the system security is based on the fact that hardly any information is located in the same place, and a lot of it isn't even digitalized. By introducing a cloud-based solution where all information will be stored in the same location, security will be an important issue.

Extending to an international market
For an international market there are additional aspects that should be taken into consideration. In many countries, the WS-industry is privately owned, rather than governmental and not have the same revenue streams as the self-cost system provides. WS-corporations may not have previous knowledge about Gemini, and might be reluctant to change their entire system. The Powel VA extension might have to be compatible with software form other providers.

Final cost
The intention of the thesis is to lay the groundwork for further innovation by presenting areas of opportunity and general requirements for Powel VA software, based on insights from their customers and their customer's customers. Considerations as cost, time and resources have been mentioned, but not been determining factors for the result. The development strategy is designed to be efficient and result in effective research and feedback sessions that will take a short amount of time and produce valuable results. But the final cost depends on development of the software.

Final conclusion

The final result is an outline of the software solution for municipalities. In order to create a starting-point for a final holistic solution, it was important to include the requirements and benefits of Powel, WS-departments and domestic subscribers. The service blueprint shows the roles of the involved stakeholders and how they each have to support the process for the improved service to act seamlessly.

Water and sewerage is an industry that receives remarkably little attention from the public, politicians and media. The Norwegian industry has experienced little innovation and technological advances in recent years. In the research phase it became clear that WS-departments have a lot of expectations of Powel and how Gemini VA could set a new standard for water and sewerage operations. But without a clear strategy of how Powel can identify the needs and fulfill these expectations. And therefor the result of recent Gemini updates has been for the worse from a user perspective.

Because the goal was to improve the service experience and the public's relationship to WS-service, it was important to focus on the final outcome for the domestic subscriber. Initially, the aim of the thesis was to create an interface prototype for new software for WS-departments. But in order to start the development of the software concept, it was essential to have a clear definition of the required functionality for the software solution. These requirements are based on the new service offerings that have been developed from the perspective of the domestic subscribers.

The WS-departments expect Powel to provide solutions that delivers a high level of innovation and improvement. The self cost system makes it difficult for municipalities to take their own measures for improvement. Although the funds are sufficient to support daily operations, there is little funding to implement long-term investments. The self-cost system seems to be the main damper on innovation within WS.

The approach used to improve the quality of service for the customers was by improving the interaction between the provider, WS-departments and their customers, the domestic subscribers. It is important that customers of WS-

services perceive water as a service they are paying for, not an inexhaustible source that is just there. By researching the current situation and need of the customers, it was possible to redesign existing service offerings and formulate new ones. In the concept development phase it was important to focus on discovering which information was relevant for the customers. By making this information accessible and easy to understand, the service becomes useful for the customers.

Because the water and sewerage industry is based on a self-cost system, the WS-departments get the funds they require just to operate. Another aspect of the self-cost system is the lack of a financial motivation for improving their customer relationship. In this thesis, the motivation that is basis for WS-departments are the value of improved information quality and reduced workloads in documentation. The proposed concept ˝Powel Subscriber˝ would increase efficiency in daily operations.

The suggested development strategy includes the outline for organization of people, communications and materials needed to create a system that lives up to the expectations of WS-departments. The new service developed by Powel in collaboration with significant stakeholders, would become desirable for the users and by gaining customer approval will become profitable for Powel.

9

EVALUATION

The final chapter is about my own reflection of the process, evaluation of the final outcome and vision for future use of the report.

Evaluation

Prior to working on this thesis I had very little knowledge of the water and sewerage industry, the assignment was very widely defined and I didn't have a lot of expectations of what the final outcome would be. I visited municipalities quite early in the process, in order to absorb as much knowledge as possible.

The municipalities I visited were very welcoming, and the people I met working in the WS-sector are very experienced and dedicated to their discipline. During the initial interviews, I was surprised when hearing the WS-employees speaking of "producing water". But after the research I am left with a whole new appreciation for the WS-industry and the work they do.

Process

In the process I spent a lot of time on reflection, analysis and gaining further insights compared to an actual work situation. For me it is important that this report and the results can be used as inspiration for further product development in Powel. But also for municipalities and subscribers to see the potential for making investments in innovation and technology in the water and sewerage industry. The process of mapping the system has been chaotic. Therefore it has been important for me to present the insights and results in a way that is easy to understand, even for people who are not familiar with the service design process. This is essential in order to make the research and final outcome available for contributors and participants from Powel and WS-departments.

Scope

When defining the assignment, the problem statement was quite vague and the scope very wide. Initially I expected to develop a software prototype that would be tested with WS-departments and look near completed. During the thesis I learned that in order to create a complete solution in 20 weeks, there has to be a specified problem statement with goals and requirements. In comparison, the process of mapping a system in order to identify the challenges, specify a problem and then to create a solution is a very different and time-consuming approach. To establish an innovative solution with a solid foundation in market demand, a holistic approach is necessary to avoid risks and create shared value between different stakeholders.

When engaging so deeply in a project, it is difficult to evaluate you own analysis and conclusions. Throughout the thesis I have relied on different methods to test my hypothesis, and tried to avoid finding solutions and opportunity areas based on my own preconceptions. I think this approach has helped me in defining more objective conclusions, which is show by how my initial expectation does not correspond with the final result.

Evaluation of concept

Because of the nature of water and the water cycle, it is difficult for people to see the impact of our water use on our immediate surroundings. Likewise, pollution from other countries is raining down on us. Since it ´s difficult for people to relate to challenges in such a big perspective, motivating people to consume less water from an environmental perspective becomes challenging.

Because of the broad customer segment, the requirements for the service offerings were quite general. The intention was to include as many as possible within the segment of domestic subscribers, in spite of diverse backgrounds and preferences.

In order to motivate the customers it is important to increase awareness, and accountability towards water consumption. The new and improved service offerings are intended to give relevant information to customers when they need it. Because of the varied customer segment I decided to keep some of the printed touch-points, as the brochure and invoice. After talking to domestic subscribers of different ages, the older generation require more tangible information, like a brochure. While younger people are used to organized information that does not require a lot of effort to acquire, like applications and messages that communicate with each other. An example is the reminder for reading water meter, and the possibility to save this directly to you calendar and add additional reminders.

Because of the varied customer base, one has to be critical to which information to include in the different service offerings to avoid an information overload. With IoT and cloud solutions, a lot of information and data is

becoming easily available. As these tools are becoming an important part of delivering optimized services, it is important to keep in mind that a great technological advance is not the same as creating customer value. Just because all types of information are available, doesn't mean that it should be. For future development of the Powel solutions, I think the key to create good services is to limit the amount of information to match what users and customers need.

What I would have done different

The initial goal was to create a software solution for municipalities, but in order to achieve a product of high quality; the initial scope and problem statement should have been more specific. I didn't end up making a prototype for a software system. But by initiating the concept and showing the opportunities this solution could present, it is a good starting point to inspire for change.

Because of previous projects, I had to write the thesis during summer. This is not to recommend. Because of summer vacations it is difficult to get in contact with users, customers and get feedback. Although I had planned for this and finished most of the user-research well in advance of vacations, I would have liked to revisit WS-departments.

It would be interesting to have another workshop with WS-departments to go through the solution and get their feedback on the final concept. This will be the next step of the process.

Working at Powel – experiencing an working environment

After working at Powel, I gained insights to their work processes and got first hand experience on the complexity of a big company. My understanding is that there is much commitment to introduce new innovation methodologies and focus on increased customer value. However they lack the knowledge of how to implement and make use of these methods. This was the main reason for proposing a development strategy with the service design approach in the concept development chapter.

Thoughts for the future

The attitude, culture and awareness of water consumption are quite weak in Norway, compared to countries that experience water scarcity and more pollution. To change the mindset of the general public, there is a need to start small by increasing knowledge.

In the near future, increasing transparency of the WS-departments and gaining a greater overview of the Norwegian WS-industry as a whole, could be done by creating a common portal for the service. Such as a public web site with live maps, real-time monitoring and comparisons between catchment areas would make the information easily accessible by subscribers and municipal workers.

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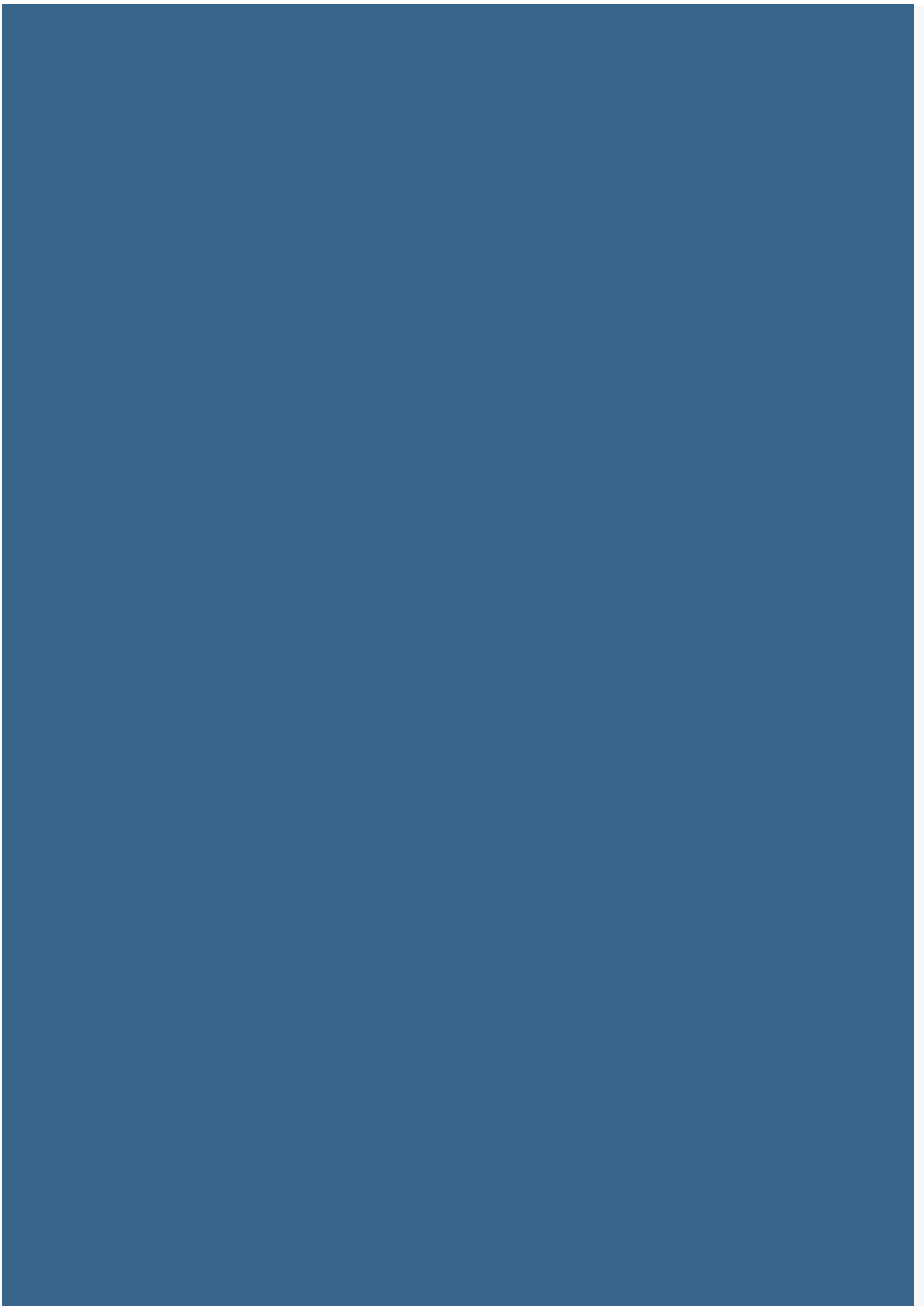
APPENDIX

Chapter 1: Introduction

Chapter 4: Discovery

Chapter 5: Redefined problem statement

Chapter 8: Concept development

Plan

RESEARCH
Introduction
Objective
Context
Methodology

EXPLORATION
Interviews
Observation
User insights
Stakeholder map
Expectatation map
Personas
User journey

CREATION
Idea generation
Benchmarking
Storyboards
Work-shop

11th
Conference
Water Management

Re-define
scope

Easter
Holiday

START

11   12   13   14   15   16   17   18   19   20

9th of
March

April

May

REFLECTION
Low-res prototypes
User testing
Concept development

FINALIZATION
Graphic
Prototype
Documentation

19th
Presentation

Reflection

Proofreading

21   22   23   24   25   26   27   28   29   30   31   DELIVER

June   July   3rd of
                                                August

Scrum board

A scrum board was used in order to keep track of all the minor tasks that needed to be done.

Activity logg

Interview guide: WS-departments

Introduksjon

Jeg kommer fra Industriell Design på NTNU, og er nå i gang med å skrive min master oppgave. Den handler om vannforvaltning, og nå er jeg i gang med å se på hvordan dagens vann og avløps- systemer fungerer i ulike kommuner. Intensjonen er å se om det er et potensiale for å utvikle dette systemet som et arbeidsverktøy for flere sektorer.

Dette intervjuet er konfidensielt. Jeg ønsker å kartlegge dagens system for å se på hva som virker og hva som ikke fungerer så bra, ved å snakke med dere som bruker det til daglig og kan det best. Informasjonen skal kun brukes i denne studien. Det vil ikke bli samlet inn sensitiv informasjon. All innsamlet informasjon oppbevares forskriftsmessig og vil bli anonymisert. Persondata slettes ved prosjektslutt i 2015. Det vil ikke være mulig for utenforstående å identifisere deg i resultatene av studien når disse publiseres.

Spørsmål

- Navn
- Faglig bakgrunn
- Hva er din rolle og stilling?
- Hva er dine arbeidsoppgaver, og hvilke syns du er viktigst?
- Hvilket VA-system bruker dere og når ble dette innført?
- Hvor hyppig bruker du VA-systemet?
- Hvilke andre viktige digitale verktøy bruker du til daglig?
- Hvem er dine nærmeste kolleger, og hvordan jobber/kommuniserer du sammen med disse?
- Er det eksterne folk du har kontakt med? Som for eksempel redningspersonell, brannmenn, rørleggere osv.?
- Hvilke oppgaver liker du best i jobben din?
- Hva er de største ulempene i dagens system?
- Hvordan fikk du opplæring i systembruk?
- Hva gjør du ved systemfeil?
- Hva tror du kunne gjort systemet med effektivt?
- Hva kunne gjort jobben din bedre?

Analyse

- Fakta
- Teknisk, hva fungerer/fungerer ikke?
- Intuitivt, er systemet vanskelig å bruke/forstå?
- Opplæring, er det tidkrevende å lære systemet, er det nødvendig å ha en bakgrunn som ingeniør?
- Kommunikasjon mellom ulike brukere, stakeholders og instanser.
- Innovasjon, hva er forutsetningene som gjør at en kommune velger å satse på innovasjon eller ikke?

TAKK FOR SAMARBEIDET

Interview guide: Domestic subscribers

Introduksjon

Jeg kommer fra Industriell Design på NTNU, og er nå i gang med å skrive min master oppgave. Den handler om vannforvaltning, og nå er jeg i gang med å se på hvordan dagens vann og avløps- systemer fungerer i ulike kommuner. Derfor ønsker jeg å få innsikt i hvordan abonnentene oppfatter tjenesten.

Dette intervjuet er konfidensielt. Jeg ønsker å kartlegge dagens system for å se på hva som virker og hva som ikke fungerer så bra. Informasjonen skal kun brukes i denne studien og det vil ikke bli samlet inn sensitiv informasjon. All innsamlet informasjon oppbevares forskriftsmessig og vil bli anonymisert. Persondata slettes ved prosjektslutt i 2015. Det vil ikke være mulig for utenforstående å identifisere deg i resultatene av studien når disse publiseres.

Spørsmål

- Navn
- Bakgrunn
- Boligsituasjon

Påkobling til ledningsnettet
- Hvordan/når koblet du deg på det kommunale ledningsnettet?
- Var tomta/huset du kjøpte allerede påkoblet når du fikk det?
- Hvordan fikk du informasjon om dette?
- Hvordan gikk du frem for å utføre arbeidet?
- Var informasjonen lett tilgjengelig?
- Hvordan var din opplevelse av kommunens krav om tilknytning?

Lekkasjer
- Har du opplevd lekkasjer, eller at du matte vedlikeholde?
- Har du alltid visst ditt ansvar ovenfor privat stikkledning?
- Har du opplevd nabokonflikter I forhold til disse? I så fall når?

Betale Gebyr
- Hvordan blir ditt vannforbruk regnet ut?
- Når fikk du eller skal du få vannmåler?

Lekkasje Reduksjon
- Utfører du noen tiltak for å undersøke eventuelle lekkasjer?
- Gjør du tiltak I forhold til å spare på vannet?

Kontakt med kommunen
- Har du noen gang meldt ifra til kommunen om feil du har sett?
- Hvordan gikk du frem?
- Var det enkelt å melde ifra?
- Ble problemet løst?
- Følte du at du ble tatt på alvor?

Analyse

- Behov
- Mål
- Bekymringer
- Teknologi

TAKK FOR SAMARBEIDET

Workshop Gemini VA

The first workshop at the Gemini VA conference was conducted in collaboration with Eirik Aartun from Powel. The backdrop for the workshop was a GIGA-map with all WS-system stakeholders and how they were connected. In order to get feedback quite fast, we printed notes and an explanation of how they were used. The notes would be pinned directly on the GIGA-map.

The note we used is pictured with a quick explanation on the next page.

The results from the notes are listed on the following pages; the names and contact information form the participants were collected in case there was need for follow up questions. But this has been blurred to keep the anonymity of the participants.

A summary video from the workshop can be found at:

https://www.youtube.com/watch?v=c_fkzvFVpj8&feature=youtu.be

Ønske

..eller utfording?

Noter nummer

12

Skriv her

1   2   3   4   5

Hvor viktig er dette for deg?

#-Lapp	Navn	Rolle	
1		Veidekke,	alle program på samme plattform. – dataflyt mot kommunen.
2		Teknisk sjef halden,	Sikkerhet i systemet.. lett å hacke seg inn i sky-baserte løsninger i forhold til matrikler som er lagret på mange ulike steder.
3		Teknisk sjef halden,	Skydrift – for dyrt.
4		Teknisk sjef halden,	G-VA gammeldags.
5		Teknisk sjef halden,	Mer moderne arbeidsverktøy i Gemini VA.
6		Fredrikstad	Like navn og tegnsetting i Gemini VA for alle - "vil vil at Powel skal sette en standard"
7		Tromsø	Bildehåndtering – ta bilde Gemini VA.
8		Terratec,	Scanne vannkum istedenfor kumkort.
9		Asker kommune,	Mulig å se kummer i grenseområder mellom kommuner. Kryssende ledninger.
10		Asker kommune,	Bedre samarbeid mellom kommuner for reservevannforsyning.
11		Lørenskog ,	Lytte etter vannlekkasjer (loggere) rett inn på Gemini VA fra GSM sender i kum.
12		Haugesund ,	Overvannsbehnadling. Mange oversvømmelser - bytte ut "svingete" ledninger. Naturlige bekker går rett i avløpssystem
13		Haugesund	Rekrutering til bransjen må starte før studentene har begynt på universitetet
14		Bærum	Bilde direkte inn i Gemini VA.
15		Lørenskog	Gemini VA mangler tilbake/angreknapp
16		Lørenskog	Forsikring på tilbakeslag er dyrt.
17		Lørenskog	Regsitrer tilbakeslag i samme kart
18		Hå kommune	Lettere å få all informasjon på samme plass. Historikk, reguleringer, overlapping osv.
19		Hå kommune	Oversikt over grunnboring for å vise terrenget i kartet.
20		Hå kommune	Gatelys inn i Gemini VA/Gemini Portal
21		Mellemstrand Annleggsservice	Reg-plan/grunnkart/VA-data fra ulike avdelinger som prater dårlig med hverandre.
22		Mellemstrand Annleggsservice	Tilgjengelig data. (for entrepentører/konsulenter. Vil ha innsyn i Gemini Portal!!!)
23		Mellemstrand Annleggsservice	Konflikter pga ikke rett data til rett tid.
24		Mellemstrand Annleggsservice	Kommunene vil ikke gi ut data ofte pga dårlige data (kaller det "sensitive" opplysninger
25		Mellemstrand Annleggsservice	All informasjon ut til ulike kunder skal være lik, uansett hvem du kjenner i kommunen.
26		Bergen	Synkronisering av data mellom VA og andre moduler.
27		Bergen	Støtte for å bygge z-koordinat fra terreng.

31		Bergen, Driftsingeniør	Få en bedre målestokk "terskling" (??) lei av å skifte "kvart"(??) type hele tiden.
32		Bergen, Driftsingeniør	Har en "VIS" funksjon for "alt" som er viktig mer enn et kartlag om gangen
33		Bergen, Driftsingeniør	Kunne ha vegfaget i i kartet, med logg!
34		Bergen, Driftsingeniør	Ta inn informasjon fra 3. partsløsninger
35		Bergen, Driftsingeniør	3D av gamle plan på mobil/nettbrett på tvers av alle fag
36			
37			
38		Bergen, Driftsingeniør	Kunne linke polygon lag(er) med aktiv informasjon
39		Bergen, Driftsingeniør	Vise online og offline likt, synkronmisering i bakgrunn
40		Bergen, Driftsingeniør	lage skilt plan for logging!
41		Bergen, Driftsingeniør	
42		Bergen, Driftsingeniør	
43		Kristiansand Ingeniørvesen	Temakart som blir lagt ut, slik at privat personer som skal sette opp små bygg uten byggetillatelse vet hvor de kan grave. Markere 4m til hver side av ledningen.
44		Kristiansand Ingeniørvesen	Tidlig og uklare informasjon om hvilken vei Powel er på vei. "vi venter på Powel.. så går det ett år.."
45		Kristiansand Ingeniørvesen	Høydemodeller: Vegvesnet bruker NN 1957 og VA bruker NN 2000. Hvordan skal vi håndtere dette? Hvordan oppdatere Gemini VA live? Konvertering fra Terreng til VA er greit, motsatt så er det håpløst.
46		Lørenskog	Gråsoner når det gjelder ansvar for overvann.
47			
48			
49			
			Mye info! Raskt, tilgjengelig og hensiktsmessig.
			Må bli enklere å dokumentere fortløpende etter at en jobb er utført.
			Positive til å øke gebyrer dersom nødvendig for å sikre vannkvalitet. Ser på andre muligheter for å gjøre det billigere. Kommunesammenslåing
			Hvordan bygge opp et brann-tappekart automatisk?
			Vanskelig og tidkrevende med oppfølging på entrepentør. Leverer ikke ferdigmelding.
			Dårlig oversikt tilstanden til private stikkledninger
			AR funksjon. Peke nettbrettet mot et hus og få opp all nødevndig informasjon.
			Bruke metadata i bilder for å visualisere i kart hvor de er tatt. (innebygde georeferanser i metadataene)

Survey results

The survey was started on the 18th of June and was open for answers for a week. Some of the results are used in chapter 3.3 Domestic subscribers, here are the total results of the feedback.

Timestamp	Kjønn	Alder	Antall personer i hushold	Type bolig	Hvordan beregnes ditt v	Hvor mye betaler du for	Vet du hva gebyrene bru	Føler du at du be
6/18/2015 22:31:40	Mann	40-50	4	Leilighet	Inkludert i husleie	I husleie	1	
6/18/2015 22:38:38	Kvinne	50-60	3	Leilighet	Stipulert fra boligens are	Inkludert i felleskostnade	3	
6/18/2015 23:04:57	Kvinne	40-50	5	Enebolig	Vannmåler	7000	5	
6/18/2015 23:19:21	Kvinne	20-30	4	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 23:21:26	Kvinne	40-50		Rekkehus	Stipulert fra boligens are	Vet ikke	3	
6/18/2015 23:32:51	Mann	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 23:42:23	Mann	40-50	1	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 23:49:01	Kvinne	50-60	4	Rekkehus	Vet ikke	Vet ikke	1	
6/18/2015 23:57:40	Kvinne	20-30	2	Leilighet	Vet ikke	Inkludert i leien	1	
6/18/2015 23:59:53	Kvinne	20-30	3	Rekkehus	Inkludert i husleie		1	
6/19/2015 0:30:39	Mann	20-30	3	Rekkehus	Vet ikke	Vet ikke	1	
6/19/2015 0:32:41	Mann	20-30		Leilighet	Vet ikke	Vet ikke	1	
6/19/2015 0:36:10	Mann	20-30	1	Hybel	Vet ikke	Vet ikke	1	
6/19/2015 0:42:09	Mann	20-30	4	Enebolig	Vannmåler	Beklager innbakt samme	1	
6/19/2015 0:54:20	Kvinne	10-20	3	Leier	Vet ikke	Vet ikke	1	
6/19/2015 0:57:21	Mann	20-30		Hybel	Inkludert i husleie	Vet ikke	1	
6/19/2015 1:00:54	Mann	20-30	3	Leilighet	Stipulert fra boligens are	6000	2	
6/19/2015 1:51:35	Kvinne	20-30	5	Hybel	Inkludert i husleie	17000	1	
6/19/2015 2:00:48	Kvinne	50-60	4	Rekkehus	Inkludert i husleie	Vet ikke	3	
6/19/2015 5:39:13	Mann	60-70	3	Leilighet	Vannmåler	Vet ikke	2	
6/19/2015 8:11:16	Kvinne	40-50	1	Leilighet	Inkludert i husleie	Vet ikke	5	
6/19/2015 8:13:58	Mann	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/19/2015 8:28:34	Kvinne	30-40	3	Enebolig	Vet ikke	Vet ikke	1	
6/19/2015 8:57:24	Mann	30-40	3	Rekkehus	Vet ikke	Vet ikke	1	
6/19/2015 9:13:16	Kvinne	40-50		Enebolig	Inkludert i husleie	Vet ikke	3	
6/19/2015 9:22:35	Kvinne	20-30	1	Leilighet	Inkludert i husleie	Vet ikke	1	
6/19/2015 10:13:33	Kvinne	20-30	1	Leilighet	Vet ikke	Vet ikke	1	
6/19/2015 10:28:46	Kvinne	20-30	4	Rekkehus	Stipulert fra boligens are	Vet ikke	1	
6/19/2015 11:24:33	Kvinne	20-30	3	Enebolig	Vet ikke	Vet ikke	1	
6/19/2015 16:14:39	Kvinne	40-50	3	Enebolig	Vannmåler	5000	1	
6/19/2015 16:35:36	Kvinne	20-30	4	Leilighet	Vet ikke	vet ikke	1	
6/19/2015 16:57:20	Mann	20-30	2	Enebolig	Inkludert i husleie	Vet ikke	1	
6/19/2015 21:34:14	Mann	50-60	4	Enebolig	Vannmåler	Vet ikke	1	
6/20/2015 1:54:58	Kvinne	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	2	
6/22/2015 19:03:58	Kvinne	50-60	4	Enebolig	Vannmåler	6300	1	
6/24/2015 21:30:53	Kvinne	30-40	2	Leilighet	Vannmåler	Vet ikke	1	
6/26/2015 16:20:13	Kvinne	40-50	2	Enebolig	Stipulert fra boligens are	14000	4	

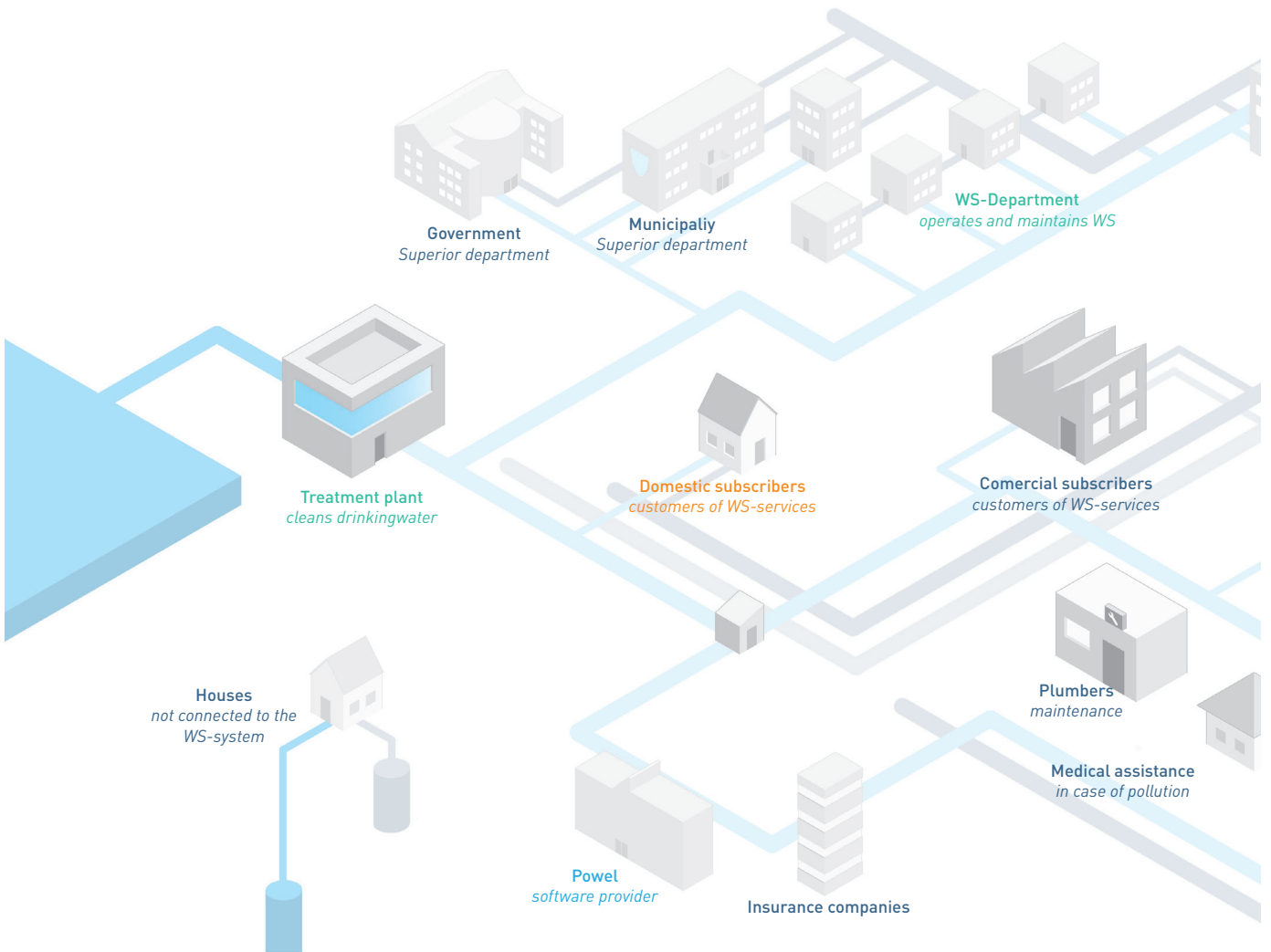| at du betaler ret	Er du villig til å betale m	Har du noen gang søkt e	Hvordan gikk du frem for	Hvor lett var det å finne i	Har du blitt kontaktet av	Var i såfall denne inform	Hva er din oppfatning av	Er du opptatt av miljøet?
3	Ja, dersom jeg vet at pe	Nei			Vannavstengning, Forur	3	4	4
3	Ja, dersom jeg vet at pe	Vedr drikkevann	Kommunens nettsider	4	Vannavstengning	4	4	5
3	Ja, dersom jeg vet at pe	Tilkobling til kommunalt l	Kontaktet kommunen på telefon		Vannavstengning	5	2	5
1	Vet ikke	Nei			Nei			
1	Vet ikke	Nei			Nei		5	5
	Nei	Nei			Nei			2
3	Vet ikke	Nei			Nei			4
3	Nei	Nei			Vannavstengning	5	4	5
3	Ja, dersom jeg vet at pe	Nei	Har ikke lett	3	Nei	3	3	5
4	Vet ikke	Anskaffelse av vannmål	Borettslaget har kontaktet kommunen, men de har		Nei		4	4
3	Har aldri hørt om betalin	Nei			Nei			
3	Aldri hørt om betaling for	Nei			Nei		3	5
3	Nei	Nei			Nei			
4	Ja, dersom jeg vet at pe	Nei	Ikke søkt		Bytte av vannmåler	3	5	4
3	Vet ikke	Nei	Har ikke søkt	3	Nei	1	3	5
	Ja, dersom jeg vet at pe	Melde fra om skade/lekk	Kommunens nettsider	1	Nei			5
3	Ja, dersom jeg vet at pe	Gebyr og avgifter	Kontaktet kommunen på	2	Nei	3	4	2
3	Vet ikke	Nei	Har aldri hatt behov for å	3	Nei	3	3	4
3	Nei	Nei			Nei			5
4	Ja, dersom jeg vet at pe	Nei			Vannavstengning	5	4	4
3	Ja	Tilkobling til kommunalt l	Kontaktet kommunen på	1	Nei		4	5
3	Ja, dersom jeg vet at pe	Nei			Nei	3	5	5
	Vet ikke	Nei			Nei, men skulle ønske jeg hadde fått mer informasjon			5
3	Ja, dersom jeg vet at pe	Nei			Nei	3	3	5
4	Ja, dersom jeg vet at pe	Nei			Nei		4	4
4	Nei	Da drikkevannet ble låst	Søkte på internett, husk	4	Nei		4	3
3	Vet ikke	Nei			Nei		5	5
	Nei	Informasjon om vanning	Kommunens nettsider	2	Forurensing av drikkeva	5	4	4
3	Nei	Nei			Nei			3
1	Ja, dersom jeg vet at pe	Melde fra om skade/lekk	Kommunens nettsider	4	Vannavstengning	5	3	4
3	Ja, dersom jeg vet at pe	Nei			Vannavstengning, Forur	5	4	5
3	Nei	Nei	Diskusjons forum/søk på	1	Nei, men skulle ønske je	1	3	3
3	Nei	Gebyr og avgifter	Kommunens nettsider	2	Syntes jeg hadde høyt f	4	3	3
3	Ja, dersom jeg vet at pe	Nei			Nei, men skulle ønske jeg hadde fått mer informasjon			5
3	Vet ikke	Nei			Vannavstengning	5	5	4
3	Ja, dersom jeg vet at pe	Nei			Vannavstengning	5	5	5
5	Nei	Gebyr og avgifter	Kommunens nettsider	5	Vannavstengning	5	3	5

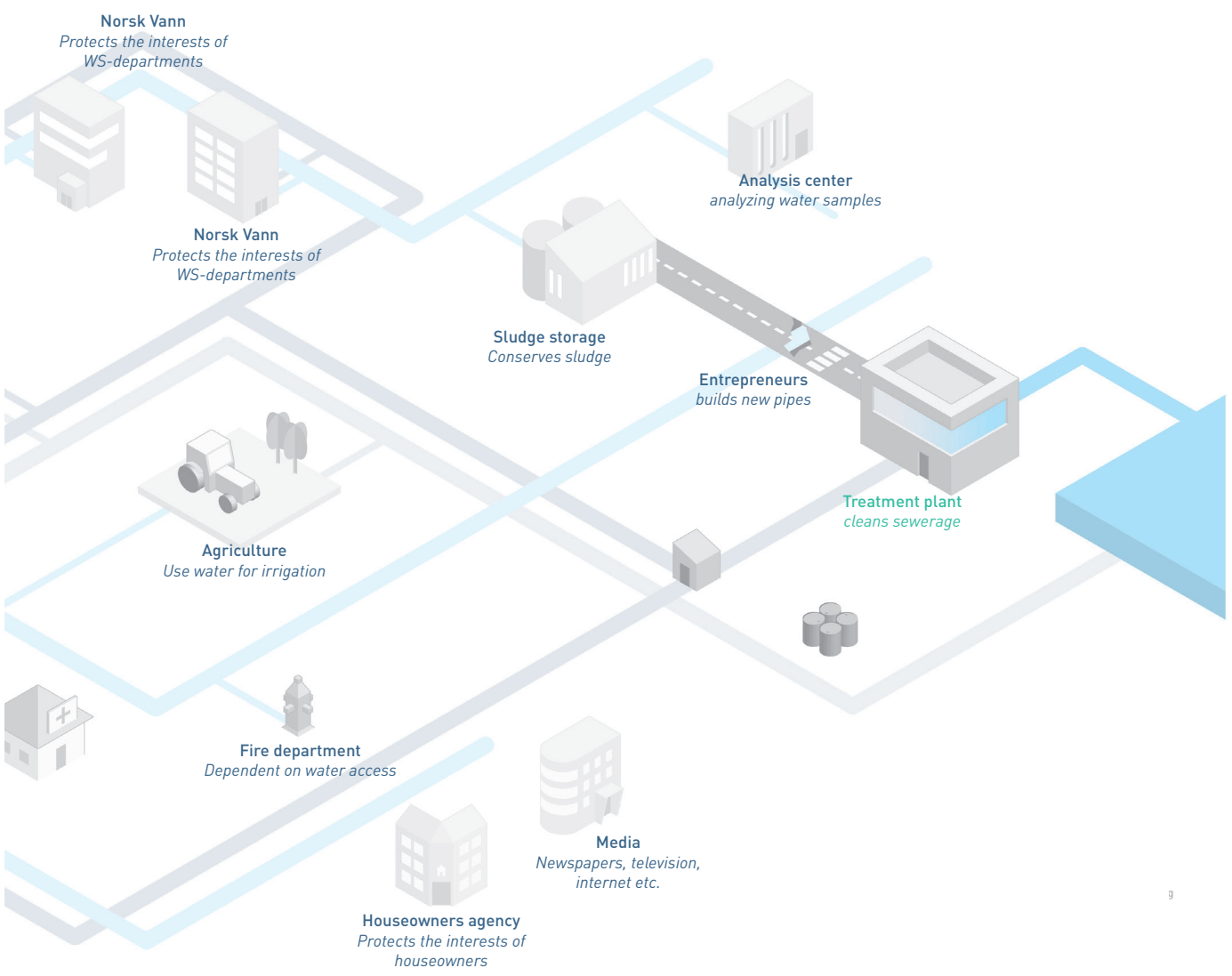| Timestamp	Kjønn	Alder	Antall personer i hushold	Type bolig	Hvordan beregnes ditt v	Hvor mye betaler du for	Vet du hva gebyrene bru	Føler du at du b
6/18/2015 15:43:29	Mann	20-30	5	Leilighet	Inkludert i husleie	900	1	
6/18/2015 15:47:02	Mann	20-30	1	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 15:47:55	Kvinne	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	3	
6/18/2015 15:49:48	Kvinne	20-30	1	Leilighet	Inkludert i husleie	vet ikke	1	
6/18/2015 15:49:48	Kvinne	20-30	2	Leilighet	Vet ikke	vet ikke	1	
6/18/2015 15:53:26	Kvinne	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 15:54:10	Mann	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	3	
6/18/2015 16:00:22	Kvinne	20-30	2	Leilighet	Vet ikke	Inkl. i leie	1	
6/18/2015 16:05:37	Mann	20-30	2	Hybel	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:06:51	Mann	20-30	1	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 16:10:05	Mann	30-40	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:19:16	Mann	20-30	6	Hybel	Vet ikke	Vet ikke	1	
6/18/2015 16:19:47	Mann	20-30		Leier	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:20:05	Kvinne	20-30	1	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:21:06	Kvinne	30-40	2	Enebolig	Stipulert fra boligens are	Vet ikke	1	
6/18/2015 16:21:34	Mann			Leilighet	Vannmåler	5000		
6/18/2015 16:21:45	Mann				Vet ikke	Vet ikke		
6/18/2015 16:23:06	Mann	20-30	1	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:24:16	Mann	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:24:27	Mann	20-30	1	Hybel	Vet ikke	Vet ikke	1	
6/18/2015 16:28:18	Mann	20-30	3	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 16:29:29	Kvinne	20-30	4	Hybel	Vet ikke	Vet ikke	1	
6/18/2015 16:30:18	Mann	30-40	3	Enebolig	Stipulert fra boligens are	10000	1	
6/18/2015 16:32:45	Kvinne	20-30	6	Leier	Vet ikke	vet ikke	1	
6/18/2015 16:35:07	Kvinne	20-30	2	Leilighet	Vet ikke	vet ikke	2	
6/18/2015 16:40:56	Kvinne	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:44:51	Kvinne	20-30	5	Leilighet	Vet ikke	Inkludert i leie	1	
6/18/2015 16:50:16	Mann	40-50	4	Enebolig	Stipulert fra boligens are	4000	1	
6/18/2015 16:53:28	Kvinne	30-40	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:54:25	Mann	20-30	2	Leier	Vet ikke	Vet ikke	1	
6/18/2015 16:59:28	Mann	20-30	2	Leier	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:59:55	Mann		2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 16:59:58	Mann	30-40	4	Enebolig	Vannmåler	Vet ikke	1	
6/18/2015 17:00:30	Kvinne	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 17:01:47	Mann	30-40	2	Enebolig	Egen brønn	0		
6/18/2015 17:02:31	Mann	20-30	2	Leilighet	Vet ikke	Inkl.fellesutgifter.	2	
6/18/2015 17:02:56	Mann	40-50	4	Enebolig	Vannmåler	Vet ikke	3	
6/18/2015 17:08:18	Mann	20-30	5	Hybel	Inkludert i husleie	Vet ikke	4	
6/18/2015 17:11:04	Mann	30-40	1	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 17:12:16	Kvinne	30-40	1	Bor i Lavvu	Egen brønn	0		
6/18/2015 17:16:12	Mann	50-60	3	Småbruk	Egen brønn	0		
6/18/2015 17:16:59	Kvinne	20-30	4	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 17:17:17	Kvinne	20-30	3	Leilighet	Vannmåler	Vet ikke	1	
6/18/2015 17:18:48	Kvinne	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	3	
6/18/2015 17:25:31	Mann	20-30	2	Enebolig	Stipulert fra boligens are	11000	3	
6/18/2015 17:33:57	Kvinne	20-30	2	Leilighet	Vet ikke	Vet ikke	3	
6/18/2015 17:41:32	Mann	40-50	4	Enebolig	Stipulert fra boligens are	5000	2	
6/18/2015 17:47:36	Mann	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 17:53:16	Kvinne	20-30	3	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 17:54:04	Mann	30-40	2	Leilighet	Inkludert i husleie	Vet ikke	2	
6/18/2015 17:55:38	Kvinne	20-30	5	Leilighet	Vannmåler	Vet ikke	1	
6/18/2015 17:56:53	Mann	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	3	
6/18/2015 18:22:15	Mann	30-40	4	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 18:35:00	Kvinne	20-30	2	Enebolig	Vannmåler	5000	3	
6/18/2015 18:35:43	Mann	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 18:36:50	Kvinne	20-30	3	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 18:41:32	Kvinne	20-30	2	Leier	Vet ikke	Vet ikke	2	
6/18/2015 18:50:40	Kvinne	20-30	1	Hybel	Inkludert i husleie	Vet ikke	2	
6/18/2015 18:52:24	Mann	20-30	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 18:56:31	Kvinne	30-40	4	Enebolig	Vet ikke	Vet ikke	1	
6/18/2015 19:00:07	Mann	30-40	2	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 19:13:44	Kvinne	20-30	3	Enebolig	Vet ikke	8000	1	
6/18/2015 19:26:08	Mann	20-30	2	Leilighet	Vannmåler	6-7000 kanskje. Vet ikke	1	
6/18/2015 20:00:13	Kvinne	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 20:01:21	Kvinne	20-30	1	Forlegning	Inkludert i husleie	Vet ikke	1	
6/18/2015 20:11:43	Kvinne	20-30		Leilighet	Vet ikke	Vet ikke	2	
6/18/2015 20:12:37	Kvinne	20-30	2	Leilighet	Vet ikke	Vet ikke	1	
6/18/2015 20:19:23	Mann	20-30	2	Enebolig	Egen brønn	4000	1	
6/18/2015 20:50:11	Mann	20-30	4	Hybel	Inkludert i husleie	Vet ikke		
6/18/2015 21:02:30	Kvinne	50-60	3	Enebolig	Vannmåler	Vet ikke	1	
6/18/2015 21:27:32	Kvinne	20-30	3	Leilighet	Inkludert i husleie	Vet ikke	1	
6/18/2015 21:29:40	Mann	20-30	3	Leilighet	Vet ikke	Er ikke sikker. Tror det e	1	
6/18/2015 22:06:06	Mann	20-30		Leilighet	Inkludert i husleie	0	1	
6/18/2015 22:17:58	Mann	40-50	1	Enebolig	Egen brønn	Vet ikke		
6/18/2015 22:19:45	Mann	20-30	2	Leilighet	Vet ikke	Vet ikke		

u at du betaler ret	Er du villig til å betale m	Har du noen gang søkt e	Hvordan gikk du frem for	Hvor lett var det å finne i	Har du blitt kontaktet av	Var i såfall denne inform	Hva er din oppfatning av	Er du opptatt av miljøet?
5	Vet ikke	Nei			Nei		3	5
3	Nei	Nei			Nei		4	4
3	Ja, dersom jeg vet at pe	Nei		3	Nei, men skulle ønske je	3	3	3
3	Vet ikke	Nei	ikke gjort det	3	Nei	3	3	5
3	Ja, dersom jeg vet at pe	Nei			Nei		4	4
3	Føler at vi er veldig heldi	Nei	ikke aktuelt	3	Nei		5	5
3	Nei	Nei			Nei		5	4
3	Nei	Nei			Nei		3	5
1	Ja, dersom jeg vet at pe	Nei			Nei		4	4
3	Vet ikke	Nei			Nei		4	4
3	Ja, dersom jeg vet at pe	Nei		3	Nei		5	5
3	Vet ikke	Nei			Vannavstengning	5	5	3
1	Ja, dersom jeg vet at pe	Nei			Vannavstengning	5	4	5
3	Vet ikke	Nei		3	Nei	3	3	4
2	Vet ikke	Anskaffelse av vannmål	Kommunens nettsider, D	1	Nei		2	4
3	Ja, dersom jeg vet at pe	Gebyr og avgifter	Spurte bekjente	3	Nei		4	5
		Nei			Nei			
3	Vet ikke	Nei			Nei		3	5
3	Vet ikke	Nei		3	Nei	3	3	4
3	Ja, dersom jeg vet at pe	Nei	Spurte bekjente	3	Nei		4	5
3	Ja	Nei			Forurensing av drikkeva	3		4
3	Vet ikke	Nei	har ingen info	3	Nei, men skulle ønske je	3	3	5
2	Ja, dersom jeg vet at pe	Anskaffelse av vannmål	Kontaktet fagperson	5	Nei, men skulle ønske jeg hadde fått mer informas		5	4
2	Vet ikke	Nei			Nei			4
3	Nei	Nei		1	Nei	1	1	5
3	Ja	Det sto i avisen at det va	Google	3	Nei, men skulle ønske je	3	4	5
3	Ja, dersom jeg vet at pe	Nei			Nei		4	5
4	Nei	Nei			Nei		3	4
3	Vet ikke	Nei			Nei	1	3	5
3	Vet ikke	sjekke om jeg kunne pa	Kontaktet kommunen på	4	Nei		3	4
3	Ja, dersom jeg vet at pe	Nei			Vannavstengning, Krav	5	3	5
3	Vet ikke	Nei		1	Nei		4	5
3	Ja, dersom jeg vet at pe	Nei		3	Nei		2	4
3	Vet ikke	Nei		3	Nei, men skulle ønske jeg hadde fått mer informasjon			5
		Nei			Nei			
3	Vet ikke	Nei			Nei		3	4
3	Nei	Anskaffelse av vannmål	Kontaktet kommunen på	3	Vannavstengning	3	3	2
5	Ja, dersom jeg vet at pe	Nei			Nei, men skulle ønske jeg hadde fått mer informas		4	5
3	Vet ikke	Nei			Nei			4
	Vet ikke	Regelverk gråvann etc.	Kommunens nettsider	3	Nei		5	5
	Har eget anlegg	Nei			Nei		3	4
3	Vet ikke	Nei	Aldri gjort det		Nei		3	4
1	Nei	Nei	Diskusjons forum/søk på	2	Nei	4	2	5
5	Ja, dersom jeg vet at pe	Tilkobling til kommunalt l	Kommunens nettsider	1	Nei	1	4	5
5	Ja, dersom jeg vet at pe	Nei	Kommunens nettsider	3	Nei	1	3	5
3	Vet ikke	Nei			Nei		4	5
3	Ja, dersom jeg vet at pe	Nei			Nei		4	3
3	Ja, dersom jeg vet at pe	Nei			Vannavstengning, Forur	4	5	5
	Vet ikke	Nei			Nei		5	5
3	Ja, dersom jeg vet at pe	Nei			Nei, men skulle ønske jeg hadde fått mer informas		3	4
2	Ja, dersom jeg vet at pe	Nei			Nei			5
3	Ja, dersom jeg vet at pe	Nei			Nei, men skulle ønske jeg hadde fått mer informas		5	4
4	Vet ikke	Nei			Nei			4
3	Ja, dersom jeg vet at pe	Nei			Nei			5
3	Nei	Nei	?	3	Nei, men skulle ønske je	1	4	4
3	Vet ikke	Nei		3	Vannavstengning	4	4	4
3	Nei	Nei			Nei			3
3	Vet ikke	Nei			Nei		5	5
3	Ja, dersom jeg vet at pe	Nei			Nei			4
3	Vet ikke	Tilkobling til kommunalt l	Kontaktet kommunen på	3	Nei, men skulle ønske jeg hadde fått mer informas		3	5
3	Vet ikke	Nei		3	Nei			5
3	Ja, dersom jeg vet at pe	Nei		1	Nei, men skulle ønske je	1	1	4
5	Ja, dersom jeg vet at pe	Nei			Nei, men skulle ønske jeg hadde fått mer informas		4	5
	Nei	Nei			Nei			
1	Ja, dersom jeg vet at pe	Nei	Har ikke sett noe inform	1	Nei	1	3	3
3	Ja, dersom jeg vet at pe	Nei			Nei		3	5
3	Vet ikke	Nei			Nei		4	5
4	Nei	Nei	Var tilknyttet eiendomme	5	Nei	1	3	3
		Nei			Nei		5	5
3	Ja, dersom jeg vet at pe	Nei			Krav om å innstallere va	1	4	5
3	Vet ikke	Nei			Nei		3	4
	Vet ikke	Nei			Nei		4	4
3	Vet ikke	Nei		3	Nei	3	3	5
	Vet ikke	Nei			Nei	1	3	4
	Vet ikke	Nei			Nei			5

Stakeholder overview

Government
Superior department

Municipaliy
Superior department

WS-Department
operates and maintains WS

Treatment plant
cleans drinkingwater

Domestic subscribers
customers of WS-services

Comercial subscribers
customers of WS-services

Houses
*not connected to the
WS-system*

Plumbers
maintenance

Medical assistance
in case of pollution

Powel
software provider

Insurance companies

Norsk Vann
*Protects the interests of
WS-departments*

Analysis center
analyzing water samples

Norsk Vann
*Protects the interests of
WS-departments*

Sludge storage
Conserves sludge

Entrepreneurs
builds new pipes

Agriculture
Use water for irrigation

Treatment plant
cleans sewerage

Fire department
Dependent on water access

Media
*Newspapers, television,
internet etc.*

Houseowners agency
*Protects the interests of
houseowners*

Workshop testing prototypes

Drawing the user journeys on a large piece of paper and placing the prototypes on the corresponding touch-points conducted the workshop. Initially a walkthrough of the user journey was done where all the prototypes was discussed in plenum. Then, everyone had time to evaluate each prototype for them selves and write suggestions and draw directly onto the prototypes and user journey. The main results from each prototype are listed below.

Brochure
- The font is too small and difficult to read. Especially for old people.
- Illustration of how my house is connected to the WS-system, makes it easier to relate to the service.
- More focus on the action "ordering plumber" than on the information pages.
- Can installing a water meter increase the value of your house?

Order plumber
- Disclose the price at an early stage.
- Is it possible to see what the total cost would be and see this before ordering?
- What will happen with price and competition, is it a set price?
- View top 10 plumbers in your area.

Plumber
- The plumber should be on the same page as the municipality and inform the domestic subscriber about the future course of the service.
- He could also set up how the domestic subscriber would be able to access the service in the future together with the subscriber.

Water meter confirmation
- This is when the municipality has registered the information, right?
- Does this have to be done by the plumber?
- What if the plumber could sign a document, and you could send it yourself. Maybe using Altinn, so you know that it happens.

Reading reminder
- What is the consequence of not reading the meter?
- Example: if you don't send the number, THIS is going to be the estimated number. Then you can se how much it differs from the ACTUAL.
- How much can you save from reading the meter vs. estimated consumption?
- When do you get the reminder?
- You should be able to say that you want another reminder, if you get it at work or when you're out, you'll just forget about it.
- It should be possible to decide yourself the dates for when you want to read the meter.

Reading meter - picture
- Don't think it's possible to put a philter on the image without an app.
- For it to be read by a system the text has to be standardized, as on cars. OSR are used to automatically detect text.
- Maybe you could put a sticker on the water meter?
- How can it reveal if there is a leakage? Don't you notice this by yourself?
- It would be relevant to inform where the collection points for leakage inspection is.
- The water meter should be placed in the branch-line, so that the leakage there would be detected as well.

Instant feedback
- There should be tips and suggestion on how to save water.
- What uses a lot of water and what doesn't?

Invoice
- The average, is that the estimated consumption? Maybe this should be clearer. Because here it seems as if estimated consumption would benefit me more.
- It is good to see the trend, but it would be nice to have something to relate it to. Like how many showers is this?
- Have to bring the numbers into a scalable level, ex showers per day.
- Very good with tips!

Service blueprint

Service provider: **Municipal WS-Departments and Powel**
Customer: **Subscribers**

PHASE	Awareness			
PHYSICAL EVIDENCE	Newspaper		Brochure Information letter	

USER ACTION	Reads about the new WS-service in the local newspaper.	Get water-meters recommended from a co-worker.	Recieve information from WS-department with a request to install a water meter.	Research online to see if it will be profitable to install despite initial cost.

··········· Line of interaction ··

FRONTSTAGE

··········· Line of visability ··

BACKSTAGE	Contact media and post in web-site. Prepare interaction guidelines for customer service.		Define information and recievers.	Provide clear directions on website on how to get water meter and order plumber.

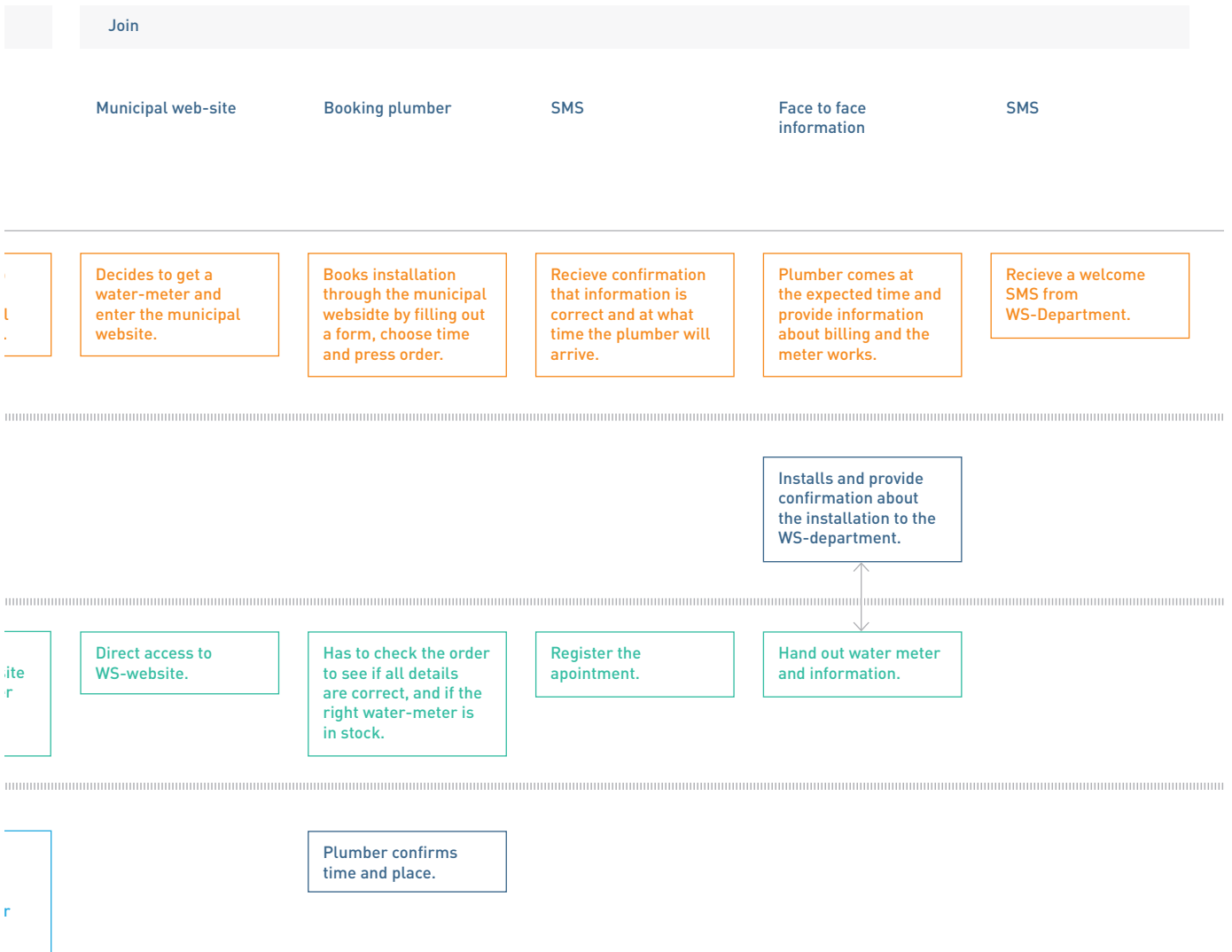··········· Internal interaction ··

SUPPORT PROCESSES	Set-up module in Powel VA.		Establish criterias for communication. Contact the National registry to locate people living in the area.	Optimise search engine. Set up water meter calculator.

Join

Municipal web-site	Booking plumber	SMS	Face to face information	SMS

Decides to get a water-meter and enter the municipal website.

Books installation through the municipal websidte by filling out a form, choose time and press order.

Recieve confirmation that information is correct and at what time the plumber will arrive.

Plumber comes at the expected time and provide information about billing and the meter works.

Recieve a welcome SMS from WS-Department.

Installs and provide confirmation about the installation to the WS-department.

Direct access to WS-website.

Has to check the order to see if all details are correct, and if the right water-meter is in stock.

Register the apointment.

Hand out water meter and information.

Plumber confirms time and place.

Use

E-mail   SMS   Feedback SMS   New invoice

Recieve information   Recieve a SMS   Takes a picture of   Recieve an invoice
about changes in   reminder to read the   the water-meter and   with price and feed-
WS-fees.   meter within a given   sends it to the WS-fee   back on consumption.
                         date.   department.

Confirms new values/   Take care of mistakes   Dispatch invoice.
prices.   or manual reports.

Dispatch pre-defined
message.

Program system   Send automatic   Image recognition.
notice new fees and   reminder.
notify operator for   Send instant summary
confirmation.   of consumptions.

Develop	Leave		
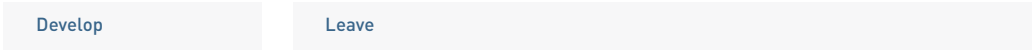
Upgrade E-mail | | Upgrade E-mail | Goodbye and welcome back.

| Pays bill and get a confirmation e-mail with suggestions on how to upgrade and customize the service. | Selling and moving to a new house. | Recieve an e-mail with details regarding and buying and selling of houses with water meter. | Discontinues the water-meter bill. |

| Provide direct link. | Verify input info. | | Make sure its easy to return to the service. |

Send auto message.

Registers move.

Messages screenshots

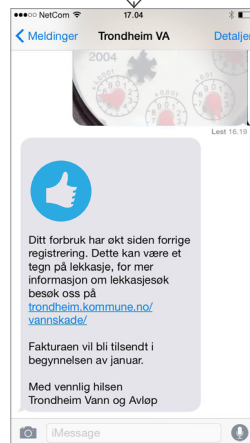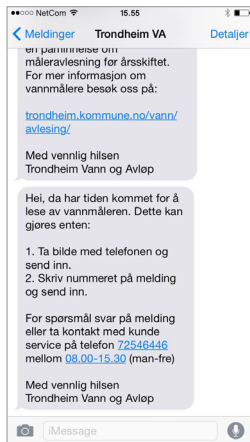These are the final message in the improved customer journey.

Scenario 1

• Registered that the water meter has been installed

Scenario 2

• Reminder for reading water meter
• Taking picture of water meters
• Confirmation text
      1. Decreased consummation
      2. Increased consummation