



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

WP 3.2: MAPPING STUDY OF INNOVATIVE DRT BUSINESS MODELS - DENMARK

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1 General status of DRT in the country

Denmark is divided into five administrative regions. The majority of health care services are provided by these regions. To coordinate the DRT transportation of patients to and from the hospitals and other treatment centres, the organization FlexDanmark is in charge of all transportations. The DRT product is collectively referred to as Flextrafik.

A number of the transportations is across regions because Denmark geographically is small and some special treatments are only done at few places. FlexDanmark is a private company that is owned by the five regions.

The actual transportation is carried out by private contractors. A wide variety of vehicle types are used. This includes person cars (mainly taxis), minibuses (9-20 persons), and large buses. A number of the minibus are specially equipped with lifts for handling passengers in vehicle chairs.

The DRT transport is generally well-coordinated, however, the number of passengers per car is relatively low because of large rural areas and a number of quality parameters, such that the detour for any passenger must maximum be 50% of the direct route between the passengers home and the centre where the passenger is being treated. In addition, there is a large number of different passenger types that typically not are merged.

DRT transportation is also used as an alternative for fixed-route public transportation. This type of transport is highly subsidized by the government. This type of DRT is still in limited use in rural parts of Denmark and only accounts for a small fraction of the trips coordinated by FlexDanmark.

The price of a trip is the main concern for planning the DRT. However, in recent years the environmental impact of transport has become more and more important. The use of environmental impact as a metric is still in its infancy but expected to accelerate over the next years.

2 Examples of demand-responsive transport services

2.1 Case study No. 1 Flextrafik

Flextrafik is a DRT service that operates almost in every part of Denmark (except the Island of Bornholm), there are different DRT services under Flextrafik. Denmark is divided into five regions covered by five different PTAs. One of the concepts of the Danish DRT-model is the mixing of different DRT-products in the same pool of transport tasks. Every PTA administrates its own pool of cars but shares the same IT-platform.

Roughly 4,5% of the Danish population used Flextrafik in 2018 around 6 million trips were made. Flextrafik is provided to people with disabilities, patients, elderly people, school children, and regular citizens.

The goal in Flextrafik is always for passengers to share rides, both in terms of a healthy economy and lowering the environmental impact. One of the unique points of the Flextrafik optimization model is the combination of trips from many different authorities and thus with many vastly different citizens. The starting point is that all types of travellers from different travel products can be combined and thus share a ride for part of or the whole trip. It is possible to decide that travellers using product A can or cannot be mixed with travellers using product B. For instance, some types of patient transportation cannot be mixed with some types of regular flexible services. This is not a technical or legally determined limitation, but a result of at service level decided by the authorities. The Region or municipality (taxpayer-funded) that orders the transport is paying the share of the cost for their specific transports. The cost of every transport is divided between the authorities according to their actual use and level of service needed. The benefit for the authorities is the discount they get from pooling their transport tasks together.

The cost depends on the use of cars and the prices given by the taxi-companies from each car at the yearly procurement.

The first Danish PTAs launched the Flextrafik system in 1997. Now it is a nationwide solution. The basic premise in the Danish Flextrafik-model is an annual procurement process, conducted by the public transportation authorities (PTAs), which provides a framework on different hourly rates from many different carriers, with a wide geographical distribution. A shared nationwide IT system continuously distributes the trips on the available vehicles, starting with the cheapest compared to time spent, hourly rate, and coordination opportunities. The taxi-company is only paid if the actual vehicle is used. The system uses a dynamic volume of vehicle resources, only using the number of cars needed minute by minute.

Within the Danish Flextrafik/DRT-model, every authority (region/municipality) can partly decide its own set of service levels. Hence similar products can have different service levels in different areas. The most recent service is the multimodal "connected journey"-concept: a nationwide product extending the coverage of traditional public transport with Flextrafik as a DRT shuttle solution.

2.1.1 Flexible disability transport service

Flexible disability transport service is a travel system that provides demand-responsive transport to disabled people, who are unable to use the same public transport as other citizens. The flexible disability transport service is offered to disabled people, to whom the local government has assigned a walking aid or wheelchair. The client must be at least 16 years of age and a permanent resident in the county of North Jutland, and the disability must have lasted more than 12 months. (NT, 2019)

The municipality of residence makes a referral to a flexible disability transport service, after which the customer will receive an annual subscription price of DKK 400 (54 EUR) (from January 1, 2013)

for 104 individual journeys per year. A trip costs DKK 2.70 per kilometre and the minimum cost is DKK 30 per trip. Trips are financed by a combination of self-financing and the support of the municipality of residence. Payment for the trips can be handled by cash, credit card or by invoice. In some PTA-areas, there is no annual subscription, but only self-financing payment. After joining the flexible disability transport service, the customer or his or her close relatives must subscribe via the Internet or call the transport centre. (NT, 2019)

As a complementary service, the service is provided to other driving services from the front door to the front door. Taxis and buses for disabled people are used in the flexible disability transport service, and the service includes transport for leisure activities, family visits, shopping, visiting cultural events, medical visits, etc. (NT, 2019)

If the customer needs assistance during transport, then it is possible to ask for an escort for free. If the customer is not provided with a free escort, then a co-passenger may travel with the customer for the same price as the customer pays for the trip. Trips are financed by a combination of self-financing and the support of the municipality of residence. (NT, 2019)

About Customers:

- 93% of customers do not have a car
- 75% of customers are over 70 years old
- 80% of clients are women

About Usage:

- 33% of customers use flexible disability transportation at least once a week
- 85% of customers order on their own devices

2.1.2 Flexible hospital transport service

Flexible hospital transport is a county-wide travel system for patients who need to go to the hospital and who cannot use regular public transport. The largest patient groups are dialysis patients and radiation and chemotherapy patients, but generally, all patients can be transported. (NT, 2019)

The County Management Centre staff assigns journeys within the flexible hospital transport service and outsource them to the planning system; nurses and doctors' assistants can order their home appointments themselves through the web-based booking module. (NT, 2019)

The Flexible Transport service is suitable for transporting almost all recumbent patients. Patient transportation is coordinated with other flexible transport services, which means that patients are transported together with other clients or patients. Some patient groups are transported separately due to severe illness. If necessary, the patient is sent to the relevant department in the hospital and gets picked-up there. The trips are financed by the county. (NT, 2019)

The transport is ordered directly through the DRT subscription module an advanced interface is available for CallCenter staff and a simple web-based interface is available for non-frequent users in municipality offices.

Patient buses are also moving in the greater capital area, i.e., Copenhagen and surrounding municipalities. In the metropolitan area, transportation of recumbent and emergency patients has also been arranged through the flexible transport service. But it does not offer transportation of recumbent or emergency patients through a flexible hospital transport service. (NT, 2019)

About Customers:

- 39% of customers have the option to use a car
- All age groups are represented
- 64% of clients are women

About Usage:

- 53% of clients use a flexible hospital transport service less than once a month
- 68% of customers order on their own

- 19% of trips are ordered by service personnel

2.1.3 Flexible activity transport service

The flexible activity transport service includes organizing different trips to day centres, rehabilitation and local-government health centres for elderly people, as well as transport for people with significantly reduced physical or mental abilities who participate in activities or social services. The municipality of residence determines the inclusion of a travel system for its customers and establishes the criteria for designation. (NT, 2019)

A flexible transport service is provided on a regular basis, on fixed routes and at fixed times, where several customers travel in the same vehicle. In some areas, travel planning is done by the activity centre staff, and elsewhere the planning is done by the local government or the demand responsive transport planning team. Trips are financed by the local government, but in some regions, user co-financing is also used. (NT, 2019)

About Customers:

- 64% of customers have the option to use a car
- 19% of clients are 80 or older
- 67% of customers are women

About Usage:

- 91% of customers use the flexible transport service once or several times a month.

2.1.4 Flexible medical appointment service

The flexible medical appointment service is a travel service for clients who need to go to a doctor or specialist or for rehabilitation and who cannot use regular public transport. The trips are determined by the municipality of residence and, in cooperation with the DRT, the municipality establishes the general level of service provided. The transport is ordered directly through the DRT web-based subscription module. (NT, 2019)

When ordering a trip, the customer is informed of the time of arrival at their home address and if they order a trip home after the end of the visit, then the client is also informed about the expected picking-up time. The client is usually delivered from their front door to the medical centre, specialist reception or the nearest entrance. Trips are financed by the local government. (NT, 2019)

About Customers:

- 82% of customers do not have access to a car
- 82% of clients are 70 or older
- 70% of clients are women

About Usage:

- 24% of customers use the service at least once a week
- 69% of customers order on their own
- 10% of trips are ordered by service staff

2.1.5 Flexible school transport service

The flexible school transport service is a travel system that offers transport for children with permanent driving needs, whose transport needs cannot be solved by conventional public transport. The driving service is assigned to the student by the administration of the school he or she goes to.

As an example, a flexible school transport service can provide transportation to home, to school or to shelter and back. It provides service to special school students or pupils attending a school where

the legal maximum public transport distance requirement is not met, or when a student is assigned a transport because of dangerous road conditions. (NT, 2019)

Trips are organized as regular services. This means driving on certain routes and at certain times and there are several students in the same vehicle. Schools and institutions often involve students from different regions - the flexible school transport service enables the coordination of journeys and thus optimal use of the vehicle fleet. Local governments or DRT workers plan the trips and this service is financed by the local government. (NT, 2019)

About Usage:

- 91% of customers use the service at least once a month.

2.1.6 Flexible general transport service

The flexible general transport service is an open service for all citizens, from one address to another. The only requirement is that the address of the departure place should be in the county of North Jutland. (NT, 2019)

This transport service can be used as a transport option which binds other public transports if the customer has a long distance to the bus or train, or as an alternative to ordinary buses and trains. It is considered as being part of general public transport because it can be used by everyone. In addition, a flexible general transport service is used to complement conventional public transport in areas or times when no bus service is provided. (NT, 2019)

To order flexible general transport service, the customer can contact the DRT call centre, book a trip using an app or book a trip on the internet. The service can be ordered by calling every day from 7 am to 8 pm, self-service (app or internet) works 24/7. Trips are done between 6 am and 11 pm. The flexible general transport service is coordinated with other DRT trips, which means that there may be other customers in the car and the journey may be longer than the shortcut from point A to B. Customers must pay for their ticket which can cost from 0,5 – 4 EUR per kilometre. (NT, 2019)

Booking must be done at least 2 hours before and no earlier than 2 weeks before the customer wishes to travel. This is not at technical limitation, but a business rule to ensure a difference between flex traffic and regular taxi service. When booking the customer needs to state the exact address of their departure and their destination. Customers can only pay in cash. (Nordjyllands Trafikselskab, 2019)

The local government finances part of the trip and the user pays the rest according to the tariff set by the respective municipality. In some municipalities, the prices of flexible general transport services are particularly favourable. Each local authority decides the price of a flexible general transport service for its citizens in its administrative area. Therefore, the tariffs in the different municipalities are different and in some cases, the price also varies between urban and rural areas. Reduced rates apply only within the respective municipality. If you drive to through another municipality, you must pay a higher price for the whole trip. (NT, 2019)

2.1.7 Flexible regular service

The flexible regular service is a service open to all citizens and is by nature a bus service. The flexible line service operates in a limited geographical area with both unchanging start and endpoints but also at intermediate meeting points and assembly points. The flexible line service only works in the specified area and time. (NT, 2019)

Flexible regular service is a bus with the same conditions as other DRT buses, which means that it can be operated by everyone and is not assigned to customers separately. However, unlike a regular bus, the customer must book a place to use the flexible line service. (NT, 2019)

To do this, call the DRT call centre from the departure point 15 minutes before the desired time.

A flexible line service also includes a phone taxi. The phone taxi operates in areas with few passengers and replaces the regular bus route. A phone taxi only runs when the customer calls and subscribes to the DRT, and only in the specified regions and times. (NT, 2019)

Table 1. Parameters of DRT case study: Flextrafik

NO.	AREA	QUESTION	REPLY
1	Name	<i>What is the name of the DRT service?</i>	Flextrafik
2	Organization	<i>Organization responsible for the DRT service</i>	FlexDanmark coordinates. The individual regions or municipalities are the interface to the passengers.
3	Location	<i>Please describe briefly the area that the DRT service is covering. Rural/urban/mixed.</i>	There are different DTR-products under Flextrafik that all operate in almost every part of Denmark (except the Island of Bornholm) Denmark is divided into five Regions covered by five different PTAs. One of the concepts of the Danish DRT-model is the mixing of different DRT-products in the same pool of transport tasks (see below, Customers). Every PTA administrates its own pool of cars but shares the same IT-platform. Flexible regular service: The flexible line service operates in a limited geographical area with both unchanging start and endpoints but also at intermediate meeting points and assembly points. The flexible line service only works in the specified area and time. The service level, opening hours, coverage and the price the citizen pays (if any) is determined by the authorities granting the service.
4	Population	<i>What is the population in the service area and how are they located?</i>	Roughly 260.000 unique citizens required about 80% of the total number of transports (6 million trips) in 2018 (20% was required by anonymous users, so no exact number can be given). So roughly 4,5% of the population has used Flextrafik. See map for the geographical distribution of usage.
5	Customers	<i>Please describe what customer group are you targeting, if any (Disabled/elderly/children etc.).</i>	Disabled; patients (hospital service); activity transport service for organizing different trips to day centres, rehabilitation and local-government health centres for elderly people, as well as transport for people with significantly reduced physical or mental abilities who participate in activities or social services; medical appointment service is a travel service for clients who need to go to a doctor or specialist or for rehabilitation and who cannot use regular public transport; school children; and "regular" citizens. Last-mile services covering rural areas with (almost) no timetable public transport. The last-mile service can be door-to-door or door-to-bus stop/bus stop-to-door.
6	Network topology	<i>Please describe your DRT network topology and what are the reasons behind it. (Fixed routes, door-to-door or fully flexible, partly flexible, combined with public transport)</i>	Flexible disability transport service: As a complimentary service, the service is provided to other driving services from door-to-door. Flexible activity transport service: A flexible transport service is provided on a regular basis, on fixed routes and at fixed times (in this context, "fixed" is adjusted according to the actual need, not a traditional timetable schedule. Flexible general transport service: This transport service can be used as a transport option which binds other public transports if the customer has a

			<p>long distance to the bus or train, or as an alternative to ordinary buses and trains.</p> <p>Flexible medical appointment service: The client is usually delivered from their front door to the medical centre, specialist reception or the nearest entrance.</p> <p>Flexible school transport service: driving on certain routes and at certain times</p> <p>In all instances, forecasts are based on demand the previous year. If new citizen groups are targeted, or new services are established, the PTAs will perform analysis with local authorities. Flextrafik relies on a spot-market procurement model, which provides flexibility for fluctuation in demand (as well as other benefits).</p>
7	Frequency/ availability of service	<i>What is the DRT schedule, how frequently does the service run, i.e. only when requested, set number of journeys per day?</i>	<p>The services are all demand-responsive, and opening hours are only limited by business rules decided by the authority who is paying. Therefore, there can be local variations from the main principles described below.</p> <p>Flexible disability transport service: for disabled people who are at least 16 years old and a permanent resident and the disability must have lasted more than 12 months. Individual evaluation for specific needs and granted service level. National regulation grants a minimum of 104 trips yearly, but each municipality can decide to increase this number. In some municipalities, there is no limit for using the service for the citizens that have been granted the service.</p> <p>Flexible hospital transport service: for patients who need to go to the hospital for research or treatment and who cannot use regular public transport. The largest patient groups are dialysis patients and radiation and chemotherapy patients. Generally, all patients can be transported if they meet a number of objective criteria (e.g. distance).</p> <p>Flexible activity transport service: The flexible activity transport service includes organizing different trips to day centres, rehabilitation and local-government health centres for elderly people, as well as transport for people with significantly reduced physical or mental abilities who participate in activities or social services. The municipality of residence determines the inclusion of a travel system for its customers and also establishes the criteria for designation.</p> <p>Flexible medical appointment service: The flexible medical appointment service is a travel service for clients who need to go to a doctor or specialist</p>

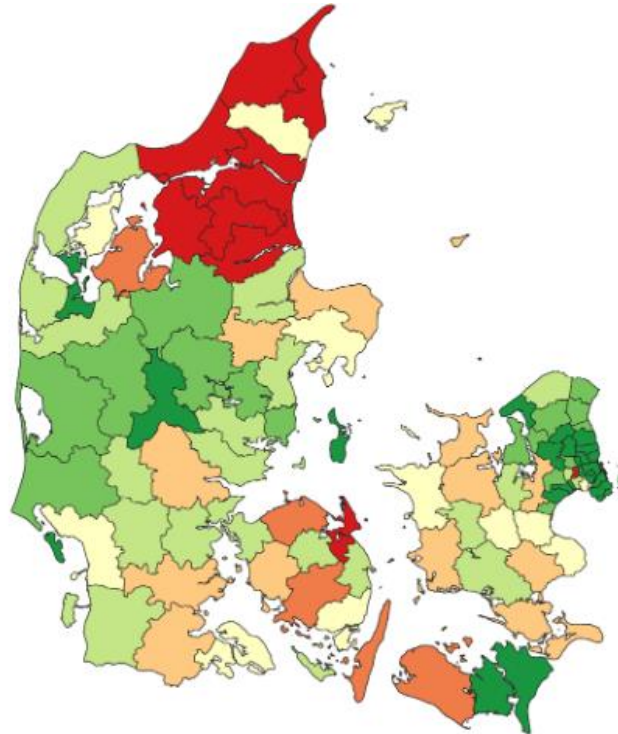
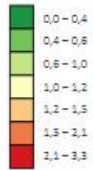
			<p>or for rehabilitation and who cannot use regular public transport.</p> <p>Flexible school transport service: The flexible school transport service is a travel system that offers transport for children with permanent driving needs, whose transport needs cannot be solved by conventional public transport. It provides service to special school students or pupils attending a school where the legal maximum public transport distance requirement is not met, or when a student is assigned a transport because of dangerous road conditions. Temporary needs, e.g. broken leg, can generate a grant for transportation.</p> <p>Flexible general transport service: The flexible general transport service is an open service for all citizens, from one address to another. Each municipality decides the business rules, service level, coverage, self-finance ticket price and opening hours. The main rule is opening hours between 6 am and 11 pm, self-finance ticket price from 0,5 - 4 EUR/KM</p> <p>Flexible regular service: The flexible regular service is a service open to all citizens and is by nature a bus service.</p>
8	Notice requirements	<i>When is booking required (on the day/when required, in advance, repeating booking)?</i>	<p>Flexible general transport service: The service can be ordered every day from 7 am to 8 pm by CallCenter service. By self-service (app and internet) 24/7. Trips are done between 6 am and 11 pm.</p> <p>Flexible general transport service: Booking must be done at least 2 hours before and no earlier than 2 weeks before the customer wishes to travel. This is not at technical limitation, but a business rule to ensure a difference between flex traffic and regular taxi service.</p> <p>Flexible regular service: Planning-window: from the departure point 15 minutes before and 45 minutes after the desired time. The actual time for pickup is given to the customer. Each authority can have its own service level regarding the deadline for ordering.</p>
9	Pick-up location	<i>Where are users picked up and dropped off (many-to-many, one-to-one, one-to-many/many-to-one)?</i>	Individual needs for each travel product. The starting point is at the front door of each traveller.
10	Transport type	<i>What types of transportation do you use (buses, cars, trams, trains)? Are vehicles also suitable for people with special needs?</i>	Flexible disability transport service: Taxes and (mini)buses and in some areas large patient buses.
11	Sharing a ride	<i>Please describe if passengers share a ride or get their own ride.</i>	The goal in Flextrafik is always for passengers to share rides, both in terms of a healthy economy and minimal environmental impact. One of the unique points of the Flextrafik optimization model is the combination of trips from

			many different authorities and thus with many vastly different citizens. The starting point is that all types of travellers from different travel products can be combined and thus share a ride for part of or the whole trip. It is possible to decide that travellers using product A can or cannot be mixed with travellers using product B. For instance, some types of patient transportation cannot be mixed with some types of regular flexible services. This is not a technical or legally determined limitation, but a result of at service level decided by the authorities.
12	Fares	<i>Please give an overview of the ticket fares. Are there any discounts? Is it per kilometre or fixed price etc.? Do the customers pay it themselves or is it funded by local government? Can they pay in cash or with a card?</i>	Flexible disability transport service: annual subscription price of DKK 400 (54 EUR) (from January 1, 2018) for 104 individual journeys per year. A trip costs DKK 2.70 per kilometre and the minimum cost is DKK 30 per trip. Trips are financed by a combination of self-financing and the support of the municipality of residence. Payment for the trips can be handled by cash, credit card or by invoice. In some PTA-areas, there is no annual subscription, but only self-financing payment. Flexible activity transport service: Trips are financed by the local government, but in some regions, user co-financing is also used. Flexible general transport service: Customers can cash or upfront with a card. Each local authority decides the price of a flexible general transport service for its citizens in its administrative area. Therefore, the tariffs in the different municipalities are different and in some cases, the price also varies between urban and rural areas. The local government finances part of the trip and the user pays the rest according to the tariff set by the respective municipality. Flexible medical appointment service: Trips are financed by the region or municipality (the local government). Flexible school transport service: service is financed by the local government
13	Total cost	<i>What is the cost of providing the service? How much do you as a transport organizer pay for it? What is the share approximate/precise share of revenues from tickets?</i>	The region or municipality (taxpayer-funded) that orders the transport is paying the share of the cost for their specific transports. The cost of every transport is divided between the authorities according to their actual use and level of service needed. The benefit for the authorities is the discount they get from pooling their transport tasks together. The cost depends on the use of cars and the prices given by the taxi-companies from each car at the yearly procurement.
14	Ordering	<i>How do users book their journeys? Please describe the transport ordering process shortly and why you chose it to be like this. (App, web, phone call)</i>	Flexible disability transport service: books via the web or by calling the PTA Flexible medical appointment service + hospitals: The transport is ordered directly through the DRT subscription module (an advanced interface is available for call-centre staff and a simple web bases interface is available for non-frequent users in municipality offices).

			Flexible general transport service: To order flexible general transport service, the customer must call the PTA call centre or use a self-service app or web/internet module. Flexible regular service: call the PTA call centre or use an app/web self-service interface.
15	Concept	<i>Is your DRT service together with regular public transport or separate? Why is it so?</i>	The first Danish PTAs launched the Flextrafik system in 1997. Now it is a nationwide solution.
16	Start time (ending time)	<i>When did you start to provide this service, is it still on-going or not?</i>	The basic premise in the Danish Flextrafik-model is an annual procurement process conducted by the public transportation authorities (PTAs), which provides a framework on different hourly rates from many different carriers, with a wide geographical distribution. A shared nationwide IT system continuously distributes the trips on the available vehicles, starting with the cheapest compared to time spent, hourly rate, and coordination opportunities. The taxi-company is only paid if the actual vehicle is used. The system uses a dynamic volume of vehicle resources, only using the number of cars needed minute by minute.
17	Improvements/ changes	<i>If you would change or improve some aspects of your transport service what would it be and why? Also, how would you improve or change it?</i>	<i>Fill here</i>

Flextrafik in numbers

Avg. number of trips per citizen



FlexDanmark

Figure 1. Geo distribution map of Flextrafik

2.1.8 Data barriers related to the Flextrafik DRT service

Table 2. Identification of data barriers related to the DRT case study: Flextrafik

No.	Question	Optional answers	REPLY
1	What are the most important KPIs for the evaluation of your organization related to the transportation of passengers?	Cost, accuracy, customer satisfaction,	<ul style="list-style-type: none"> • Accuracy • Cost
2	Are you collecting data from the transportation of passengers?	What type of data are you collecting? <ol style="list-style-type: none"> 1. Pickup and drop-off points? 2. Number of passengers 3. Vehicle types 4. GPS data 5. Fuel consumption 6. Accuracy of pickup and delivery? 7. ... 	<ul style="list-style-type: none"> • Start and end points • Intermediate stops • GPS data from the vehicles • Passenger count and other related information • Accuracy
3	Are you using the data collected to monitor in real-time the transportation?	YES/NO (additional comments)	Yes

4	Are you storing the data and using the historical data from analysis and optimization?	<p>1)Please describe the currently existing data platform used for the planning and operation of special transport services (STS) and DRT. (Information flow, which type of GIS data is used, how is data updated, where is data stored, how is data retrieved). Is this data platform specific to 1 organization or is this country-wide?</p> <p>2)Please describe the major challenges related to the currently available data platforms (cost, data availability, accuracy of data, etc.)</p> <p>3)Please explain the pricing on the use of various proprietary software & data providers for the use of special transport services (STS) & DRT systems (app-s, maps, ticketing, etc.).</p>	<p>Yes, in particular, historical GPS data is being used for planning the DRT.</p> <p>Data is generally stored in a number of data warehouses and used both for planning, analysis, and reporting purposes.</p> <p>Data is treated uniformly across the five regions. The services for each region varies.</p> <p>A number of legacy systems are based on proprietary software. A goal is to use open-source software.</p>
5	Is there any information about the real-time monitoring of the vehicles you are missing?	<p>If possible prioritize the information that could benefit your organization the most</p> <p>1)Would you like to know how the passengers evaluate the quality of the service you provide?</p> <p>2)Would you like to know how accurate you are at pickup and drop-off of passengers?</p> <p>3)Would you like to be able to compare the accuracy of your current service with the service last year?</p> <p>4)Would you like to be able to do green accounting? (how large is the CO2 emissions from your entire organization, or per passenger kilometre)</p>	<ul style="list-style-type: none"> • There is structured feedback from the customers at regular intervals. • Accuracy is automatically determined • Accuracy of the various services is carefully monitored. This includes any changes over time. • Green accounting is an emerging topic that is becoming more and more important.

3 Barriers in the country related to DRT services

The information about the barriers that halter the DRT development in Denmark can be found from Annex VIII of the report - Barriers synchronization table.

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