



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

DEMAND-RESPONSIVE TRANSPORT (DRT) IN THE BALTIC SEA REGION AND BEYOND

A mapping study of business models
and targeted barrier-enabler analysis
for policy makers

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List of abbreviations

API - Application Programming Interface
DRT - Demand responsive transport
GDP - Gross Domestic Product
GDPR - General Data Protection Regulation
GIS - Geographic Information System
GPS - The Global Positioning System
ESIF - European Structural and Investment Funds
ICT - Information and Communications Technology
IT - Information Technology
LPP - Ljubljanski Potniški Promet
JCC - Jurisdiction City Council
KPI - Key Performance Indicator
POC - Proof of Concept
PT - Public Transport
PTA - Public Transport Authority
PTO - Public Transport Operator
STS - Special Transport Services
SUMP - Sustainable Urban Mobility Plan

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Project partners

The project consists of 8 partner organizations from 5 different countries.

1. Stockholm Environment Institute Tallinn Centre (SEI Tallinn), Estonia

SEI Tallinn is the lead partner of the project. SEI is world-known for its engagement in sustainability management and underlying socio-economic drivers and impact analyses. It partners closely with national authorities in Estonia to investigate and develop new digital societal services, including public transport.

2. Aalborg University, Denmark

Aalborg University is one of the largest ICT universities in the Baltic Sea Region. The Daisy Research Group at Aalborg University runs one of the largest company-independent data warehouses with GPS data and has considerable practical experiences in the integration of GPS vehicle data with other data sources.

3. Karlstad University, Sweden

The Service and Market Oriented Transport (SAMOT) Research Group at Karlstad University is a forum for collaboration between industry, public sectors, universities, and higher education. SAMOT has conducted over 10 research projects only within demand-responsive transport, focusing on accessibility problems, organization, and psychology.

4. Kolumbus AS, Norway

Kolumbus AS is the public transportation administration in Rogaland, Norway and is organized as a county agency. The agency is responsible for planning, marketing and organizing the public transport in Rogaland, including buses and passenger ferries.

5. Region Värmland, Sweden

Region Värmland is a public authority in Sweden which is also acting as local public transport authority by being responsible for strategic decisions about public transport in the region.

6. Ruter AS, Norway

Ruter AS is the public transport authority for Oslo and Akershus counties in Norway. It is responsible for the administration, funding, and marketing of public transport in the two counties, including buses, the Oslo Metro, Oslo Trams and ferry services.

7. Innlandstrafikk, Norway

Hedmark Trafikk and Opplandstrafikk were merged into Innlandstrafikk from the 1st of January 2020. Innlandstrafikk is a public transport authority in Norway.

8. Kaunas City Municipal Administration, Lithuania

It is a public authority in Lithuania in the city of Kaunas and carries out the functions of local government, public administration and public services as defined in the Constitution of the Republic of Lithuania, the law of local government and other laws applicable to local municipal institutions.

1. Executive Summary

This report compares global Demand Responsive Transport (DRT) business models across 12 countries and benchmarks these to service models operating within the Baltic Sea Region. In doing so, it aims to provide an evidence-based analysis to support policymakers to consider innovative, transboundary service designs and concepts, and transfer lessons among the RESPONSE partnership (project partners in Estonia, Denmark, Sweden, Lithuania and Norway). This is important for policymakers to consider when piloting or scaling DRT services designed to meet the needs of different community users.

The study has many key findings. It firstly creates a typology of common service models that successfully operate in rural and regional contexts. It then identifies, prioritizes and examines the impact of a range of barriers experienced by different project partner countries to provide key recommendations for overcoming these.

DRT modalities aim to be tailored to meet the needs of their customer base and often diverse. However, this study finds that out of the 36 DRT service models analyzed, the majority of services utilize minibuses that operate flexibly from Monday to Saturday, and are ordered via an app. Of these 36 cases, 22 can be used for the broader public, 4 for the elderly, 3 for children and youth, 3 for disabled, 1 for patients, 1 for children, elderly and disabled people and 1 for employees.

Approximately one-third of the DRT models also have very broad operating hours whilst the other third have fixed operating times (for example mornings and evenings with a break in between, or only mornings or only evenings). Rural DRT cases were found to have mostly a longer notice time when compared to urban ones. In most cases, the price is fixed or counted per km, and often lower than a taxi and similar to regular public transport.

Most door-to-door services are operational in urban areas or cover both urban and rural areas within a defined region, however, the majority of the DRT services in rural areas have fixed, or partially fixed routes. It has been argued by Davison, Enoch, Ryley, Quddus, & Wang (2012) that DRT services work most efficiently when combined with traditional public transport. The analysis demonstrated that, in cases where DRT services are integrated with traditional public transport systems, passengers have an increased accessibility to public transport in areas with low passenger demands, via extra services or entirely new routes.

In Norway, Sweden and Denmark, DRT services are relatively well developed. Estonia has recently piloted its first services (in the form of social transport services), and in Lithuania, the concept remains nascent.

A range of barriers were examined throughout this study, in surveys and interviews involving leading DRT country experts and technology service providers. Barriers

were then grouped into common themes, such as data, market penetration, legal and procurement-related barriers and capacity requirements. In terms of **data-related barriers** (i.e. availability and quality, access to the data platform, GDP protection regulation, and software costs) **seem to be equally important in all countries**. Participating countries relay that the availability of the data in most cases is less of an issue than its quality and usability.

“One of the recommendations to it for the PTAs would be to discuss the important KPIs with the software provider during the early procurement process discussions, also pay attention to maintenance cost and integration issue by choosing to have a manager role only. The cost of such an approach is easier to manage and can put pressure on suppliers to be commercially more aggressive.” Antoine Lunet, International Business Development Manager at Padam Mobility

Market penetration (ticket costs, operation/piloting costs, limited access to public transport market) and **legal/administrative barriers** (fragmented legal framework, specific rules and requirements, lack of awareness) **are more important in Estonia and Lithuania, however less so but not completely irrelevant for Norway, Sweden and Denmark**. Estonia is facing challenges as currently most of its regions offer public transport for free, rendering private DRT service models uncompetitive. In Lithuania, DRT is rarely implemented (only for a few social taxi services in some cities or special services during some larger events) with a key barrier being the lack of awareness among decision-makers and politicians. Nevertheless, at times it can be a challenge even for Norway to communicate the positive impacts of DRT. In terms of the fragmented legal framework, different laws exist in Sweden for public transport, special passenger transport, and taxi service. While it is not necessarily a problem for Denmark that private organizations have restricted access to the public transport system (only the Regional PTAs have the right to offer public transport service), it may be a barrier while wanting to test more innovative DRT solutions.

“One of the main recommendations to this type of barrier would be to start with the public transport oriented pilot and finding the right targets both area and user wise: campus, elderly, kids, etc.” Antoine Lunet, International Business Development Manager at Padam Mobility

Opposite to the market penetration and legal/administrative barriers, **the barriers related to procurement schemes** (integration of different vehicle types with regularly scheduled public transport, permits/procurements to offer transport on outside predefined routes) are **less important for Estonia and Lithuania than for Sweden, Norway and Denmark**. In Estonia for instance, the contracting authority may request different vehicles in the same procurement contract meaning that different vehicles can exist on different routes. Moreover, under the Estonian Public Transport Act, all the routes need to be predefined. In Norway, to

the contrary, smaller vehicles need taxi licenses and cannot be procured under the same contract. In Denmark, public transport in general is divided into entities, where ordinary public transport (buses and local train services) and DRT services are procured separately. In Sweden, special transport services (patient transport, school buses) also require special permits.

Generally speaking, DRT may be more widespread in the listed Scandinavian countries due to the process regarding discussions, planning and actions towards the development of DRT services in those countries being more established and developed. This study anticipates that, over time, DRT services may be more common in Estonia and Lithuania to service harder to reach markets in rural and regional areas. As DRT usage rates climb, public transport costs and patronage will be impacted, and incentivize cost-efficient service provision, raising awareness among local policymakers and planners. Moreover, with the adoption of holistic accounting practices, the socio-economic benefits of DRT services for increasing the mobility of often marginalized groups should further increase its use and support improved service and policy provision.

2. Introduction and methodology

2.1. Aim of the report

This report compares global Demand Responsive Transport (DRT) business models across several countries, benchmarking DRT services both globally and within the program partners across the Baltic Sea Region. In doing so, it aims to provide an evidence-based to support policymakers to consider innovative, transboundary service designs and concepts, and transfer lessons among the RESPONSE partnership.

This report is structured around three main areas.

- 1) Mapping the status of DRT services in each country;
- 2) Determining case studies of best practice DRT business models from partner countries as well as examples from elsewhere;
- 3) Identifying and characterizing systematic barriers in RESPONSE project countries related to DRT services and making recommendations on how to overcome these.

Collectively, the consortium partners highlighted two common and critical issues that are most relevant in a transnational context; the legal framework governing public-private cooperation, and the procurement schemes used within DRT service models. Finding the right balance between business and financing models is essential, with many countries exhibiting a range of public-private partnership arrangements.

Before discussing the main areas, the report firstly defines the concept of DRT services.

2.2. Defining a Demand Responsive Transport service

Demand-responsive transport (DRT) is a fit-for-purpose and flexible mode of transportation that adapts to the demands of specific user groups. In the past, it has primarily been used to achieve social benefits for often marginalized cohorts with limited access to public transport or private vehicles. (Hunkin, S., Krell, K., 2018) Nowadays, DRT is increasingly considered an alternative for traditional transport, and a cost-effective and efficient way to cover large areas, especially in rural areas. (Papanikolaou, A., Basbas, S., Mintsis, G., & Taxiltaris, C., 2016)

DRT offers an intermediate solution of flexibility and capacity between taxis and conventional buses. Its service model varies and distinguished by its network topology (i.e. fixed route, divergence, fully flexible routing within a predefined area) and operation, boarding and alighting locations, schedule and advance notice

Figure 1. Main parameters of DRT service; (Hunkin, S., Krell, K., 2018)



requirements. There are many variations of DRT services, which combine different attributes (Figure 1) depending on the specific needs of the area served. (Hunkin, S., Krell, K., 2018)

There are several key benefits that DRT service models offer, including:

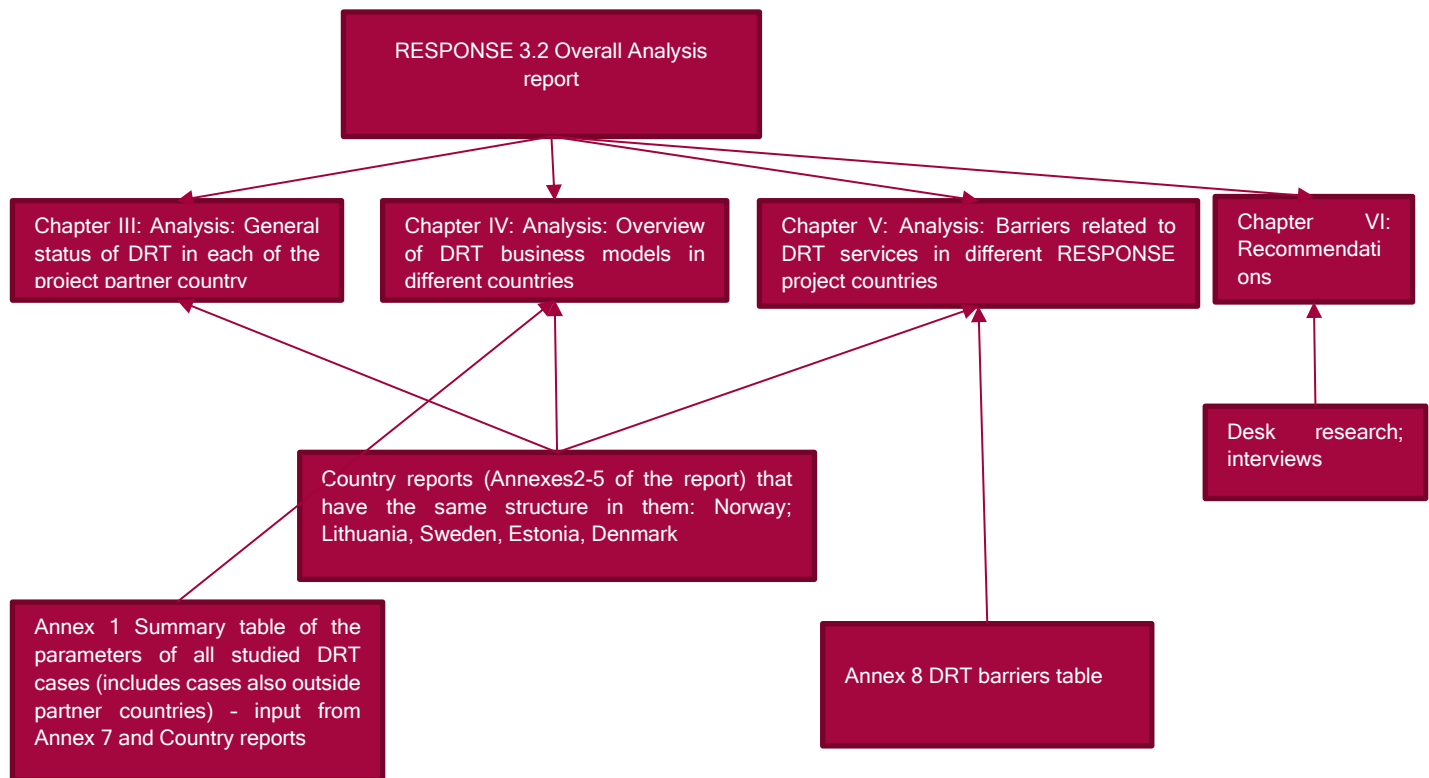
- Flexibility for all user groups.
 - Environmental benefits through the reduction of private vehicles on the road. DRT increases multimodal transport and often acts as the first/last mile solution for linking communities with broader transport networks. (Hunkin, S., Krell, K., 2018)
- Cost-efficient connectivity for rural populations. Compared to the urban areas where work, leisure and services are located more densely, DRT can support rural areas to be more attractive and cost-effective, compared to running full-scale public transport. (Hunkin, S., Krell, K., 2018)
 - Supporting citizens with limited mobility. In both urban and rural areas, DRT services demographics that might not otherwise be able to readily access transport, such as the elderly or people with disabilities (Hunkin, S., Krell, K., 2018)

To establish a successful DRT service, Papanikolaou, Basbas, Mintsis, & Taxiltaris (2016) have demonstrated that it is the first imperative to determine the modelling and decision-making problems experienced within current public transport network for specific areas. The initial planning objectives for the DRT service should be clearly defined and subsequent performance during pilot periods should be compared to alternative options. Other success factors related to DRT usage include its public perception as an efficient, environmentally friendly and convenient option to become a preferred transport option, rather merely than a necessity. Consideration should also be given to integrate DRT into other modes of transport (i.e. traditional public transport network). (Hunkin, S., Krell, K., 2018) Optimal regional services, therefore, require coordination between stakeholders, ICT investments, a sustainable financial model and the adaptation of various parameters, such as presented in Figure 1.

2.3. Structure of the report

The structure of the report is presented in Figure 2 and is themed around three analytical chapters that examine key findings and a final recommendations chapter. The reports' introduction, methodology, and conclusion chapters are not shown on the scheme. However, they are included to complete the report.

Figure 2. Selection of methods and structure of the report



The analytical chapters (3-6) are derived from the country reports contained in the Annexes 2-5. Country reports reflect the status and scope of DRT services in the program countries, and are the result of a dedicated questionnaire that presents results divided by Chapters, that include information about:

- Chapter I: General status of DRT within the country
- Chapter II: Examples of DRT cases within the country
- Chapter III: Barriers relevant to the DRT services

Chapter II of the country reports (Annexes 2-5) includes the results of a questionnaire for specific DRT service operators to discuss the main parameters in their business models. This aims to examine and compare how DRT companies in different countries are operating, in general, using responses to the following questions:

- How does the user book their journey?
- When is booking required?
- How frequently should the service run?
- How flexible is the route?
- Where are users picked-up or dropped off?
- What area is the service covering?
- Who are the main users?
- What size of the vehicle should be used?
- What is the price for the user?
- How is the DRT system financed?
- What competition is there with other transport solutions? Is there cooperation between public and private organizations, especially so-called "destination point" organizations such as spare time activity organizers (sport associations, bingo events, job centres, etc.)?
- What are the legal possibilities and barriers related to the development and implementation of the model?
- Description of procurement and liability schemes (also with actors with sufficient local navigation knowledge, i.e. local taxi services, ride- and car-sharing and private drivers)

Other DRT services that were not from the RESPONSE project partner countries were also studied using an identical questionnaire. The results are provided in Annex 7 of this report. A comparison of DRT cases is summarized in Annex 1, which includes a total of 36 DRT case studies from 13 different countries, as identified below:

Table 1. The status of 36 studied DRT cases in 13 different countries

Country	Ongoing	Stopped	Pilots	Total
Australia	3			3
Czech Republic	2			2
Denmark	5			5
England	4			4
Estonia	1		2	3
Finland	1	5		6
Germany	2			2
Ireland	1		1	1
Netherlands	1			1
Norway		1	4	5
Slovenia	1			1
Lithuania	1			1
Sweden	2			2
Total	23	6	7	36

Chapter 5 analyses the collective barriers related to DRT service in different RESPONSE project countries and is largely derived from Annex VIII – the Barriers synchronization table. This Annex was prepared for a better comparison of the impact of a range of barriers upon the development of DRT services in different countries. In this Annex, each partner identified and prioritized the critical barriers impeding DRT within their countries, and gave an overview of legal/administrative barriers; market penetration of DRT solutions; procurement schemes, and the barriers related to data flows.

The complete report contains 8 Annexes, which are attached as separate files to this report, as detailed below:

- Annex 1 Summary table of the parameters of all studied DRT cases
- Annex 2 DRT mapping study country report - Norway
- Annex 3 DRT mapping study country report - Estonia
- Annex 4 DRT mapping study country report - Denmark
- Annex 5 DRT mapping study country report - Sweden
- Annex 6 DRT mapping study country report - Lithuania
- Annex 7 DRT cases from other than project countries
- Annex 8 DRT barriers table

3. Analysis: General status of DRT in each of the project partner countries

This section describes the general status of DRT services in each country and summarises the key findings of the questionnaires sent to DRT service operators.

In Denmark, the DRT service is privatized, centralized, and well developed by a private corporation called FlexDanmark that is owned by five regions (Denmark is divided into five regions). In Denmark, the DRT is used as an alternative for fixed-route public transport however remains highly subsidized with limited uptake in rural Denmark (only a small fraction of the trips are coordinated by FlexDanmark). **Critical problems relate to the low number of passengers per vehicle due to large rural areas and restrictive quality parameters, for instance, the detour for any passenger must be less than 50% of the direct route between the passenger's home and the centre where the passenger is being treated.** Another critical problem in Denmark relates to its categorization of needs of different passenger types which are diverse and typically not merged. The price of the trip is also a concern, however in recent years also environmental impacts are important. (FlexDanmark, 2019)

In Norway, the main DRT service providers are Ruter AS and Kolumbus AS. DRT services are relatively popular, and have been increasing over the past 10 years, becoming integrated into traditional public transport services. Several pilot projects are being carried out in different sectors of the country in line with increasing demands for transport flexibility.

In Sweden, DRT is offered in various forms across different regions, making it difficult to compare regulations or determine the service model that is the most efficient or best suited to customer needs. Prices, products, business models and payment systems are different across municipalities and regions and not consistently monitored when compared to traditional public transport. **Differences are also noted in route planning with some offering – fixed or flexible pick up locations and others only servicing customers with special needs or for the general public.** DRT in Sweden can be primarily found in rural areas where the population is low density and considered an extended service to increase accessibility to public and private services. An example of this system is Närtrafik (literal meaning "near-traffic") that can be found in many regions. **In terms of evaluation, Svensk Kollektivtrafik (Swedish Public Transport) oversees evaluations of special transport services (STS) and patient transport (PT) and ANABRO is an ongoing quality survey of STS and PT conducted annually since 2014.**

In Estonia, the DRT system is nascent, however, several public transport coordinators are starting to offer DRT services on a small scale, **primarily in situations where demand is low, and users locate diffusely**. Four DRT pilot projects have commenced in 2019, aiming to deliver social and wellbeing outcomes in Pärnu, Saaremaa, Võru, and Põlva, with early results likely to be impacted by COVID-19 response. In Saaremaa, the pilot aims to cultivate regular customers. This is aligned with the Ministry of Economic Affairs and Communication who outline policies and targets in the Transport Development Plan 2014-2020, under Measure 5.2 (Development of regional public transport connections, page 44):

1. The network of lines will be modernized.
2. The procurement documents shall be adapted to meet the requirements of the service standard.
3. Regional public transport arrangements will be moved from the county level to the level of larger regions covering different counties.
4. Flexible public transport solutions, such as demand bus, social transport or taxi, are introduced in sparsely populated areas. (Ministry of Economic Affairs and Communications, 2013)

DRT has also been recognized in various other policy documents, presentations, roundtable meetings and in several municipalities across Estonia in recent years, but requires further development and planning. **In Lithuania**, there is little experience with DRT services provision or related legislation. DRT is considered however as a possible solution in a range of studies (for example, sustainable urban mobility plans). A few cases of social taxi services exist in some cities, along with special public transport routes that are operated after sporting or recreational events via a special bus service called Ža offered by Žalgirio Arena (in Kaunas). Ža offers 6 bus routes ŽA2, ŽA3, ŽA4, ŽA5, ŽA6, and ŽA7, that travel to separate areas of the city.

4. Analysis: Overview of DRT business models in different countries

Analysis of DRT business models:

This section aims to provide a summary overview of the 38 DRT business models examined for this study, as described in the table below. Data was collected and disaggregated using the following parameters: the organization responsible for the DRT service; location; population; customers; network typology; frequency/availability of service; notice requirements; pick-up location; transport type; sharing a ride; fares; total cost; ordering; concept; start time (ending time) and improvements/changes.

The list of analyzed 36 DRT cases is as follows:

Table 2. List of analyzed DRT cases

DRT case	Country	DRT case	Country
Bravoflex	Netherlands	Connect2Wiltshire	UK
Flextrafik	Denmark	HentMegSauda	Norway
Flextrafik	Denmark	myBUS	Germany
Flextrafik	Denmark	Pilot Oslo (Ruter DRT)	Norway
Flextrafik	Denmark	Pilot Stabæk (Ruter DRT)	Norway
Flextrafik	Denmark	Pilot Oppegård (Ruter DRT)	Norway
Dublin	Ireland	Pilot Nes (Ruter DRT)	Norway
Kan-go	Australia	LPP	Slovenia
Telebus	Australia	ArrivaClick	UK
MVG IsarTiger	Germany	Radiobus	Czech Republic
DaRT	UK	DHD	Czech Republic
Föli	Finland	PickMeUp	UK
Oulu	Finland	Tornio	Finland
Hopkid	Estonia	Keolis Downer	Australia
Saaremaa DRT pilot	Estonia	Kutsuplus	Finland
South-East Estonia pilot DRT	Estonia	Kylakyyti	Finland
Närtrafik	Sweden	Kylakyyti	Finland
Anropsstyrd trafik	Sweden		

At the time of the study, majority of the DRT services included in this study (Annex I; Annex VII) were on-going or still in piloting phases. Some pilot projects had multiple lines operational, such as in Australia where, New South Wales Transport was operating large scale services in the Southwest Region and Sydney, via 26 individual demand-responsive transportation lines. Out of these, 22 lines are marked as Trial Service.

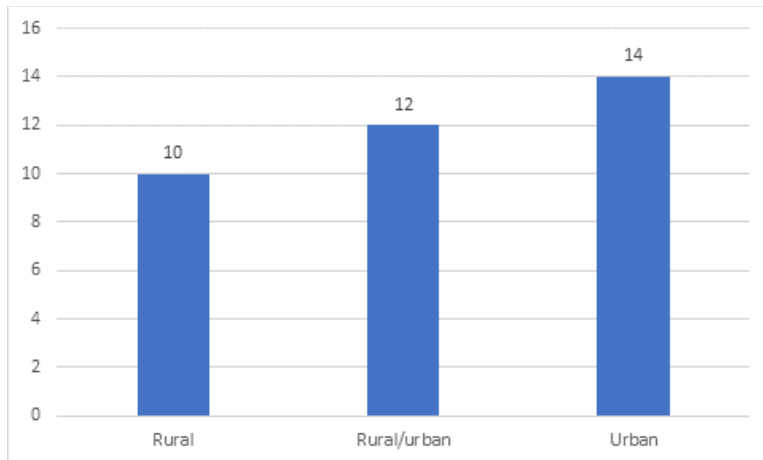
Other DRT services however have ceased activity, for example, Kutsuplus (Helsinki) that operated between 2012-2016 and was closed due to a lack of users. Despite having some loyal patrons, its prices were slightly higher when compared to traditional public transport services and it lacked promotion. Due to this, it has

been challenging for some of the cases to locate detailed information about DRT models in English, and due to inconsistencies in information provided on their websites.

The division between urban and rural services

Of the total of 36 analyzed DRT cases, 10 only operated in urban settings, 12 operated in both urban and rural and 14 only operational in rural areas.

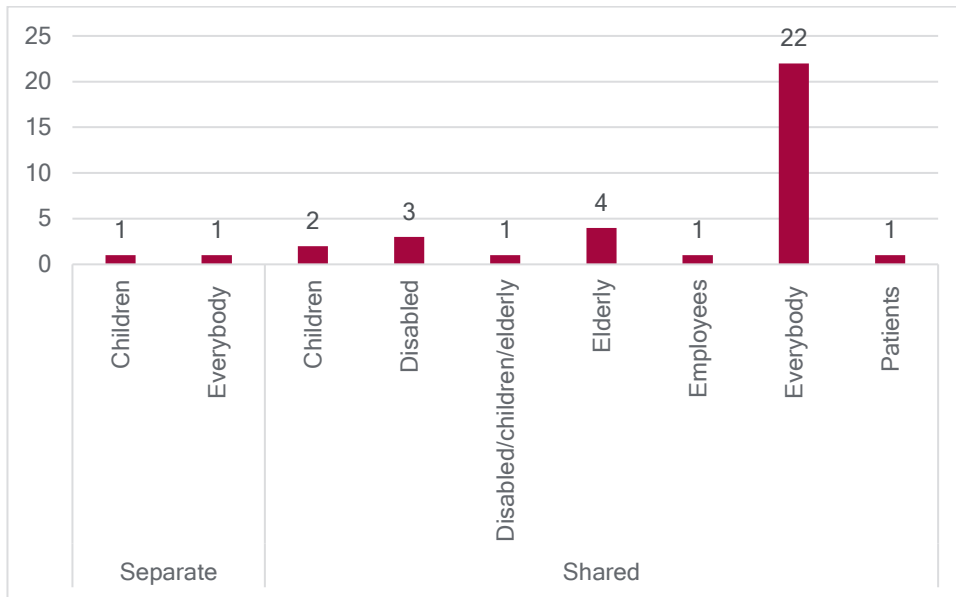
Figure 3. The division between urban and rural DRT services



Customer and user profile

While analyzing the different customer groups of DRT services, it is clear that there is a diverse array of DRT models (Figure 4). Some are designed to be used by everybody, and others are 'fit-for-purpose' designs for specific users. Out of 36 DRT cases, 22 are for everybody, 4 for the elderly, 3 for children and youth, 3 for disabled, 1 for patients, 1 for children, elderly and disabled people and 1 for employees of two factories. Out of the 36 cases, only two have a service where the trips are carried out separately, one of them is for children and one is for everybody.

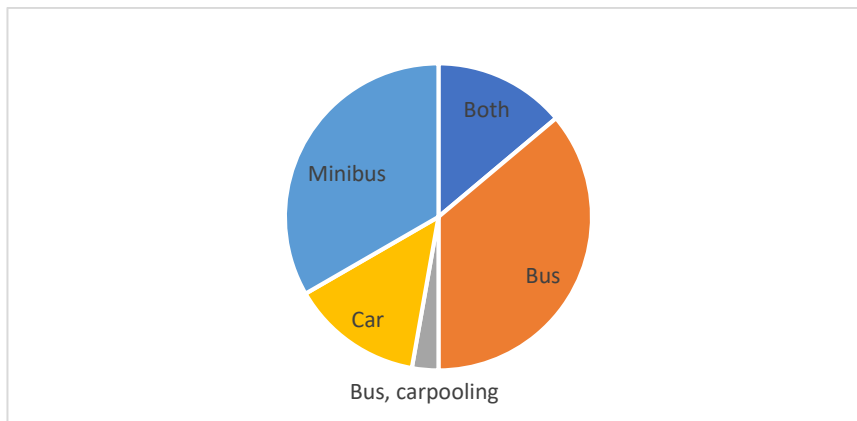
Figure 4. Number of DRT cases by customer groups



Transport type

Most companies prefer to use minibuses or regular buses, depending on the purpose of the service, however, five companies have both car and (mini)buses available. One DRT service uses buses and also carpooling. (Figure 5 **Error! Reference source not found.**)

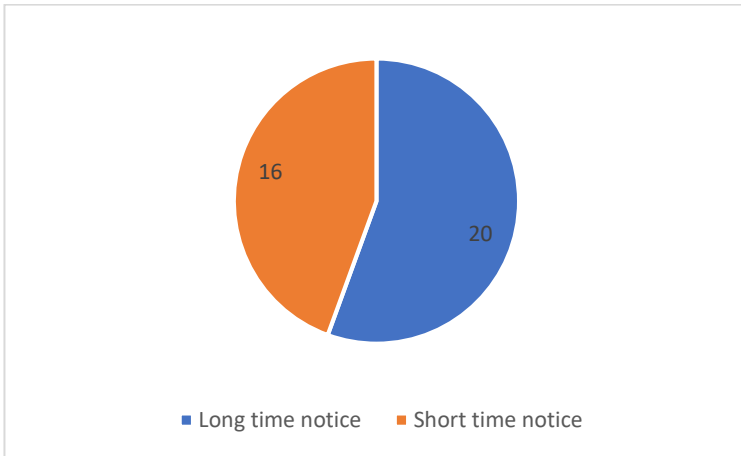
Figure 5. Number of DRT cases by transport type



Notice requirements

The majority of the DRT cases studied (i.e. 20/36) had a long time notice requirement (Figure 6) requiring customers to pre-order their trips, by 30 minutes to 24 hours in advance, and enable other trips to be combined with theirs. Companies able to offer short-time notice (up to 30 minutes before the trip) were mainly operating in urban areas and have smaller servicing areas; hence requiring less time to react.

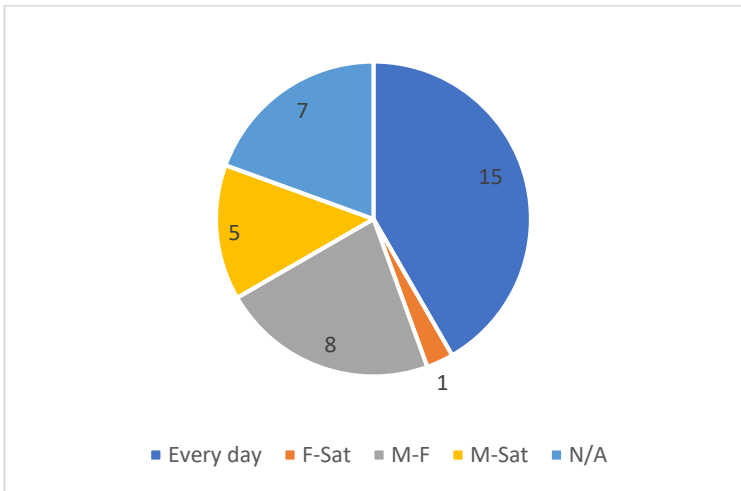
Figure 6. Number of DRT cases by how many of them need a time notice before the trip



Frequency/availability of service

Many DRT examples do not operate on Sundays, which can be inconvenient for customers who want to travel from rural areas back to cities or vice versa. As illustrated in Figure 7 below, about one-third of the DRT models have very broad operating hours and the other third have fixed operating times (for example mornings and evenings with a break in between, or only mornings or only evenings). Others are only operated as on-demand services, however, most cases still had their semi-fixed operating times. Only one of the services operated on Fridays and Saturdays (Figure 7). The 'N/A' category on the figure refers to a lack of information on which days this service runs.

Figure 7. Number of DRT cases by their operating days

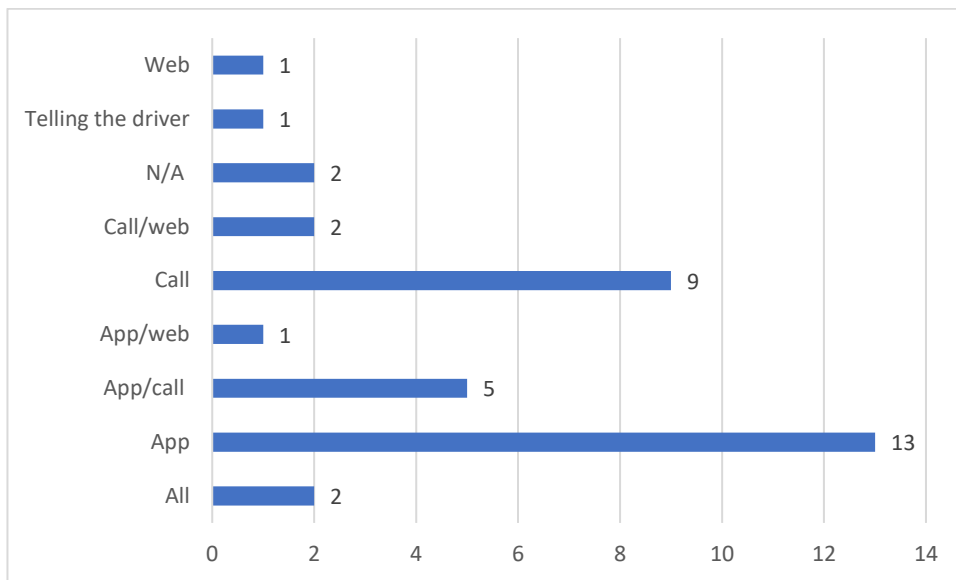


Ordering and online ticketing

Newer DRT models usually have a smartphone application, where customers can book their trips and, in most cases, facilitate payments via bank transfer. Out of the 36 DRT transport cases studied, 21 had developed an app for their customers (Figure 8), and one-fourth still used call direct (to the bus-driver or call-center)

option for ordering the service. One service-connected customers directly to their drivers. There was little information about the ordering methods of two DRT services (marked as N/A on the figure).

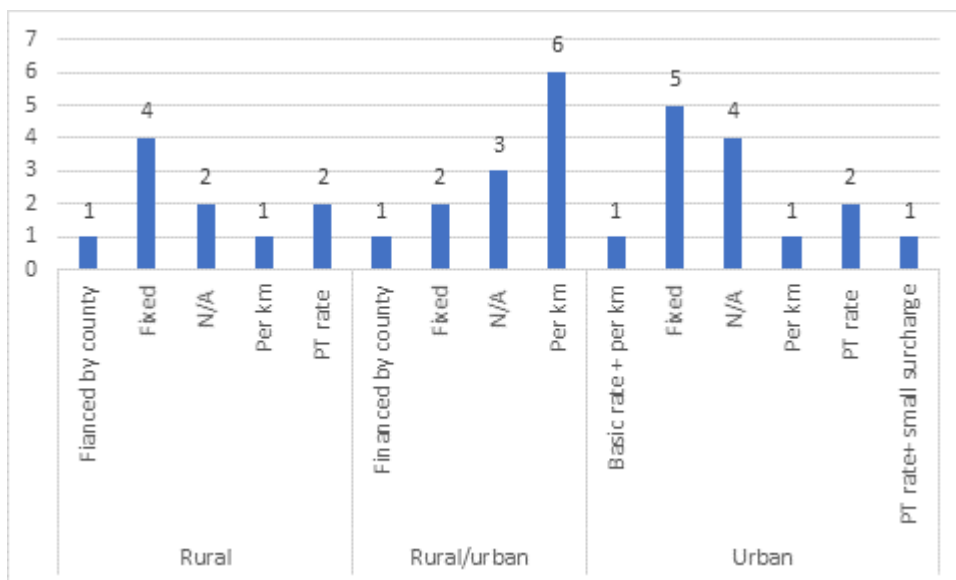
Figure 8. Number of DRT cases by ordering type



Fares & Location

Some of the DRT service models are 100% publicly financed or subsidized however a majority had a cost per kilometer or fixed price. The price was independent of the location of the service and found to be lower than a taxi, but higher than the regular bus fee. In some cases, services allowed local public transport cards to be used (Figure 9). There was little information about the ticketing systems of eight DRT cases.

Figure 9. Number of DRT cases by their ticketing systems and service area



Network topology

Responding to the needs of customers, DRT services offer both door-to-door services as well as fixed lines. Most door-to-door services are operational in urban areas or cover both urban and rural areas within a defined region. Of the urban services studied, two have fixed routes and nine have flexible door-to-door services (Figure 10). Of the 14 DRT services in urban areas, 11 required a short notice period before booking or, in some cases, offered on-demand services (no notice required). Conversely, the majority of the DRT services in rural areas have fixed, or partially fixed routes. Three offered flexible routes and door-to-door service. Nine out of ten rural DRT services require a longer notice period before the trip. (Figure 11).

Figure 10. Number of DRT cases by area and if the service is flexible/fixed

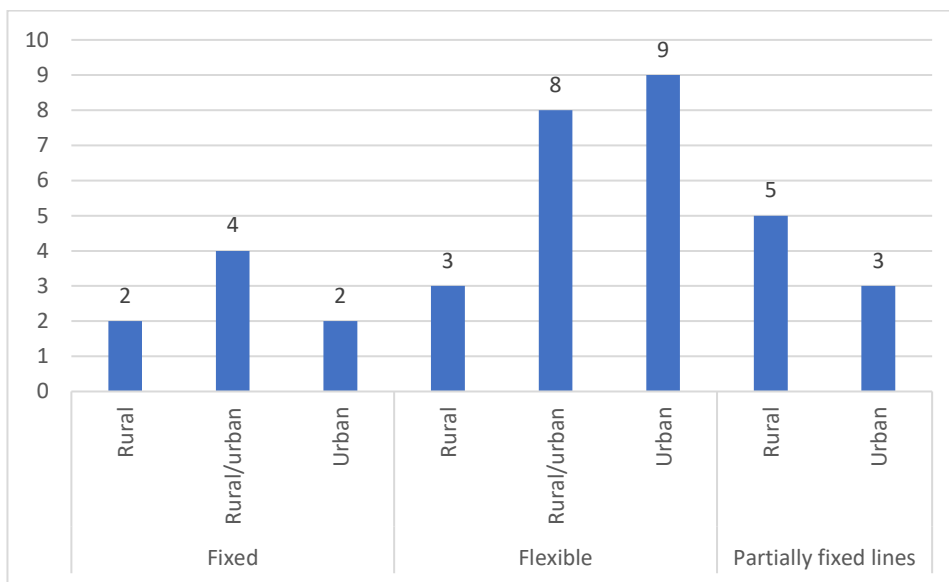
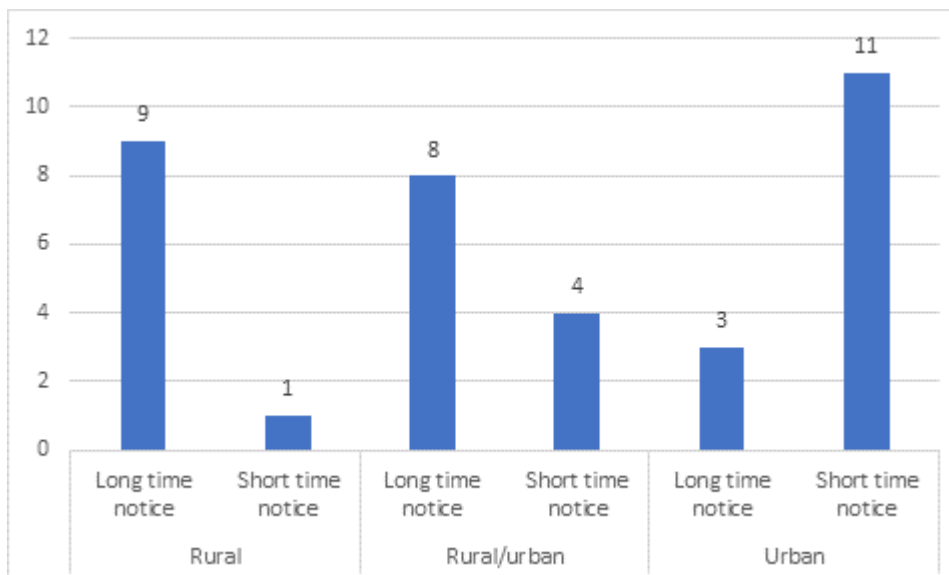


Figure 11. Number of DRT cases by area and if there is a time notice requirement



Concept and specific examples from project partner countries

Table 3. Specific DRT examples from project partner countries

	Scale of the service (national, regional or other)	Important KPIs	Data collected by the service provider	Is this data used	Currently used data platforms
Sweden					
Närtrafik DRT	In all municipalities in Region Västra Götaland	Customer complaints; customer satisfaction; accuracy	Pickup and drop-off points; number of passengers; the accuracy of pickup and delivery	No, don't use real-time monitoring	Planning platform - PLANET, sourced by the company PLANit
Anropsstyro DRT	Across Värmland county, mostly rural, but also in Arvika and Hammarö municipalities, which are more urban	Costs; customer satisfaction, accuracy	Number of passengers; number of trips taken, GPS-data	Yes	
Norway					
HentMeg	Sauda municipality in Rogaland, Norway.	Passenger satisfaction, cost (compared to fix route); vehicle mileage vs passenger-km	Pick up and drop off points; number of passengers	Yes, but the system works well without monitoring	Data is stored at the Spare platform. Don't use raw data for analysis but use the analytics tool within Spare.
Nes	Nes municipality in Akerhus county.	Passenger satisfaction, cost (total and per trip); number of active riders; average boardings per vehicle hours; pooled trips ratio	Pick up and drop off points; number of passengers; vehicle types, data about the user (phone number, birthdate)	Yes, real-time transportation is monitored	Different platforms being tested - Spare, Viavan, Pass

Estonia					
Saaremaa DRT	County of Saaremaa	Cost per passenger, service hasn't started	Pick up and drop off points; travel times data, how many passengers are in the car together	Not yet	Google Platform at the moment; the final solution is unknown - the goal is to create software
South-East	Southeastern Estonia (Põlva and Võru County), where the organization of public transport is coordinated by the NGO Southeast Public Transportation Centre.	Customer satisfaction, cost, and accuracy	Timing, number of passengers; accuracy; mileage	Yes	PIKAS - software for planning PT; Ridango servers (bus tickets and info in Ridango servers)
Denmark					
Flextrafik	Runs almost in every part of Denmark, except the island of Bornholm	Accuracy, cost	Start and endpoints; intermediate stops; GPS data from the vehicles; passenger count and other related information; accuracy	Yes	Historical GPS data, FlexDanmark nationwide IT platform
Lithuania					
Ža	Kaunas city	Customer satisfaction	No data is collected	No	NA

Connectivity to regular public transport service

Table 3 demonstrates that some DRT services are part of the public transport system and help increase accessibility to public transport in areas with low population density. Services that are fully separate from public transport systems are aimed at servicing specific demographics, such as youth or elderly cohorts, or employees of a company.

Presented below are DRT service models that are represented in a range of Response project partner countries, and their integration with regular public transport services:

- **Flextrafik**

Flextrafik was launched in Denmark in 1997 and operates in most parts of the country through a national IT system. It offers a range of demand responsive transport, including patient and general transport. Each municipality and/or regional authority can contribute to the design of transport services in their area, however, its trips are distributed through a nationwide IT system.

- **Anropsstyd trafik**

Anropsstyd trafik in Sweden is integrated within the traditional public transport system and is successfully utilized in a way to increase accessibility to public transport in areas with low passenger demands, through extra services or entire routes. This is highly cost-effective when compared to running public transport and only spends taxpayers' money when the trip is going to happen.

- **Närtrafik**

Närtrafik in Sweden is part of the public transport, but tickets are not valid for transfer to public transport. This service allows to travel when there is no public transport alternative, e.g. between certain hours and in certain areas. Närtrafik customers are also able to connect with regular public transport.

- **Saaremaa demand-responsive social transport**

Saaremaa's DRT service in Estonia will be at first separate from the regular public transport. The plan is to combine the two, but at first, a new public procurement has to take place. The old public procurement allows only parts of the public transport to be demand responsive.

- **HentMeg**

Kolumbus in Norway has the same provider for both regular bus transport and HentMeg. There is only one minibus that drives for HentMeg, replacing 3 public transport routes in the same area that HentMeg now services at a better cost-efficiency. HentMeg usually drives from door-to-door, but in the Suda town centre, there are 4-5 bus stops.

- **Ruter Pilots**

Ruter AS pilot services in Norway are intended to complement ordinary public transport. In some cases, the minibuses that pick up at certain points use the same stops as the regular bus lines, but in general, they drive door-to-door (Age-friendly and Pilot Nes) or use "virtual" stops (Oppegård) that drive from point to point without marked stops. Besides the aforementioned pilots,

Ruter's DRT transport is primarily a service in areas where there are few people and no need for big buses, or the roads are too small for large vehicles. There are different vehicle providers for large and small buses. It is traditional for Ruter service areas to offer either minibus and taxi services, or large buses. They currently have very few suppliers offering both concepts on a large scale.

5. Analysis: Barriers related to DRT services in different RESPONSE project countries

5.1. Legal and/or other administrative barriers

This section examines and maps the legal barriers related to DRT development within each of the five RESPONSE project countries, and ranks the legal and administrative barriers in each country according to their impact¹

Table 4. Legal and/or other administrative barriers and their importance in different countries

	Very important
	Medium importance
	Not important at all / not relevant because the barrier has been removed
	NA – not available

Category	Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
Legal and/or other administrative barriers	Fragmented legal framework (different authorities have separate laws for traffic management)					
	Too specific rules and requirements for small vehicles, only seen as taxi service (conventional or app-based) - i.e. requiring taximeter					
	Lack of operators competence/experience in setting up and running a DRT system operators					
	Lack of awareness of DRT as an alternative or complementary measure for policymakers					
	Legal barriers to fund DRT as part of public transport					

The Table demonstrates that the legal and administrative barriers have had a larger impact in Lithuania, and a lesser impact in Norway and Denmark.

- This is mainly due to the lack of DRT experience and public awareness in **Lithuania**. Few cases of social taxi services in some cities exist, such as special public transport routes which are operated only after events (like sport or recreation). DRT in Lithuania has been mentioned as a possible solution however in all the studies (for example in sustainable urban mobility plans) but is rarely implemented in real-time. In terms of the specific rules and requirements for small vehicles seen as taxi service, there are some restrictions such as not being able to park at the taxi parking space.
- The situation in **Denmark contrasts with the** Lithuanian experience. DRT is widely used in all regions of Denmark for more than 20 years and is organized through a national entity, owned by the Danish PTAs, called "Flex

¹ The importance of the barriers was marked by the expert from each country

Denmark". Flex Denmark is responsible for the maintenance and development of the national DRT platform, used by all Danish PTAs. The "open" DRT services in Denmark is funded as an integrated part of the Public Transport Service and directly funded by the municipalities (as local and regional public Transport is). There are no legal barriers to fund DRT as it is considered to be part of public transport. The DRT-services offered by visitation are subsidized 100% and are funded by law by municipalities or regions. The only legal barrier that has been marked with medium importance for Denmark is the fragmented legal framework as public transport in Denmark is regulated by "Law on PTA's" and includes a special DRT-service for disabled citizens who cannot use ordinary public transport. Besides the general law, DRT is regulated in different sectors: health care, education, rehabilitation, etc. It's a decision made by local and regional authorities (municipalities and regions) whether they allocate these DRT-services to the PTA's or organize these services by themselves (in-house or procurement process).

- In **Norway**, all the barriers have been marked with equally medium importance. Whilst DRT has a great deal of awareness among local authorities such as municipalities and county authorities and several DRT services operate in the country, there is always room for improvement. Norway is also considering a law that allows taxi traffic without a taximeter and without the need to be connected to a common booking centre.
- For **Sweden**, DRT is a relatively widespread form of providing public transport and there is a lot of experience in both PTOs and PTAs. Many PTA/PTOs are looking at new kinds of DRT in the form of on-demand solutions. The most important legal barrier for Sweden is the fragmented legal framework as there are different laws for public transport, special passenger transport (transport that requires a permit to use), and taxi traffic. DRT is used in both public transport and special passenger transports. Taxis are private companies and are procured by the PTA/PTO if they are needed to perform the DRT services as part of the other types of traffic. In 2018, the Swedish parliament decided to introduce a new category of taxi traffic that does not need a taximeter. Instead, taxi vehicles must be connected to a booking centre for taxi traffic and have special equipment. However whilst, there is high interest from PTAs and PTOs, the general awareness of decision-makers and politicians may require some improvements - DRT solutions have been used when passenger demand is low and the regular public transport is facing low load factors, to preserve the traffic in these areas whilst also spending the taxpayers' money efficiently. The lack of political awareness may also stem from the fact that regular public transport takes up a much larger proportion of costs and therefore receives most of the politician's attention. Regular public transport needs to adapt according to commercial interest as it is not supposed to provide a commercially viable service. This is however not seen as a barrier to current forms of DRT that focuses on routes with low load factors and the only reason DRT exists is to uphold mobility in the area of the route.

- Similar to Sweden, **Estonia** shares a fragmented legal framework since the organization of the transport service is divided between the State (JCCs which organize the transport of county lines) and local authorities (school transport, social transport, and in the larger cities also urban transport), which creates confusion and is not viewed as a single entity throughout the region. In general, there is not much experience on setting up and operating a DRT system, however, if the scheme on how to do it would be clear on state-level then this study considers that there will be no problem to find operators for the service as general awareness itself is pretty good. In Estonia, a new law (amendments to Public Transport Act on 01.11.2017) on public transport regulating the ride-sharing service was entered into force. With this amendment, ridesharing was established as a type of taxi service (pricing of this service must be made through IT-platform). There are no legal barriers to finance DRT because the service is acquired under public procurement law.

5.2. Market penetration of DRT solutions

Five barriers related to market penetration in each of the partner countries were mapped and colored according to their importance as follows:

Table 5. Market penetration of DRT solutions and their importance in different countries

Category	Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
Market penetration of DRT solutions	Ticket prices for customers compared to regular public transit services	Light Red	Light Red	Light Red	Dark Red	Light Red
	Private organizations have limited access to the public transport market	Light Red	Light Red	Light Red	Dark Red	Light Red
	Difficult to pilot/test/initiate new schemes due to high upfront investment costs (acquiring fleet/training staff / etc.)	Light Red	Light Red	Light Red	Light Red	Light Red
	High operation costs once the service is running (difficult to maintain)	Light Red	Light Red	Dark Red	Dark Red	Light Red
	Lack of understanding of the market, the users and their needs	Light Red	Light Red	Light Red	Light Red	Light Red

The countries where the barriers from this category are the most important are Estonia and Lithuania. The least in Sweden and Denmark.

- For **Estonia**, these barriers are the most important because in many rural areas public transportation is free for users and the cost of PT rises every year. At the same time, it is difficult to implement new services (for example DRT) because it would increase the costs even more. It raises questions such as should DRT services also be free and if not then how to price it? There is also a lack of reliable and useful data and awareness in terms of users and their needs. The access of private organizations to the public transport market is limited since the public transport market is not very agile as all the transport service providers are contracted through public procurement and with contracts lasting at least 5 years.
- In **Lithuania**, most barriers have been made with equally medium importance simply because DRT is relatively non-existent in the country and

hence it is not easy to tell anything specific about these barriers. Public transport fares are defined by the local authorities in the country and in most cases are the same as PT. Social taxi services might have some variations - some municipalities subsidize these services, others ask passengers to contribute with their own funds. Private companies can participate in tenders for public transport services, but the local authorities (municipalities) can decide to entitle public transport services for the municipally-owned companies. Investments are certainly needed for future DRT services as its currently not popular in Lithuania whereas in some cases DRT could be cheaper to run compared to regular public transport lines and cheaper than planning new routes. There is also a high lack of data regarding the DRT users and their needs in the country.

- In **Norway**, the question of costs is considered to be the most important barrier out of the market-related barriers. Norway highlighted that it is a challenge to make all the positive effects of the DRT visible when discussing costs. Often policymakers question whether the socio-economic benefits of DRT services outweigh the business economics. So far it is the same price for DRT as it is for other public transport. No higher prices are currently planned for DRT. Despite Norway being a relatively positive example of running DRT, there is still lack of user data, about their needs and demands. It is also a challenge for private companies to have access to the public transport market as this is regulated by national regulations, however, there are also positive examples, i.e. Ruter working with schools.
- In **Denmark**, the municipalities and regional transport authorities set demand-responsive trip prices at a level high enough to encourage the use of regular buses and trains. The "Open" services include - Flex Traffic: A DRT service door - to door. The cost scheme consists of a flat fee (including the first 10 km) of Euro 4.8/3.2 + a fee per km (Euro 0.8) exceeding 10 km. - Plustur (Plus trip): DRT service from door to Public Transport Hub (or reverse), at a flat fee of Euro 2.8. These trips are offered in rural areas with limited PT. Must be booked through the national travel planner ("Rejseplanen"). As all funding for Public Transport is carried by the Municipalities and Regions, funding of new and innovative solutions is hard to find. However, due to the collaboration and funding of "Flex Denmark" by all PTAs new DRT offers are continuously being developed and tested. Whereas the access of private organizations to the public transport market is restricted by law and only the Regional PTAs have the right to deliver Public Transport it can be a barrier in testing more innovative DRT solutions, but has not been an issue so far. In terms of the high operation costs, it is a political issue (at the municipal level) as the higher cost of DRT is taken out of the budget for "regular" Public Transport. However, DRT is put in service to replace buses running with few passengers at a high cost per passenger. In terms of understanding the market, users, and their needs, in Denmark, there is a relatively good and growing awareness in this respect. The local operators (often Local taxi services) have a more regular income through DRT services procured by PTAs and a broader range of customers use the service, especially Plustur (flat-rate door-DRT service).

- For **Sweden**, in most places, DRT services have the same price as it is for regular public transport. DRT services tend to be used to cut costs but not needing to maintain a service that has lower demands. To finance the investments related to running the pilots, the model "as much traffic as possible for the available funds" is what dictates the conditions in Sweden.

In terms of private organizations having limited access to the public transport market, it is regulated by national regulations, but there are also positive examples of public-private co-operations. For instance, in Region Värmland and Värmlandstrafiken, businesses and public organizations cooperate by providing "företagskortet" an opportunity to connect the organizations business trip to a single invoice.

In Sweden, it is common to look at travelling statistics. When the load factors decrease, a DRT solution is considered as there is a change in user needs. More can be done to tailor to the needs when a DRT solution is what the user needs.

5.3. Procurement schemes and barriers related to this in RESPONSE project countries

2 barriers related to procurement schemes in each of the partner countries were mapped and colored according to their importance as follows:

Table 6. Barriers related to procurement schemes and their importance in different countries

Category	Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
Procurement schemes	Integration of different vehicle types with regularly scheduled public transport - demands for permits do not allow smaller vehicles or special transport services to be procured under the same contract					
	Permit/procurement to offer transport on outside predefined routes					

Under this category, the situation has been marked as the opposite – in Estonia and Lithuania these barriers have been marked as less important than in Sweden, Norway, and Denmark.

- This is so as **Lithuania** has highlighted that the procurement procedures might be more complicated to compare with regular public transport, but there are no restrictions for procuring any kind of public transport services.
- In **Estonia**, the contracting authority may request different vehicles in the procurement under the same contract and different vehicles can exist on

different routes. Under the Public Transport Act, all the routes have to be predefined.

- In **Norway** in turn, smaller vehicles need a taxi license and cannot be procured under the same contract. Although this has been marked as a barrier, there are some positive examples, i.e. operators who have a contract with Ruter do not need any permit because Ruter is an administrative company for public transport in Oslo and Akershus.
- In **Denmark**, public transport in general is divided into entities, where ordinary public transport (buses and local train services) and DRT-services are procured separately. Fixed routes and flexible DRT-services are furthermore separate in different procurement processes. In terms of permits/procurement to offer transport on outside predefined routes, that is not an issue for Denmark as the contracts have a high degree of flexibility.
- In **Sweden**, special transport services (patient transport, school buses) require special permits. As long as the procurement is written correctly, these vehicles can be used to provide DRT solutions together with regular public transport. The other way around, although possible, is less likely as the vehicles still require a special permit. Contracts can include clauses for additional traffic and is, therefore, if procurement is done well, not an issue.

5.4. Data and software-related barriers

Data flows and the barriers related to this in RESPONSE project countries 7 barriers related to data flows in each of the partner countries was mapped and colored according to their importance as follows:

Table 7. Barriers related to data flows and their importance in different countries

Category	Name of the barrier	Sweden	Denmark	Norway	Estonia	Lithuania
Data flows	Access to data platform is expensive					
	Availability/Quality of the data for regular analysis					
	It is costly to be the software maintainer for the DRT service provider					
	Limitations of proposed software package (booking options via different means (app, webpage, phone, etc.) depending on the					NA

user group in one software/platform)						
General Data Protection regulation restricts the usage of data						
Strict internal regulations of the PTA-s regarding the use of external software.		NA				
Lack of existing DRT Data specification standards and API:s to fall back on		NA				

Data related barriers seem to be equally important in all countries. More in Estonia and Lithuania but some specific data related barriers are also very important in all the other countries. The least important are these barriers for Denmark.

- In **Lithuania**, as the DRT is simply not very well known, there is obviously lack of information about real data flows and there is no specific software in use in the country.
- In **Estonia**, there is no software in use at present for the 4 running social transport pilots. The barrier has been marked as with medium importance because due to it the development of pilots are somewhat stuck behind the discussions which software would be the best to use. There are many software package options in the world, but very good ones are very expensive and the ones that are not so expensive are not so user friendly. In terms of the data itself, the accuracy of data in sparsely populated areas has been marked as an important issue for Estonia as well. Also, the General Data Protection regulation hinders innovative approaches to data usage in many cases.
- For **Norway**, the same data platform has been used for many more services than only DRT, which makes it cheaper. A large issue for Norway is how the legal barriers restrict the usage of data and how it can be stored and used rather than the availability of the data itself.
- In **Denmark** the data platform is integrated within the FlexTrafik (DRT) planning system, so the access of data is not a problem. There are good data sources available and open for use. However, as data is used broader for statistics and analysis, the main barrier is the data platforms lack of certain features. The costs of the service maintenance are shared between the five regional PTA's in Denmark which makes it cheaper. The General Data Protection Regulation does set restrictions but is not seen as a barrier itself because it does not harm the value of the data, but takes resources to rinse out social security numbers, names, addresses etc.

- In **Sweden** the data availability is acceptable, however, the problem is the quality and how to uphold it especially in flows where the main input will be manual and not sensory/automatic. Maps or GIS data, in general, can be used in open-source-way (OpenStreetMap for instance) but more qualified services can be bought once-off or per-period through the Swedish Lantmäteriet or by 3rd party providers such as ESRI, HERE, Google or others. It is often costly to be the maintainer of the software solution and to make structured integrations.

6. Recommendations

Davison, Enoch, Ryley, Quddus, & Wang (2012) determine that DRT models work best when the service provider can:

- work together with traditional public transport;
- Service an area of DRT that is not too big, meaning it can remain cost-effective;
- is easy to use for customers;
- Is designed based on thorough market research (who and when will use the service);
- Trains its drivers, call centre staff, politicians, and the general public well. (Davison, L., Enoch, M., Ryley, T., Quddus, M., & Wang, C., 2012)

In the Interreg Europe report 'Demand Responsive Transport: A Policy Brief from the Policy Learning Platform on Low-carbon economy' (2018), by Simon Hunkin and Katharina Krell, recommendations to help DRT services to operate better in European Regions include:

- The need for DRT systems to be championed by a public authority. It is the role of the public authority to consider the long-term aims and to set goals to meet broader public policy goals, focus on the issues of social inclusion, and reducing congestion.
- DRT needs to be made attractive and convenient if it is to have a wide impact. Communication should focus on the multiple benefits of DRT.
- ICT should be used as far as possible, to effectively integrate services into public transport information systems. The integration of smart cards and electronic payments can help to improve the convenience of the DRT solution, but care must be taken to avoid alienating users who may not have access to those technologies. For example, avoid app/mobile-only services. Systems should aim to provide both instant and pre-booked services.
- Support is available for developing and implementing DRT systems; looking at using European Structural and Investment Funds (ESIFs) and take inspiration from what regions have done before always becomes beneficial.
- Sustainable Urban Mobility Plans (SUMP) should be developed or altered to include DRT, considering linkages with other transport modes. The process should be overseen by a single transport authority, setting clear targets for low-carbon transport to show the long-term direction of travel. (Hunkin, S., Krell, K., 2018)

This study considers that, in line with the country reports (Annexes 2-6), the critical consideration from the DRT service providers operating in the project partner countries is to improve funding from the municipalities to provide better services. Furthermore, DRT services need to be more flexible and integrated with public transport – for example with the same ticket price. Närtrafik providers in Sweden for instance, relay that improvements are needed to raise public awareness of their services, to raise their searchability and profile among potential users. Anropsstyrd

trafik providers in Sweden consider that Närtrafik may represent a future service, as it collects and drives passengers differently via a network topology that is not entirely fixed. Additional recommendations to each barrier groups in the project partner countries are provided by Padam Mobility² as such:

Table 8. Recommendations provided by Padam Mobility

<p>Barrier</p>	<p>Fragmented legal framework (different authorities have separate laws for traffic management). In Sweden, different laws exist for public transport, special passenger transport, and taxi services. DRT can be used in both public transport and passenger transport.</p>	<p>Market penetration barriers. In Denmark for instance private organizations have restricted access to the public transport system, meaning that only the Regional PTAs have the right to deliver Public Transport services. Although it has not been an issue so far, this may be a barrier to testing more innovative DRT solutions.</p>	<p>High operation costs once the service is running (difficult to maintain). In many countries (especially Norway has highlighted it) it is a challenge to raise awareness of the positive impact of DRT as it is integrated with traditional public transport. It is difficult to quantify the socio-economic benefits or adopt efficiencies or another business model that can improve its profitability.</p>	<p>Costly to be the software maintainer for the DRT service provider. Sweden for instance has highlighted that while data availability is acceptable, issues remain with its quality and usability. In some instances, it is still imputed manually, and not automated. Maps or GIS data can use open-source platforms such as OpenStreetMap, however analytical services need to be bought once-off or per-period through the Swedish Lantmäteriet or by 3rd party providers such as ESRI, HERE, Google or others. This can be making software maintenance expensive and challenging to make structured integrations.</p>
<p>Recommendation</p>	<p>Going step by step to reach a full-scale deployment. From the experience of Padam Mobility, a legal framework is a constraint but is not a barrier if taking a "Proof of concept" (POC) approach: Start with a pilot public transport oriented Then extend the services, still through the same booking platform but integrate a larger and specialized fleet (for example using the SUTI protocol to integrate cabs). By using this approach, a legal barrier can be lifted once at a time as the service is adjusting</p>	<p>Finding the right target: private campuses for example could be a way to try more Innovative DRT. Acting as a POC it could lead to a better split between public and private stakeholders. Thus, allowing for more involvement from the Private sector in transportation matter.</p>	<p>Norway is very much a car-oriented country (Low density, Spread territory) In order to reach an ounce of profitability, ridership needs to increase. The decision needs to be made in marketing DRT services: DRT pilot platform "hentmeg.no" is relatively unknown and is covering a small village that can't generate an interesting ridership. Even the pilot taking place in the "larger" town of Kongsberg is called the "Phantom bus".</p> <p>By focusing on finding the right target (youth, the</p>	<p>Quality of Data is, indeed, an issue. PTA should count on software mobility providers to generate quality data (Important to set the right KPIs to be measure during early talks). During the procurement process, they should also pay attention to maintenance cost and integration issues by choosing to have a manager role only. For example, an RFI just issued by Malmö Stad: - City is the manager of the solution but wants to rely on a duo: Software provider + Integrator company (Cap Gemini for example) to maintain the software and structure the integration</p>

² Recommendations were provided by Antoine Lunet, International Business Development Manager at Padam Mobility on 20.05.2020

			<p>elderly.) for the right area and launching an adequate marketing campaign it will be possible to increase ridership, prove the benefits of DRT and start thinking about a viable business model.</p>	<p>- The cost of that approach is easier to manage and can put pressure on suppliers to be commercially aggressive.</p>
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7. Conclusion

All in all, it can be said that in Scandinavian countries and especially in Denmark the DRT services are relatively well developed. Estonia occupies a position somewhere in-between and is rolling out its first services as social transport pilot projects. However, in Lithuania DRT remains relatively unknown. Each project partner relayed examples of 1-2 DRT service cases in their countries (totaling 8 cases), with 28 additional cases from other countries analyzed in terms of their operation and business models. Project partner country cases were analyzed in greater detail, to determine the type of data collected and different types of barriers.

A total of 36 DRT business models were thus analyzed for this study (10 urban, 14 rural and 12 half urban/half rural), to highlight their most common parameters which we conclude to be the following:

- The preferred vehicles for most companies are minibuses or regular buses.
- Most services operate on flexible routes, less on fixed or partially fixed lines.
- Companies in urban areas need a shorter notice time (a maximum of 30 minutes) than the ones in rural areas. Hence, it is very common to have DRT services in towns with short booking time, even though there can be exceptions. Most rural DRT cases have long pre-booking time and customer notice periods.
- The services mainly operate either every day or from Monday to Friday or on Saturdays.
- The most preferred way of ordering the services is via an app or via phone, a few cases also need booking via the web or just contacting the driver directly (via given phone number).
- The survey showed that the price of the services is not depending on whether the service is rural or urban. In most cases, there is a fixed ticket price or the ride fee is counted per km. The price is usually lower than taking a taxi, but higher or the same as regular public transport. In some cases, the service is financed by local municipalities.
- In cases where the DRT service is part of the traditional public transport system, it mostly functions as a last-mile solution to offer a connection to the traditional public transport service.
- The analyzed DRT cases in project partner countries have indicated that the most important KPIs for them are: customer satisfaction, cost (total, per trip, compared to traditional service), and punctuality. Different data platforms are used such as PLANET, Spare Lab, Viavan, Pass, Google Platform, PIKAS. The data they mostly collect is pick-up and drop-off points, number of passengers and travel time. Real-time data is used most often.

In terms of the national barriers in the countries, 4 different barrier categories were analyzed: legal and/or other administrative barriers, market penetration of DRT solutions, procurement schemes and data flows.

In Estonia and Lithuania, the barriers were more important than in Sweden, Denmark, and Norway in setting up DRT services. The various barriers had the least significance for Denmark. However, all countries addressed certain barriers as being the most relevant for them, such as:

- For Lithuania, the main barrier is the lack of awareness and willingness among decision-makers. Hence, Lithuania does not have much experience with DRT service in general, there is a lack of available data, information about users, and their needs. There are some cases of social taxi services in some cities, or special public transport routes which are operated only after sporting or recreation events. DRT is always mentioned as a possible solution in all the studies but is rarely implemented as a real-life solution.
- For Estonia, the main barrier seems to be the fact that currently in most Estonian rural areas public transportation is free for users, and hence it raises questions if DRT services should also be offered for free and if not then how to price them? Additional main barriers for Estonia include also the General Data Protection Regulation (GDPR) that hinders innovative approaches to data usage. Also, the available data in sparsely populated areas is not accurate enough and the cost of the user-friendly software is too expensive.
- Norway has highlighted the legal barrier as being the most important for them as it limits how data can be stored and used. Also, smaller vehicles need taxi licenses and cannot be procured under the same contract as buses for example. An additional main barrier is how to make the positive effects of DRT services more visible. There is often the question, when prices are being discussed, whether there are other effects of DRT that can differentiate it from ordinary public transport, and in turn, make DRT more profitable in other aspects than simply the cost?
- For Sweden, necessary data is available, but the problem is the quality and how to uphold it, especially in flows where the main input will be manual and not sensory/automatic. The second main barrier is the fragmented legal framework as there are different laws for public transport, special passenger transport, and taxi services. Also, it is often costly to maintain the software solutions and to make structured integrations.
- In Denmark, the situation, in general, seems to be the most advanced compared to other countries. DRT has been widely used in all regions of Denmark for more than 20 years already and is organized through a national entity, owned by the Danish PTAs, called "FlexDanmark". Hence, none of the barriers in Denmark were highlighted as being most important, rather mentioned as having either medium importance or not being important at all. The only barrier for Denmark is that while the data platform is part of the FlexTrafik (DRT) planning system and the access of data is not a problem (there are good data sources available and open for use), the data platforms lack certain features as data is used more broadly for statistics and analyses. Another barrier for Denmark, even though it is not a real issue now, is the fact that the access of private organizations to the public transport market is restricted by law. Only the regional PTAs have the right to offer public

transport services and hence this can be a barrier in testing more innovative DRT solutions.

The main recommendations to eliminate the barriers provided by Padam Mobility were:

- Starting with the public transport-oriented pilot and finding the right targets (both area and user wise: campus, elderly, children, etc.) can help to eliminate restrictions related to fragmented legal framework, test for more innovative DRT solutions, and increase general awareness.
- In terms of improving the quality of data, PTAs should discuss the important KPIs during the early procurement process with the software provider and choose only to have the managerial role.

In conclusion, while some barriers are less relevant for Estonia and Lithuania, most of them still exist in the Baltics, being less present in Sweden, Norway, and Denmark. Yet, there is always room for improvement also in the Nordics, especially in terms of data and software improvements, even in Denmark where DRT has existed for more than 20 years. The general reasoning behind the fact that DRT works well in the listed Scandinavian countries might be the fact that the process regarding discussions, planning, and actions towards the development of DRT services in those countries simply started earlier and is, therefore, more advanced.

8. List of Annexes – all Annexes have been added as separate files to this report

- Annex I Summary table of the parameters of all studied DRT cases
- Annex II DRT mapping study country report – Norway
- Annex III DRT mapping study country report – Estonia
- Annex IV DRT mapping study country report – Denmark
- Annex V DRT mapping study country report – Sweden
- Annex VI DRT mapping study country report – Lithuania
- Annex VII DRT cases from other than project countries
- Annex VIII DRT barriers table

9. References

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