



Demand-Responsive  
Transport to ensure  
accessibility, availability  
and reliability of rural  
public transport

## ITERATIVE INNOVATION PROCESS FOR ON-DEMAND TRANSPORT

### Ruter AS

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# 1 Introduction

This research paper provides an understanding on how to innovate and create new on-demand transportation services. It presents the different steps in an innovation process and addresses the importance of taking external factors into consideration. The objective of this paper is to provide and share insight from creating and running pilots of demand responsive transportation (DRT) services in the Norwegian transportation company Ruter. The paper will be useful for regional and local public authorities that are responsible for the creation and organization of new publicly funded on-demand transportation services. It provides transnational experience on how to involve the citizens in innovation processes for design, prototyping and testing of new, customer-oriented services. This insight can be used in the development of new demand-responsive public transportation services.

This research paper starts with a short introduction to the project, followed by information about the pilots, and continues with an explanation of external factors that need to be taken into consideration. Further on, a detailed description of the innovation process is documented, including some examples from ongoing pilots in Ruter. The innovation process used in this paper builds on the Norwegian model «KS veikart for tjenesteinnovasjon», which is developed by the Norwegian Association of Local and Regional Authorities (KS) (KS, 2020). KS is an umbrella organization for local governments in Norway and works to meet the local need for community development, innovation, efficiency improvement and employer growth. The framework of the process has been inspired based on the theory of service design and design thinking principles. It illustrates five stages on how to create agile and customer-oriented DRT-solutions.

As the transportation organization Ruter is owned by public authorities, the need for new transportation services has historically been presented by the municipalities. Hence, the alignment and problem framing are defined together and in cooperation with public actors. It is argued that customer and market insight is highly important as the on-demand services are more attractive if the business model is designed to meet the customers' needs. The paper highlights different ways to retrieve knowledge about the customers and their demands. Further, some explicit KPIs are presented before the paper concludes with a set of recommendations on how to innovate demand responsive transport. The recommendations will be a useful complement to literature on innovation process management and provides a guideline to develop and design user-oriented services to specified target groups within the sector of on-demand public transport.

## **1.1 Project Background**

The Response project is a study that maps out different business models for DRT in several countries within the Baltic Sea Region. The initiative is financed by Interreg Baltic Sea Region and driven by the public transport sector, seeking to develop and coordinate existing publicly funded transport services. The project consists of eight organizations from five different countries in the Baltic Sea Region. One of the partners in the project is Ruter, which is responsible for providing and sharing insights from creating and running pilots on DRT, such as transport for elderly and children that are not able to use the ordinary public transportation, through this research paper. The main pilot contributing to the Response project is a pilot in Nes municipality. The pilot exploits DRT transport in a suburban area for people above 67 years of age that may have difficulties using ordinary public transport.

Ruter AS is a publicly owned company that is responsible for public transport in Oslo municipality and parts of Viken county. Ruter determines fares and route offers for subways, trams, buses, and ferries in the two counties, which are sourced from different operating companies (Ruter, 2021a).

The output will be used to create new pilots in the Baltic Sea Region countries and the broad outreach is secured by the participation of associated Response partners. As part of the contribution to the Response project, Ruter will prepare a product pilot sheet of the pilots included in this article by the end of the project

## **1.2 Innovation Development in DRT**

DRT is a flexible model of transportation that is created to fit the travel purpose of specific user groups. It has primarily been used to meet the needs of people with limited access to public transport or private vehicles, as many people have geographical or economic restraints, or difficulties to mobilize travels without assistance (Hunkin, S., Krell, K., 2018). Compared with ordinary transportation, a DRT solution can be personalized, be a social arena and provide door-to-door capability. However, providing such a service is costly and is highly dependent on people travelling together to create an economically sustainable solution.

Due to innovation in the transport sector and the rapid growth of communication technologies and planning systems, it is now possible to effectively offer new forms of demand responsive transport. The various transportation business models will differ based on geography, time of day/week and the market segment. Ultimately, the needs of the market and operational possibilities will shape the design of the transportation model used and utilize the technology that is available (Khattak & Yim, 2004).

To develop and design new and user-friendly demand responsive services, it is important to collect marked insight from all aspects of the market demand. Service design is defined to have a user-centered approach with an outside-in perspective and is described to ensure that the service is used by users in the intended way. Using customer feedback creates positive experience for the users and minimize the risk of unnecessary costs (Holmlid, 2007).

PESTEL is a framework to analyze the macro-environmental factors that may have a profound impact on an organization's performance. These acronyms stand for Political, Economic, Social, Technological, Environmental and Legal factors (business-to-you.com, 2021)

The factors in the model are not intended to be a complete overview of what may have an impact on an innovation process, but it is a division of focus areas around which managers in innovation projects must consider when making decisions and implementing actions. From an analytical perspective, the factors give us an easier way to interpret and better understand the reasons why the innovation process proceeds as it does. All factors can in their own way inhibit and promote the innovation process, and if one of the factors fails, it will potentially damage the innovation (Bergum, 2005).

## 2 Ongoing Pilots in the Response Project

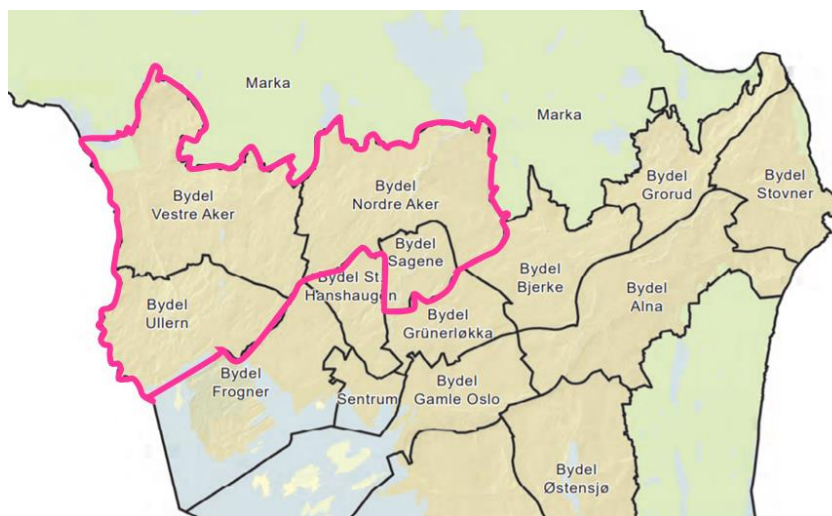
The way people move is constantly changing, and the customers' expectations are rising in line with new technological developments and business opportunities. Our customers demand flexible and sustainable mobility services and together with customers and owners, we pilot new mobility concepts that are presumed to reach the goal of sustainability and freedom of movement (Ruter, 2020, p. 69). Ruter has started a set of pilots to test different models of demand-responsive transportation. The purpose of the pilots is to introduce new technology to customers and surroundings, to explore what kind of roles DRT solutions can play as part of the public transport service, and what kind of mobility services that will ease the travels for our customers. Ruter has four ongoing DRT pilots in Oslo and Viken during the year of 2020. This paper will use insights drawn from pilots included in the Response project when discussing the different phases of the development of innovative transportation services. Followingly, the Response pilots will be shortly introduced.

### 2.1 Pilot Demand-responsive Transport for Elderly in Oslo

The DRT service that is being tested in Oslo started in September 2017 and is an age-friendly DRT service for people aged above 67. The main goal of the pilot is to provide an age-friendly transportation model that will ease the challenge for elderly to get out and socialize. Many elderly are lonesome and have problems

with running errands and being part of a social life, without help to transportation. The customers are transported door-to-door within a given geographical area and they may book their trip in real time or up to a week in advance. The service is available from 10 a.m. to 6 p.m., Monday through Saturday. If there are several passengers going in the same directions, they will be picked up and dropped off along the way, which will optimize the driving logistics. The pilot runs with pink minibuses with the capacity of 15 passengers and one wheelchair. The customers book their trip by an app or a phone call to the operation center.

This concept is being tested in the city center of Oslo. The pilot started in the district of Nordre Aker in 2017, followed by Sagene (2018), Vestre Aker (2019) and Ullern in 2020. The map below displays the area with the pilot for elderly in Oslo.



Picture 1: A map of the area for the pilot on DRT for elderly in Oslo municipality in 2020

## **2.2 Pilot Demand-responsive Transport for Elderly in Nes (Pilot Nes)**

As a part of the Response project, Ruter started a new DRT pilot in the municipality of Nes in Viken (former Akershus) county. Nes municipality was selected based on geographical conditions, the fact that it is a low population area with scattered population, and travels constitute fairly long travel routes, and existing public transport in the area has a low customer satisfaction score.

Nes is a rural municipality, and the population is clustered together in different areas. 2/3 of the citizens live in these clusters, and 1/3 of the citizens live outside of these clusters in even more rural areas. Pilot Nes started in November 2019 and the outcome of the pilot will be documented in a pilot product sheet.

The business model of Pilot Nes is inspired by the pilot for elderly in Oslo, which also aims to enable elderly people to socialize and take control of their own lives

without help from others. The pilot offers a door-to-door service with flexible routes for people above the age of sixty-seven. The passengers are picked up and dropped off where they want, within a predefined area in Nes municipality. If there are several passengers going in the same directions, they will be picked up along the way which will optimize the driving logistics. The bookings may be done in real time or up to a week in advance through the app or by calling the operation center. The transportation service will be available from 9 a.m. to 5 p.m., Monday - Saturday. The pilot will be adjusted if needed, if it appears that the service should run differently to meet customer needs. The customers can book their trip one week prior to their trip. The customer may also reserve trips with a fixed interval (e.g., every Monday at 10 a.m.).

### **2.3 Pilot Oppegård**

The DRT service tested in Oppegård municipality, started in September 2019, and takes costumers from virtual stops that can be their home address, sports arenas or other social meeting areas. Bookings are made in real time in a service specific application. Pilot Oppegård is uses a fully automatic solution for planning and booking. The main goal for the pilot is to test the digital plan system solution for booking and route planning. The service is open for everyone, but the main target group is young technologically adept users, aged between 8-12 that need transport to their sport activities. Customers book their trip through the app and the bus arrives within few minutes, with an estimated waiting time between 4 and 8 minutes. The pilot's opening hours are between 4 p.m. to 9 p.m.

### **2.4 Activity Transport for Children**

The DRT service that was tested in Bærum municipality was started in January 2018, and the pilot period ended in December 2019. From August 2020 we started a new pilot in the same area and included more activities, more schools, and more children. The service is for 2nd-5th graders that run organized sports activities after school. The children are picked up at school and driven to the sports arenas and returned home afterwards. When the child is "subscribed" to this transport, all bookings are made for the following semester. New customers can start using the service during the semester if needed.

This pilot includes 12 schools, around 330 children and 20 minibuses. By organizing the transport like this, we have gathered many passengers in the same vehicle and minimized the need for private cars. The pilot aims to reduce the need for private cars, as well as make children develop good travel habits at an early age. The service runs Monday-Friday, and the children are picked up from their schools so that they arrive in time for practice at 2.30 p.m. Practice ends at 4 p.m. and the children are then driven home. This means that the

transportation happens between 1.30 p.m. and 5 p.m. at pre-set departure and arrival times.

Below is a model that presents an approximate number of trips the Ruter pilots had during the piloting period from 2019 to 2020.

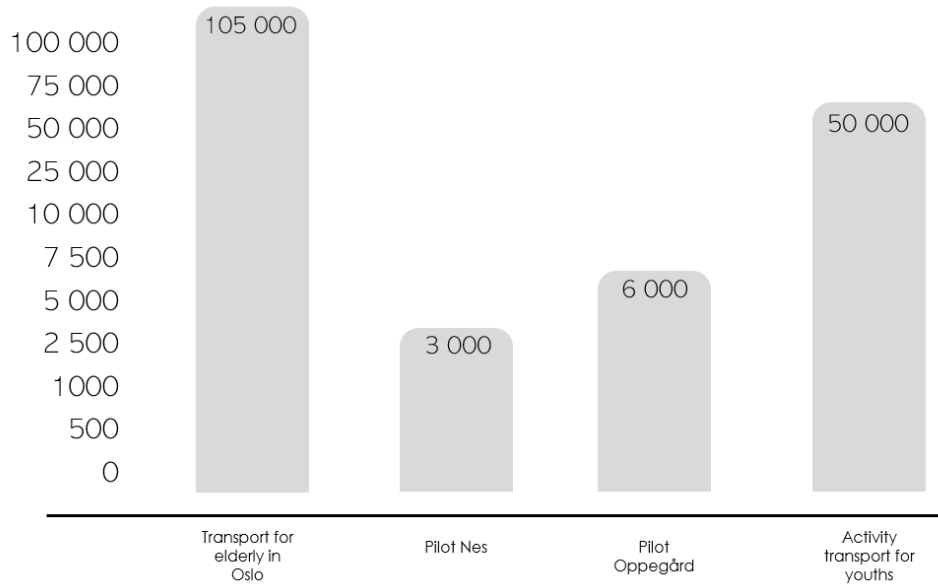


Table 1: Key numbers of trips in the Ruter pilots during the piloting period in 2019 and 2020

## 2.5 Pilot HentMeg by Kolumbus

HentMeg is the first demand-responsive transport in the rural area of Rogaland. The population in the area is 4,760 people. This target group consists of people that do not live along the main transport routes with high frequency. Customers order their transport through the webpage or by calling the operation center. The earlier the customers order their transport the greater the chance that they will be picked up at the time they want. The car or bus pick-up time could differ by 15 minutes before or after the time ordered by the customer. This is a door-to-door service. After ordering the transport, the customers must go outside of their homes to be picked up. This enables the elderly to get around much more conveniently and frequently than before.

HentMeg is available in the hours between 9 a.m. to 2 p.m. and 4:30 p.m. to 8 p.m. on weekdays, and from 10 a.m. to 3 p.m. on Saturdays. Kolumbus started to provide this service in 2018 and it is still on-going at the end of 2020.

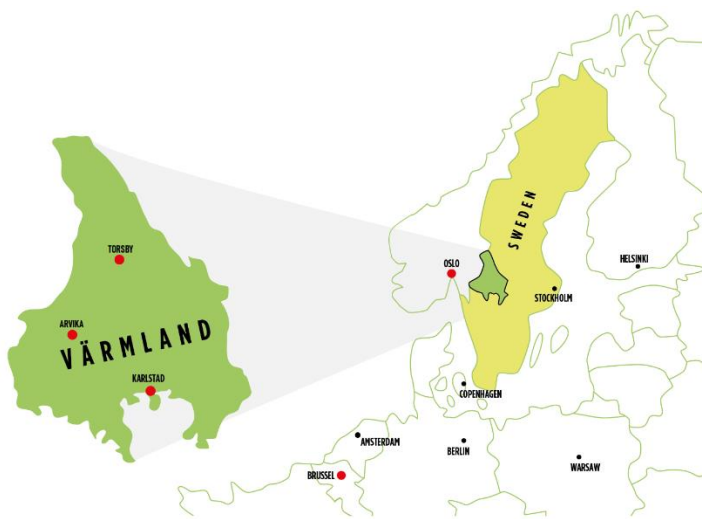
## 2.6 Pilot in Värmland

The pilot aims to investigate whether the availability of digital bookings in combination with a new pricing strategy and better integrity, encourage travelers



of vulnerable groups to use more regular public transport, instead of Special Transport Services (STS), especially for their health related trips. In Sweden, STS is provided to individuals that have been approved of having a permanent disability and have mobility problems when travelling alone or by public transport. Consequently, this will be cost saving for public transport authorities and hopefully contribute to reduced emissions by introducing more people to opt for patient transport instead of private vehicles when going to their health care appointments.

The pilot runs in Värmland (Sweden), and in the current version of June 2020 the customers need to book a trip together with a healthcare appointment at one of the three hospitals in Arvika, Karlstad or Torsby.



Picture 2: A map of the area included in the pilot in Varmland

The pilot targets travelers of vulnerable groups in the form of patients with healthcare appointments belonging to the three above mentioned hospitals. The customers can book their trip through an online website which is accessible all day long.

By moving expensive STS customers to regular public transport (including our DRT services) the transportation can be made more economically efficient as STS transport generally comes with higher costs. By moving some of the bookings from our call center to an online self-service solution the idea is that the service that we offer is better for those customers who really need the assistance of the call center.

## **2.7 Pilot in Saaremaa**

The DRT pilot in Saaremaa, Sõrve peninsula is planned to be launched from July 1st, 2021. The pilot will run from three to six months with two operating cars.

The service will be available for all the local inhabitants, including those in need of social transport. After a few months, the performance of the service will be evaluated, and new areas with poor public transport and service categories (e.g., school transport, elderly transport) will be considered.

Saaremaa is the largest island in Estonia and home to a population of 31,000 people. It has a large, sparsely populated area and is struggling to divert regular public transport to reach many places, as there are few customers, and the mobility needs are unpredictable. Bus stops are often far from home and buses rarely run. The result is that the population must rely on private vehicles or pay-as-you go transport which can significantly be a disadvantage to youth, non-car owners and elderly cohorts.

The piloting area in Saaremaa was chosen in collaboration with local transport planning experts as most suitable geographically and as an area with the highest price per passenger km. After the initial testing in Sõrve peninsula, the goal is to extend the project to other areas of the municipality where the availability of transport is low, and the price of regular schedule-based transport is relatively high.

The first version of the service is planned to be launched based on a call-centre to better control the requests for trips. All trips must be booked on the previous working day. Saaremaa municipality will use the software also for organizing social transport. The passenger app is planned to be made available after some months enabling registered users to place orders, get messages or reminders and make payments. In the future it will also be possible to plan end-to-end trips. All drivers will have a dedicated app for reporting tasks taken and registering boarding and exiting.

The software provided by Modern Mobility makes it possible to register the trip requests, pooling and logging of on and off boarding of passengers. The vehicle cost for the pilot will be covered by Toyota Baltic who participates as a partner in the testing period. Saaremaa Municipality will cover the costs for fuel and drivers.

Saaremaa DRT will be the first pilot of its kind in Estonia. The pilot would significantly build the capacity of public authorities and Estonian ICT solution providers alike, and ideally create conditions that are favorable for scaling DRT services in other municipalities. The pilot will aim to create a user experience that supports a policy of public learning and social wellbeing with at little risk as possible. The pilot will deliver important feedback on customer usage, mobility trends and potential cost effectiveness.

## 3 The Innovation Model

Creating a business model is not simply about creating a business plan or determining the service design. It is about mapping out the needs of the customers and how the service will fulfill these needs and create ongoing and future value for the customers. The innovation model consists of a process in five phases and a theory that offers six different perspectives that needs to be considered in each phase of the process. First, we will present the different perspectives from the theory of PESTEL.

### 3.1 Theory on the PESTEL Analysis

PESTEL is a structured method that can be used to identify, analyze, and understand the political, economic, social, technological, environmental, and legal factors that may influence the innovation process in your organization. In addition to working through the steps in the innovation model, companies must in each iteration and in each step consider the external factors that may affect the organization and the innovation process.

The six factors in the model are not intended to be a complete overview of what may have an impact on an innovation process, but it is a division of focus areas around which managers in innovation projects must make decisions and implement actions. From an analytical perspective, the factors ease the way to be able to interpret and better understand why an innovation process proceeds as it does. All factors can in their own way inhibit and promote changes and decisions to innovate.

The model contributes to a general understanding of important factors that can affect the business model and is used as a tool to ensure that all main categories of external factors are considered. The method is well suited for work meetings, but it is analytical and can be time-consuming. It is easy to end up with big and general factors, such as "globalization". It is important to focus on what is relevant to the specific organization, and for a good result it is important to ask the right questions (DigitalNorway, 2020, p. 1).

The table below gives an overview of the PESTEL analysis, which is further discussed in the following chapters.

| P  | E   | S   | T   | E  | L   |
|--|---|---|---|--|---|
| <ul style="list-style-type: none"> <li>- Government policy</li> <li>- Political stability</li> <li>- Corruption</li> <li>- Foreign trade policy</li> <li>- Tax policy</li> <li>- Labour law</li> <li>- Trade restrictions</li> </ul> | <ul style="list-style-type: none"> <li>- Economic growth</li> <li>- Exchange rates</li> <li>- Interest rates</li> <li>- Inflation rates</li> <li>- Disposable income</li> <li>- Unemployment rates</li> </ul> | <ul style="list-style-type: none"> <li>- Population growth rate</li> <li>- Age distribution</li> <li>- Career attitudes</li> <li>- Safety emphasis</li> <li>- Health consciousness</li> <li>- Lifestyle attitudes</li> <li>- Cultural barriers</li> </ul> | <ul style="list-style-type: none"> <li>- Technology incentives</li> <li>- Level of innovation</li> <li>- Automation</li> <li>- R&amp;D activity</li> <li>- Technological change</li> <li>- Technological awareness</li> </ul> | <ul style="list-style-type: none"> <li>- Weather</li> <li>- Climate</li> <li>- Environmental policies</li> <li>- Climate change</li> <li>- Pressures from NGO's</li> </ul> | <ul style="list-style-type: none"> <li>- Discrimination laws</li> <li>- Antitrust laws</li> <li>- Employment laws</li> <li>- Consumer protection laws</li> <li>- Copyright and patent laws</li> <li>- Health and safety laws</li> </ul> |

Table 2: An overview of the PESTEL analysis

### 3.1.1 Political Factors

Changes in legislation, regulations, popular opinion, etc. might influence the rate and direction of innovation. These factors are all about how and to what degree a government intervenes in the economy or a certain industry. Basically, the influences that the government has on the organization could be classified here. This can include government policy, political stability or instability, corruption, foreign trade policy, tax policy, labor law, environmental law, and trade restrictions. Furthermore, the government may have a profound impact on a nation's education system, infrastructure, and health regulations. These are all factors that need to be considered when assessing the attractiveness of a potential market (business-to-you.com, 2021).

Political focus on climate and environmental protection makes it easier for public transport companies in Norway to be able to experiment to a greater extent with new services and gain support for services that affect, for example, people's driving habits. In addition, the UN's sustainability goals have focused on equalizing inequalities. Services that have vulnerable groups such as children and the elderly as target groups will therefore be easier to get support for (such as age friendly transportation in Nes and Oslo, as well as activity transport Bærum). It is a political goal in Norway to run emission-free by 2028. This will have an impact on what kind of buses we can get political acceptance for using in our

services. Because of this, Ruter must engage in contractual agreements with the operators to only drive fuel-free vehicles.

Within the scope of these factors it is also relevant to look at how political fluctuations will affect the future of business and industry. For example, a conservative or socialist government may influence business differently. In Norway, there have been both county mergers and railway reforms that have an impact on the public transport business and might have an impact on the DRT innovation work.

The climate panel in Bærum municipality proposed in October 2016 that the municipality should take the initiative to facilitate carpooling to leisure activities. This would reduce the need for passenger vehicles. The pilot for activity transport follows one of the goals in Bærum municipality's Climate Strategy 2030: "In 2025, the proportion of passenger travel by public transport, bicycle and walking will be 60 percent and the bicycle share will be seven percent" (Bærum kommune, 2021).

### **3.1.2 Economic Factors**

Economic factors are determinants of a certain economy's performance. Factors include economic growth, exchange rates, inflation rates, interest rates, disposable income of consumers and unemployment rates. These factors may have a direct or indirect long-term impact on a company since it affects the purchasing power of consumers and could possibly change demand/supply models in the economy. Consequently, it also affects the way companies price their products and services (business-to-you, 2021).

Economic factors will determine how much resources can be used in the innovation work in the organization and limit the time of running pilots. Public actors are dependent on economic transfers from counties and the state, and companies must see these transfers in connection with the most political currents in the society.

The financial resources available become a leading condition for resources that can be used for innovation activities. Funding affects schedules and the number of people who can work with innovation (Bergum, 2005).

In the Ruter pilots there is a question whether to develop a minimum offer and use the already existing functionality, or develop a new management system with more options to fit our customers' needs which usually is more expensive than using already existing systems. The price the customer should pay for a DRT service can be politically determined, which will affect the cost of a pilot. For example, it can be difficult to test for price elasticity in the pilots if it's not allowed to charge less or more than the price of an ordinary bus-ticket. In such

case, the services are usually subsidized by the municipality in the Norwegian pilots.

The pilots in Ruter are mostly paid for by the municipalities or counties where the pilots are running. Hence, the pilots will be influenced by their economic goals and decision making. The funding depends on what the public authorities want to learn, and what output and insights they will get from the pilot.

In Oslo municipality, there is a goal to have elderly live at home for a longer period. It is no secret that public services are expensive, and for an elderly to live at a nursing home the price for the government is high. Therefore, is it important for the municipality that transportation services for elderly people are tested and developed to increase the number of elderlies that can live at home longer and potentially reduce the total cost for the municipality.

In Viken county, they want to further develop on-demand transport in rural areas, to potentially save money on ordinary public transport that is not used as much. The pilot in Nes and other ordinary DRT solutions contribute to this development. Consequently, Viken county wants to provide the financial support to reach their political goals through the testing of new pilots.

### **3.1.3 Social Factors**

This dimension of the general environment represents the demographic characteristics, norms, customs, and values of the population within which the organization operates. This includes population trends such as the population growth rate, age distribution, income distribution, career attitudes, safety emphasis, health consciousness, lifestyle attitudes and cultural barriers. These factors are especially important for marketers when targeting certain customers. In addition, it also says something about the local workforce and its willingness to work under certain conditions (business-to-you, 2021).

Both the ageing population, the rise of social networking and the growing concern for the environment would all be relevant social trends concerning our innovation tasks. The elderly is healthier than before, and usually live by themselves. This can make it difficult for the elderly to get out, which in turn can lead to a focus on DRT services where the elderly can get to meeting places without having to travel by expensive taxis if they have trouble using the ordinary public transport.

Social factors tend to be part of the culture of the society. In Norway, there is tradition to expect the state to take care of older people and people with reduced functionality. Therefore, it is not the norm for families to take care of their elderly parents personally but rather give this responsibility to the public actors (Warner-Søderholm, 2012). Consequently, Norwegians are extremely independent people and do not like to bother others and rather feel like they disturb family and

friends if they ask for help. As a result of this, customized transportation from door-to-door was seen to be critical to provide independent lives for elderly people.

It is also interesting to look at travel habits between urban and suburban areas. Research shows a tendency that people living in suburban areas in Norway use the car more than people living in cities. They choose a car because it is more time efficient and because the public transport service is not well enough adapted to their needs. Furthermore, people in suburban areas use a car because their public transport offers are complicated and sometimes demand the use of corresponding services (Nordbakke & Lunke, 2021).

### ***3.1.4 Technological Factors***

These factors pertain to innovations in technology that may affect the operations of the industry and the market favorably or unfavorably. This refers to technology incentives, the level of innovation, automation, research, and development activity, technological change, and the amount of technological awareness that a market possesses. These factors may influence decisions to enter or not enter certain industries, to launch or not launch certain products or to outsource production activities abroad. By knowing what is going on technology-wise, the companies may be able to prevent spending a lot of money on developing a technology that would become obsolete very soon due to disruptive technological changes elsewhere (business-to-you, 2021).

If the demand-responsive transportation service depends on a new technological contact point for planning systems, the technology must be developed before the pilot can be driven. If the pilot is small, it is possible to run it using a manual planning system, but in both cases, it is necessary to have a planning system that can communicate directly with the drivers. Consequently, it is important to have a close dialogue with the technologic environment at an early stage to explore the technological possibilities.

DRT services have already been operational in several countries for many years. Innovation within DRT will therefore be disruptive innovation in the form of new services breaking down or knocking out existing services in the form of simpler and cheaper solutions or new business models, or in new technology developing an existing service and making it better. For example, the development of app technology and increasingly accurate GPS technology are factors that can improve DRT services considerably. At the same time, new technological solutions are often difficult to access for the elderly and children, for whom these services are often intended. Technology is associated with material objects but does also includes specialized knowledge and expertise that can be important for the innovation process (Bergum, 2005).

In rural areas, internet connection may also be poor. Such issues must be accounted for before launching a new service. The customers usually know in which areas the internet connection is poor, and it may influence their way of booking the trip. Additionally, the service provider is responsible to ensure that the planning and routing system work even though the connection in some areas is poor.

From Pilot Oppgård, we tested different digital solutions to offer a full digital solution with an automatic planning system. The customers booked their transport in the app, and the system created a route automatically. Hence, we were dependent on customers with a high degree of technological competency. The system also sends the routes automatically to the buses' GPS. This saves a lot of human resources and is much more efficient. From this pilot we learned that automatic planning system is a crucial asset to be able to deliver full-scale DRT solutions.

Furthermore, we learned that the customer center was not able to take all bookings by phone calls after exceeding a high number of daily customers, which resulted in long waiting lines at the customer center. At the most, some customers waited 30 minutes to get through on the phone line. A booking app is needed to ease this part of the service, aiming at an automatic booking process. It is limited how many people can be hired to handle the incoming calls, given that the service must be sustainable, and the costs associated with the operation center are relatively high. This, consequently, highlighted the challenge to get more elderly people to use the app, as we know they feel insecure and are unfamiliar with the use of technology solutions.

### ***3.1.5 Environmental Factors***

Environmental factors have come to the forefront only relatively recently. They have become important due to the increasing scarcity of raw materials, pollution targets and carbon footprint targets set by governments. These factors include ecological and environmental aspects such as weather, environmental offsets, and climate change, which may especially affect industries such as tourism, farming, agriculture, and insurance. Furthermore, a growing awareness of the potential impacts of climate change is affecting how companies operate and the products they offer. This has led to many companies getting more involved in practices such as corporate social responsibility (CSR) and sustainability.

The focus on saving the planet has the consequence that more people see the benefits of driving many people in a vehicle rather than driving alone in their own



car. An example of this is activity transport which is being piloted in Viken county where children are picked up at school in minibuses and driven to activities. After the activities, they are driven home in buses. Before, these children were picked up by their parents, and potentially 300 cars have now been replaced by 20 buses.

### **3.1.6 Legal Factors**

Although these factors may have some overlap with the political factors, they include more specific laws such as discrimination laws, antitrust laws, employment laws, consumer protection laws, copyright and patent laws, and health and safety laws. Companies need to know what is and what is not legal in order to trade successfully and ethically. If an organization trades globally this becomes especially tricky since each country has its own set of rules and regulations. In addition, you want to be aware of any potential changes in legislation and the impact it may have on your business in the future. It is recommended to have a legal advisor or attorney to help you with these things.

DRT solutions in the public sector can be slowed down by new laws such as GDPR. Implementing laws that protect the traveler's personal information, will also make it difficult to obtain the information needed about customers and can make it difficult to reach them to ask them questions.

Feedback we have got from the customers that have tested the pilots, show that they would like to contact the drivers or have the driver contact them if any problems occur with finding each other. The same applies when the customers would like to receive an SMS if the bus is delayed. With the European Commission GDPR standards, we must secure approval to use personal data. With strict restrictions on how to save and use personal data, it is a challenge for us to provide personal contact between the customers and drivers.

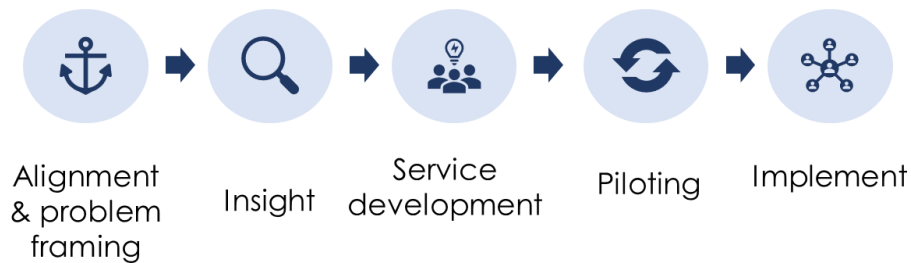
## **3.2 How to Run an Innovation Process**

With these influential factors in mind, we can move forward to the concept of developing a business model. The conceptual framework of the process to develop innovation builds on the Norwegian model «KS veikart for tjenesteinnovasjon», which is developed by the Norwegian Association of Local and Regional Authorities (KS) (KS, 2020). KS is an organization for all local governments in Norway and they work to meet the local governments needs for community development, innovation, efficiency improvement and employer growth. They see the importance of developing innovative solutions for the benefit of the public, and because of this, they have created the model and steps for service innovation to be used in the public sector.

Furthermore, the model has been inspired by the theory of service design and design thinking principles. The most recent definition of service design appears to be the “overall process of developing new service offerings” (Johnson, 2000) and is concerned with the complete set of stages from idea to launch (Goldstein et.al., 2002).

The model illustrates the five phases of an innovation process on how to create agile and customer-oriented DRT-solutions. The model starts out by discovering a need and ends with a new service in full operation. Throughout the model, different tools are presented to involve the right people, make decisions based on the right assumptions and develop the service based on customer need and travel purpose.

The five steps of the model are presented in model 1. The testing is worked on iteratively, and the evaluation of the tests will continue to improve as more knowledge is presented during the pilot period. In other words, the pilot may change based on new knowledge and new assumptions through the piloting period. This cycle is repeated to learn as much as possible about the users’ needs, their travel purposes, and how Ruter can organize and operate the service. The goal of iteration is to get closer to a solution that utilize cost benefits with and meet the users’ needs. The solution eventually converges into a concept that is suitable for customers, operators, and owners, and that can be fully implement into daily operation.



Model 1: The innovation process to create new DRT services in the public transportation sector

### 3.3 The Five Stages of the Innovation Process

In the following chapters, the different phases of the innovation process will be presented. To further discuss how to design a good user experience, some examples from the pilots will be shown and explained together with the model.

#### 3.3.1 Alignment and Problem Framing

The purpose of the first phase is to define the challenge or a customer need, and furthermore ensure that the organization and other actors have a common understanding of both the problem and the goal of the innovation. Successful work with service innovation is characterized by thorough preparation, good

planning, and broad alignment with customers and within the organization and stakeholders. It is necessary to have the support from the involved firm, key roles, actors, and shareholders (KS, 2020). Therefore, the first step in the process is to describe the identified challenge through problem definition and goals for the initiative. The identified challenges should be clarified through involvement of future users and customers, so that they are a part of the alignment. It is important that the organization completely understands the customers need to be able to frame the challenge. Moreover, it is necessary to ensure that the goal is in line with the organization's strategy and other stakeholder's goals. It will be most important to execute the factors presented in the PESTEL analysis in this phase. As mentioned previously, they will determine significant aspects that it is critical to have in mind before moving on to the next phases.

The problem alignment for the pilot offered to elderly people was described after the citizen involvement in the age-friendly city of Oslo. Oslo municipality wants to be an age-friendly city, which is an inclusive and accessible urban environment that promotes active aging. An age-friendly city facilitates that even the elderly will experience belonging, mastering and security and get the opportunity to live free and meaningful lives. Transportation was found to be the second most important aspect to reach the goal of an age-friendly city. This insight was gathered through interviews and focus groups with the elderly. Oslo municipality talked and questioned a large group of people above the age of 67, where the elderly mentioned long distance to the closest bus stop and slippery roads as obstacles to using public transport. They also do not want to be a nuisance to others and ask for help with transportation when going to the doctor's, the grocery store, the mall or to a café with friends. Based on this information we knew that the goal was to bring elderly people from door-to-door and provide the help they need to get on and off the bus.

Ruter as a company that wants to strive for sustainable freedom of movement and a part of the goal is to decrease the number of cars in Ruters area of operation to reduce greenhouse gas emission. It was discussed to cut the number of cars used to drive children to and from activities after school. Traditionally each kid was driven by their parents. And even though the children lived in the same neighborhood, they were driven in separate cars. Ruter looked at the opportunity to organize on-demand transport to get more people to travel together when going to the same destination.

### **3.3.2 Insight**

Phase number two is based on collecting results from different types of research to be able to highlight the weaknesses of an existing service or insights into what type of service potential customers would prefer. It is common to start this

process by examining the target group and potential customers. Furthermore, the objective of this phase is to identify and contextualize the actual problem or opportunity and use this to see all sides of the specific need.

As customer interaction is such an important aspect of developing new services, the hardest part is to get users to talk. The people that are affected by the service are the best to identify and understand the actual need. In the insight phase, the business developers should spend a lot of time to examine the users' life situation and employees' everyday work. They should really know the customers, both their habits and actions, feelings, and needs. Using the tools of observations, interviews or surveys, makes it possible to gain insight into what type of service they need and what attributes they would like in a future transportation model.

In all pilots, Ruter has organized surveys to understand the users' needs. Such surveys are arranged before the pilot starts to analyze the potential and understand the need, and obtain customer feedback during the pilot on how the service is working and how the customer reacts to the different service aspects, and to arrive at one final survey after the pilot is completed. The final survey should be the most comprehensive one and, focus on the user experience, customer satisfaction and whether such service fulfilled the need that was identified to begin with. On-demand services are offered to meet customer demand and should be designed to meet the customers' expectations. In the survey, we ask about the customers' travelling purpose, the level of service needed, and other factors that will make them use the transport. Furthermore, we ask the customers at what time during the day, which days and within which geographical area they would like to travel. If we have a hypothesis of some changes that will improve the operation of the service, we will ask them how they would react to such changes. It is also interesting to ask about the customers price elasticity, digital knowledge, and transportation alternatives if the DRT service were not available in that area.

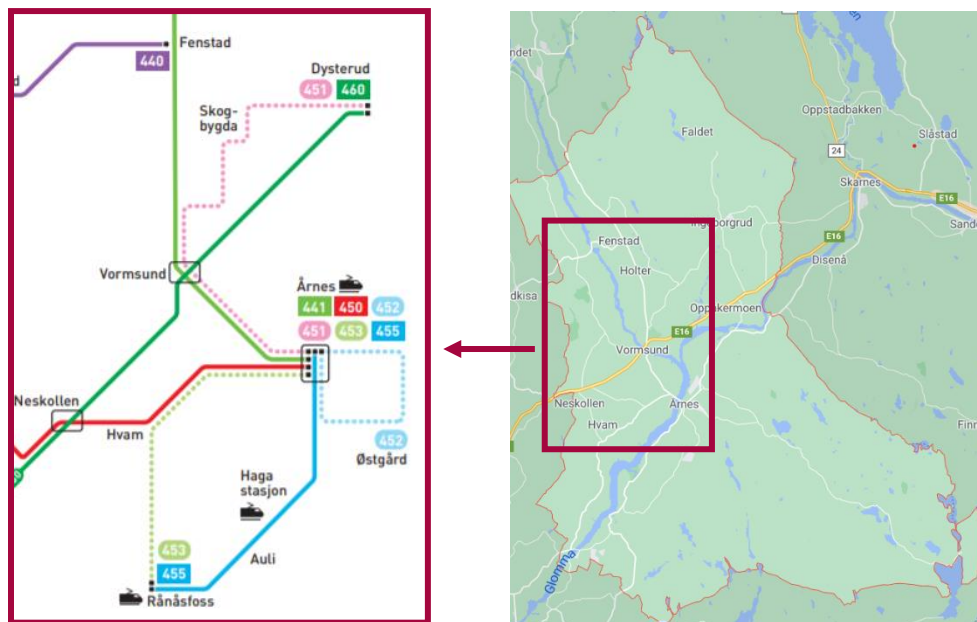
During this phase, Ruter learned that elderly people will do most of their travels during the weekdays and often early during the day. They may need help to enter the bus, and they would like to have the possibility to cancel the trip if they do not feel well. From talking to the elderly, we also learned that the most critical travel destinations were medical institutions, grocery stores, the mall or to use the hairdresser. In other words, they need transport to do errands and practical trips.

For the activity transport, we understood from user feedback, that it was essential to the parents that there would be a person responsible for ensuring that their children got on the correct bus for them to trust their children to travel

alone. Hence, we were depended on the sports clubs to be involved in the organization to be able to arrange such transport.

Other activities at this stage would include market research and collection statistics, figures and other facts related to the services. Doing this will give the opportunity to see different aspect of several transportation models, and especially what transportation services are offered today in the nearby area and learn from what other mobility companies do in other cities or countries.

Researching the market in Nes municipality, we understood that the neighborhoods were spread withing three geographical areas, with the city center in the middle. Most of the public services, stores and cafes were placed in the city center and the existing public transportation offer was based on these. Picture 3 shows where the existing public transportation lines operate and illustrates that the existing offers are not optimal for the habitants living on the outskirts of the municipality. The current lines in the area are classified as bigger lines between the city center and other transportation hubs and do not include the residential areas. Moreover, it is less attractive for customers to use the transportation service if it is more than 2 kilometers for them to walk to the closest bus stop.



Picture 3: Overview of the existing route map in Nes municipality.

### **3.3.3 Service Development**

Service development is the phase where techniques such as brainstorming, and workshops are used to generate ideas and potential business models. Ideation is the creative process of generating new ideas based on the insights found in phase two. Creativity is an important part of the design process, in which the

business developers will focus on uncovering the pain points their customers are experiencing and developing new products, services, and transportation models aligned to their needs.

The idea generation is done together with the actors involved with the development of the new service. It is necessary to invite people that will take part in the service in different ways to a workshop with brainstorming to come up with ideas to solve the problem. This is to align, hold accountable and give ownership to the different individuals to take part in the service offering. Furthermore, the purpose is to work systematically with the knowledge you have gained through the insight work in the previous phase. New ideas for solutions are then assessed and prioritized based on feasibility and assumed gains.

Defining the concept means to elaborate on the different components of the project, making sure everyone understands the context of the project (both internal and external) as well as understanding what lies within the capabilities of the organization. This implies that it is necessary to take finance, resources, logistic and market situation into account when further defining the concept.

Based on the knowledge we gathered in the insight phase, we arrange workshops with different actors to discuss in what way we can best deliver the value expected from our customers. Regarding the daily operation, it is necessary to know what kind of service that is possible to deliver. This depends on how large the market is and how many buses that needs to be ordered to fill the potential need. The number of buses may also be dependent based on the budget and available financing.

Financing, ticket pricing and contracts play a large role in how the service will look like and how attractive the business model is. The service should be developed to fit a given budget and the expected demand. In our Ruter pilots, it has previously been decided that the fare will be the same as for regular transportation during the piloting period. However, the ticket price for on-demand solutions is under an ongoing debate in Ruter and the price might end up being different from regular fares in the future. This is based on the assumption that the customers are willing to pay more for a flexible and tailored solution than for regular public transport.

Creating the business models are, as previously mentioned, based on customer insights, demand, and other influencing factors. For example, knowing that the elderlies were doing errands and needed transport during the day, the transportation service was offered Monday through Saturday between 10 a.m. to 6 p.m. Furthermore, we knew that the elderlies have mobility challenges and felt lonesome and therefore the bus driver has a bigger role in the transport. The

drivers will help with boarding and exiting, as well as being polite and extra helpful. Many of our customers have commended the drivers for this and said that it is nice it is to have someone to talk to during the day.

The business model for the pilot in Nes is based on the pilot in Oslo. The buses used in the pilot are also used to drive children to school in the morning, and to optimize the driving, the pilot opening hours are between 9 a.m. and 5 p.m. The ending time is an hour earlier than Oslo because the stores and other actors close at 5 p.m. in Nes. There have not been any comments on these opening hours in Nes after starting the pilot.

After creating a business model that satisfies the demand of the customers and the given budget, it is necessary to create learning objectives followed by key performance indicators (KPIs) to meet the main goal. We have learned that the main goal is given by political goals but as a mobility actor, Ruter has its own goal to optimize a service offer through the learning areas of customer attractiveness, operational possibilities, and economical sustainability. Hence, we create learning objectives that will provide knowledge on how different aspects of the business model works in the pilot. Defining learning objectives for the pilot helps to evaluate how the pilot and that the business model fits in the market. Testing different aspect of the business model will imply which solutions work well and which do not. Normally, we plan for different test phases throughout the pilot. The number of phases differ between the pilots and is based on the learning objectives. In the pilot in Nes, we have three test phases which are presented in table 3. When to implement the tests is decided after we have reached desired level of learning. In the different test phases, we adjust some of the service attributes to learn how the changes may impact the KPI's. Furthermore, the KPIs will provide objective evidence of progress towards achieving a desired result, as well as give the information necessary to decide on whether to implement the pilot or not.

| The pilot is carried out in three phases: | Test phase 1   | Test phase 2   | Test phase 3  |
|---|--|--|---|
| Offer available for:                      | People above the age of 67   | People above the age of 67   | Open to all age groups  |
| Fleet optimization                        | Exploitation of vehicles for other periods outside the opening hours of the service. | Exploitation of vehicles for other periods outside the opening hours of the service. | Utilization of the vehicle for several offers at the same time. |
| Planning routes:                          | Free travel in all areas of Nes  | Free travel in all areas of Nes  | Free travel and a fixed route                                   |
| Plansystem                                | Manual   | Digital  | Digital   |
| Booking:                                  | Phone  | Phone and app  | Phone and app   |

Table 3: Example of the three test phases in Pilot Nes

The following are examples of learning objectives and critical success factors in the Nes pilot:

**Learning objectives:**

1. Operational utilization
2. Operating quality
3. Fleet optimization
4. Route planning
5. Planning system
6. Booking
7. Travel intentions and needs
8. Costs and effects for user and municipality
9. Target group and potential

**Critical success factors:**

- Customers are driven from door to door to shorten the walking distance
- Customers get extra assistance and time when they are getting on and off
- It must be easy to bring a wheelchair or walker

### **3.3.4 Piloting**

The most important aspect when developing new transportation models is to test the concept with some early adaptors or potential customers. That is why the next goal of the process is to develop a pilot that can be put into testing in the chosen testing area. Piloting means that the service is tested in a limited geographical area over a set period of time to ensure that everything works as intended. The purpose is to uncover errors and omissions, identify unforeseen problems and thereby reduce risk.

During the pilot period, the actors should collect as much feedback about the service as possible. Based on feedback, the concept can evolve and change in several iterations. It is important to determine who the customer will be and what he or she will use the transportation service for, before the pilot starts up. The pilot should run a representative number of tests with a small group of people. With that in mind, the company might discover issues or problems with the current transportation model. However, it is important not to interpret these kinds of discoveries as failures as this gives us just the same amount of learning.

During the piloting period, it is important to follow the economics and keep up the accounting to see how the business model works financially. Furthermore, we measure key statistics relative to the KPIs to ensure that we are able to evaluate and do changes in the business model if needed. Some examples of key numbers to use as measurable KPIs are:

- Number of trips
- Number of new customers and customers in total



- The service productivity (number of trips per hour)
- Length and driving time of the trips
- Number of delays and missed trips
- The number of customers that bring friends
- The number of wheelchairs that are brought on to the bus (elderly)
- Which geographical area the customers travel to
- Number of bookings through the app
- The number of customers that orders the trip by pick-up time and how many orders that are based on delivery time
- The number of customers who drive together during one trip
- The number of customers who do not get the time they want due to lack of capacity
- Cost per trip
- The age of the customers

The more that is learned from the pilots, the better the final solution of the transportation business model will be. The tests that are run during the piloting period give an indication of how the customers use the transportation and what kind of travels they need transport for. It is therefore useful to assess the impact of customer satisfaction to see the value of the service. Furthermore, we have the responsibility to create feedback loops to open the possibility for constant improvement of the service. These loops may continue also after the pilot period ends.

Additionally, through surveys or interviews, Ruter will learn how the customers perceive the service and what they think about the experience of using such on-demand transport. During the research on customer satisfaction, the customers have the possibility to come up with suggestions for improvements. The customers feedback of the service is an important KPI for the further development of new on-demand transportation services as it gives us insight into how satisfied or dissatisfied our customers are with the level of service we provide.

For example, we offered the possibility to book a trip based on the arrival time after receiving feedback from customers. Several of our elderly customers felt it hard to use the pilot to appointments as they did not know how many customers would be picked up during the trip, and consequently, they were afraid of not arriving in time for their appointment. Using a digital planning system, we were able to create routes which assured our customers that they would arrive in time. In addition, the elderly mentioned that they would like to book their returning trip in real time, as they did not know when they got tired and wanted to travel

home. Hence, we changed the requirement to book the trip one hour in advance to real time booking in the pilot.

Another lesson learned was that the bus drove many missed trips if the youths forgot to cancel the trip if they did not need it that day. The parents usually informed the teachers and coaches that their son or daughter would not come to practice but forgot to cancel the transportation. Knowing this, we had to implement a way that the parents had to sign them on the transportation instead of remembering to cancel a trip. This resulted in saved costs with fewer rental hours because they only drove the children that were there that day.

Introducing a new service to the market can be hard, and especially a pilot which intends to stop after the piloting period. We have experienced that it takes time for people to try out new solutions. This varies based on the user group, and particularly elderly people think it is scary to book a trip for the first time as they are somehow unsecure on how it works - and if they can use the service at all. For the elderly we have learned that it takes at least one to two months from the start of the pilot until the service is regularly used.

The pilot in Nes municipality had to be paused due to the Covid-19 situation in April 2020. When re-opening in October later the same year, Ruter was under restrictions to do marketing that would lead to more travels. This was to maintain the governments recommendation to not travel unless necessary. With no marketing, we had very few travelers and we considered it impossible to continue to pilot the service in Nes. Consequently, the pilot was paused again in December 2020. The pilot will not start again until Ruter can do marketing, and we are permitted to show up on strategic places to do face-to-face marketing towards existing and potentially new customers.

In the Pilot Oppgård, we learned that the customers had to know about the service and equally important, the booking app to start using the service. We reached out to the local sport clubs to do direct marketing through them.

After the piloting period, it is time to evaluate whether the transportation service should be implemented or rejected, and how the service should be created based on the learning obtained from the pilots. It might be that you reflect and review that the pilot has failed to meet the pilot's goal, or it does not solve the initial problem or need. Then, instead for implementing the service into operation, you should reject the pilot based on the relevant learning and insight. Bad results are also great knowledge, and a way to know that the proposed solution is not the correct way of solving the problem.

### **3.3.5 Implement**

It is now time to phase out the project and start planning for a long-term operating service. It is necessary to evaluate and summarize results from the pilot and the insights gathered previously, and to assess whether the project has achieved its original goal, what has gone well, and what are important improvement points. It is also necessary to use facts about project results and talk to people who have been involved in the project and to document the evaluation in a final report. If the service is dependent on new technology, new products or other assistance from external partners, the organization must carry out procurements. It must assess whether there is a need to procure assistance related to skills development and counselling. One should start by preparing a competition strategy, implementation plan and competition basis, and make sure the purchasing department is involved and think carefully about how the procurement can best be carried out.

Furthermore, the transition from pilot to operation needs a follow-up plan. It must be defined how KPIs are to be measured in operation. This could be finance, key numbers, and other government improvements. It is also necessary to define how you should detect errors in the service, follow up suppliers and implement corrective measures. Lastly, the responsibilities for further work must be anchored with all levels of the organization.

## **4 Summary & Recommendations**

The development of innovative services represents an opportunity to offer customer-oriented value. A structured service development process should ensure that the important tasks will be accomplished in time and that companies reflect on the external factors that may influence the business model. Enterprises that apply such an approach by involving the customers as well as pilot different services in real life scenarios, have indeed been able to reduce development costs significantly and increase service quality. On the basis of this, we have listed a set of recommendations on how to run an innovation process.

### **1. Know potential influencing external factors**

As presented, there is a lot of external factors that may influence the transportation service model. We experience that the municipality and political ambitions set the substructure for engaging in innovation and influence largely where the pilots will run, the target groups and length of the pilot. It may also impact the financial aspect and pricing models, and accordingly the business model's sustainability.

2. Know your customer and his/her need, and tailor solutions based on the target groups

From running pilots, we have learned that it is necessary to know the customers well to be able to customize solutions to different segments. Diverse target groups have unique needs, and the services should be tailored to deliver value to the respective groups. If the service is not designed well enough, the customers will be more unlikely to use the service.

3. Know the geographical area and evaluate DRT innovation in combination with existing transportation models

Geographical knowledge is seen as a necessary condition to start up pilots on DRT solutions. Population and population density will impact the potential demand for your service. Also, the travel purpose and the existing transportation offer will influence how people travel. Having such facts and figures of different areas will help to determine where it is most suitable to start an on-demand transportation service. From working with pilots on DRT solutions, we have also learned how demand-responsive transport can be used to fulfil the market potential of public transport. Looking at a greater area, DRT solutions may cover the areas that are not a part of the existing route map.

4. It might be necessary to do changes in the pilot if you discover new learning objectives during the piloting period

Working iteratively with innovation provides solutions that become better and are better suited for the customers as errors are discovered and corrected before the service is launched. The users' feedback is priceless, and such piloting will contribute with new insights of the problems that the users might face but are not discovered during the insight phase. Bad results are also good learning initiatives, and it may show that the pilot should not be implemented at all. Hence, continuously, and iteratively analyzing user feedback and the pilot's KPI's will help you to identify the changes needed to improve the learning objectives of the DRT solution. Eventually you will have a demand-responsive transportation model that is designed to fit the customers' needs and travel habits, as well as operational possibilities, or a rejected model that is not suitable for solving your initial problem and therefore should not be implemented.

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