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Review of service level and technical level for rural and peripheral areas

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1. Introduction

Remote regions in central Europe share the same risks and issues related to the fact that they are located at the periphery of main transport networks. Inadequate and under-used services, excessive costs, lack of last-mile services and proper intermodality, poor communication and information to users and car commuting are some of the challenges that many central European regions face.

The SMACKER project addresses these disparities and promotes public transport and mobility services that are demand-responsive and that connect local and regional systems to main corridors and transport nodes.

Within SMACKER mobility issues related to peripheral and rural areas, main barriers are assessed and addressed and solutions drawed on the best international know-how are provided. SMACKER promotes demand-responsive transport services to connect local and regional systems to the main transport corridors and nodes. Soft measures (e.g. behaviour change campaigns) and hard measures (e.g. mobility service pilots) are used to identify and promote eco-friendly solutions for public transport in rural and peripheral areas, with the aim of achieving more liveable and sustainable environments and better integration of population to the main corridors. SMACKER helps local communities to re-design their transport services according to user needs, through a coordinated co-design process between local/regional partners and stakeholders; SMACKER also encourages the use of new transport services through motivating and incentivizing campaigns. The direct beneficiaries of the actions are residents, commuters and tourists.

Participation reflects the overall integration of citizens and groups in planning processes and policy decision-making and consequently the sharing of power. In particular, transport planning and transport relevant measures are often the subject of controversial discussions within the urban community. The concept of Sustainable Urban Mobility Planning has established the principle that the public should be included from the very beginning of the transport planning process and not only when the plans are largely completed and only minor amendments can be carried out. For that reason, public authorities need to open-up debate on this highly specialised and complex subject area and make participation a part of the planning process. In order to ensure participation throughout the process, the development of an engagement strategy would be necessary.

This report intends to conduct an analysis of the literature about existing Demand Responsive Transport (DRT) services in the Central Europe area, taking in specific account lessons learned from previous and ongoing EU projects and last implementations. The analysis highlights also good and bad practices with detailed focus on technical developments and solutions, including possible adaptation of technologies planned for other purposes with a special focus to low cost IT tools and scale economies.

Chapter 2 gives an operative definition of Demand Responsive Transport solutions as it is not easy to agree on a common understanding for these kind of flexible transport services. For all these reasons, this chapter provides a definition of a “perimeter” of transport solutions to be included into our DRT services analysis.

Chapter 3 provides a synthesis of the main evidences arising from the huge scientific literature on the topic of demand responsive transport. In particular, this chapter defines some key elements for selecting a strict number of international and EU scientific publications providing relevant information and suggestions for the development of a DRT service.

Chapter 4 includes an analysis of existing EU projects (both ongoing and ended) with a specific focus on the topic of demand and responsive transport. The aim of this analysis is to identify and map the key recommendations and evidences collected throughout these projects, and to have a complete overview of the relevant information for SMACKER.

Lastly, chapter 5 elaborates the main conclusions arising from the analysis conducted throughout the report and gives some recommendations for the development of the next SMACKER project steps.

2. Demand responsive transport (DRT) definition

Demand responsive transport (DRT) is defined as “a form of transport where vehicles alter their routes based on particular transport demand rather than using a fixed route or timetable” [Community Transport Association CTA, 2017]. These vehicles typically pick-up and drop-off passengers in specific locations according to passengers needs and can include taxis, buses or other vehicles.

The DRT services have to be analysed in strict relation with the existing technical and economic problems of providing a reliable and effective public transport service in peripheral/low density areas. In fact, public transport is a key component of the urban mobility systems in small-medium size cities not only for the city area, but also and especially for the surrounding areas such as the countryside, industrial areas and those low-populated areas which suffer from a lack of transport options, making the inhabitants of these areas rather isolated. The reason for this lack of transport offer is quite simple: a traditional public transport service in low density areas is not sustainable from a financial point of view as its demand is too low. It is resulting in a massive use of private cars to reach the city, producing pollution, traffic congestion and road saturation, especially at peak hours.

The need for a DRT service originates from these kind of economic and technical problems. A demand responsive/flexible transport service is something between the traditional service and a door-to-door service. More in detail, a DRT system integrates the traditional public transport offer by [ATTAC Project, 2011]:

- Replacing normal public transport offer in specific areas or hours of the day with low demand;
- Integrating traditional public transport services in smaller towns with low population density, population sprawl (mountain areas, rural locations, etc.) or areas not served by traditional public transport services;
- Offering a high quality service, closer to the need of users, thanks to the customization, the duration and the comfort of the trip that must not be greater than 30 minutes and that could be performed with small and ecological vehicles, equipped with devices for transporting disabled people.

This solution exists in several contexts and also in big cities in order to satisfy the request of users in particular zones or hours.

It is not easy to define which kind of transport solutions are included into the definition of Demand Responsive Transport. This complexity is also given by the fact that different terms are used when referring to these kind of transport solutions. In order to simplify the analysis summarized in this report, the terms “Flexible Transport Service” (FTS), Transport-on-Demand (ToD) and Demand-Responsive-Transit are used as synonyms of DRT.

In the scientific literature, DRT transport solutions are defined in relation to the others public and non-public, regular and non-regular transport services.

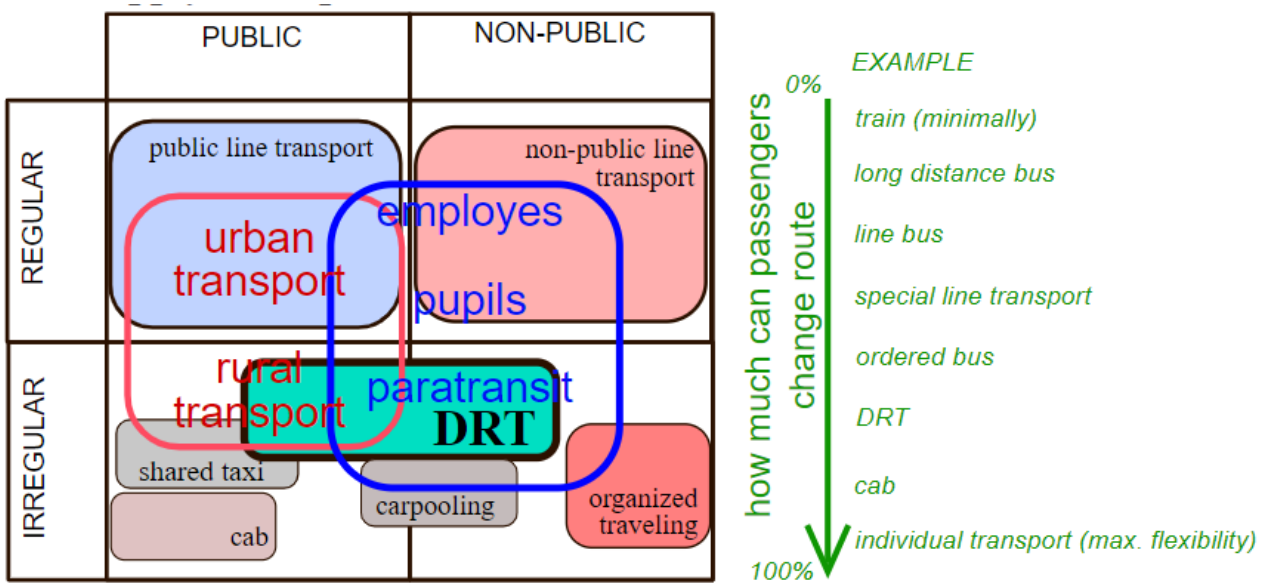

Figure 1: Public transport classes. DRT [Source: Davison et al., 2012]

Based on scientific literature, there are some common elements for all the demand responsive transport solutions [Davison et al., 2012]:

- DRT can be situated between regular public transport services (which are usually served by buses) and completely personalised services provided by taxis;
- DRT services can be flexible on any of the following features (or combination of these elements): route, origin-destination pattern and timetable.

Some authors include pre-booking as an element of the definition [Wright, 2013]. There are also 'hybrid' forms of DRT, combining a fixed route system allowing pre-booked deviations (up to a predefined maximum distance) with a "Ride hailing service" on the fixed route section (Mulley et al., 2012). For all these reasons, there are several DRT typologies:

- with fixed itineraries and flexible time tables;
- with fixed itineraries with deviation on demand;
- with flexible itineraries;
- with predefined bus stops;
- with flexible itineraries and flexible stops (door-to-door service, very similar to a taxi).

The different typologies of DRT services are briefly summarized in the scheme below.

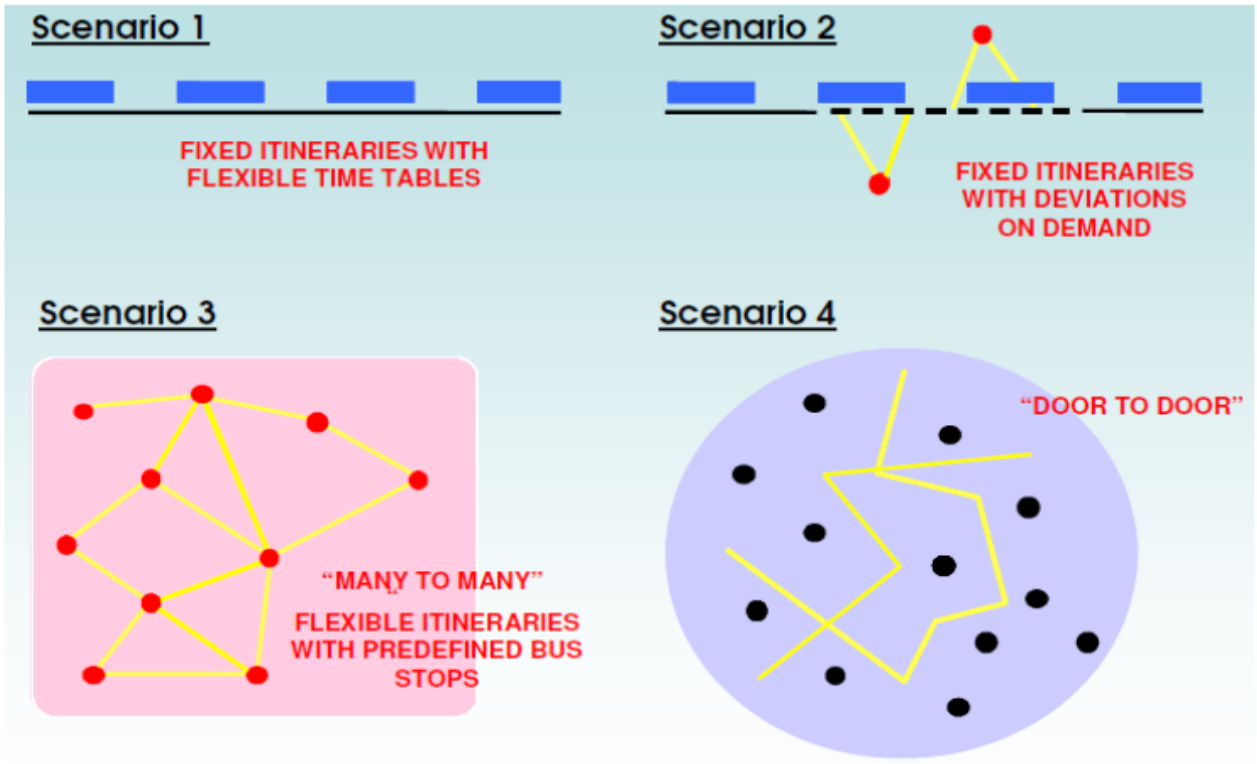

Figure 2: Demand Responsive Transport different models of services. [Source: ATTAC Project, ITL, 2011]

The different kinds of DRT services differ also in relation to the different typology of vehicles used. Depending on the market served, DRT services can be provided by minibuses or mid-size vehicles (22 to 30 seats) but also by taxi operators. Wright (2013) has developed a methodology to derive the optimal vehicle size for a given demand and average trip length. In particular:

- **Taxis** provide more cost effective DRT services in areas where demand is lowest and more dispersed;
- **Minibuses** work better on semi-fixed route patterns in more densely populated areas.

Wang et al. (2015) find that the current level of evidence on optimal vehicle sizes remains weak. In regions with high seasonal variability (such as touristic areas), taxis can replace buses during the low demand season [Mulley et al., 2012]".

It is therefore possible to identify different typologies of DRT services [OECD, 2015]:

- **A "Virtual line"**. A virtual line is a service that is similar to normal scheduled services since it stops at fixed stopping points, follows regular routes and runs according to timetables set in advance. The basic difference compared with normal scheduled services is that it only runs if requested by one or more users.
- **A "Door-to-Door" service**. A Door-to-Door service, although less common, is a service transporting users from their homes to specified destinations. It is reserved for the elderly or for people with reduced mobility. There is no set route in this case and the service may be provided by taxis or minibuses belonging to the main network operator.
- **"Stop-to-stop" or "point-to-point" services**. Stop-to-stop or point-to-point refers to a system that serves an area with stops defined in advance. Routes may vary depending on stops and user demand. It may also use taxis or minibuses.

3. Analysis of the scientific literature on rural and peripheral demand responsive transport solutions

3.1. Selection criteria of the main scientific publications on DRT solutions

As the scientific literature on DRT is pretty wide, the scope of this paragraph is not to analyse all the existing documents, but to find the most interesting/relevant documents for SMACKER and for all the relevant stakeholders involved in the project.

The selection of the most important literature on DRT topics was conducted on the basis of the following key parameters:

- **Authors' importance** (international research institutions, studies supported by European Commission or others EU important institutions, the most quoted documents, etc.);
- **Up-to-date information** (selection of the most recent documents);
- **Relevance for the SMACKER topics** (documents with a specific focus on DRT measures/policies implementation, documents with a specific focus on economic /technical aspects);
- **A specific focus on DRT** (documents with a major focus on DRT topics. It is worth noticing that the largest part of the scientific analysis on DRT are included in reports with a wider focus of sustainable mobility and Mobility-as-a-service).

On the basis of the above-mentioned parameters, **eight** scientific reports were selected.

Authors	Year	Document title	Geographic Focus	Main DRT topics
OECD. International Transport Forum (ITF)	2015	International Experiences on Public Transport Provision in Rural Areas	Finland, UK, Norway, France, Japan	Institutional framework
ENEA, UITP	2004	Demand Responsive Transport Services: Towards the Flexible Mobility Agency	International perspective	Technical aspects
TRANSPORTATION RESEARCH BOARD (TRB)	2010	A Guide for Planning and Operating Flexible Public Transportation Services	US	Planning
ESPON	2015	TRACC. Transport Accessibility at Regional/Local Scale and Patterns in Europe	EU	Transport accessibility
Interreg Europe	2018	Demand Responsive Transport. Policy Learning Platform on Low-carbon economy	EU, Central Europe	EU policy
Community Transport Association (CTA)	2017	The Future of Demand Responsive Transport	UK, EU	Future scenarios and social aspects
Interreg Europe, Lastmile project	2017	State-of-the-Art of regional public transport	Central Europe	DRT case studies development

Authors	Year	Document title	Geographic Focus	Main DRT topics
		systems and particularly flexible systems		
TRANSPORTATION RESEARCH BOARD (TRB)	2007	Why do demand responsive transport systems fail?	International perspective	Failure factors of DRT solutions

Table 1: Synthesis of the main DRT scientific reports analysed

The single scientific academic papers are not analysed as the selected reports are written taking into considerastion several academic papers.

3.2. Review of the main scientific literature reports on DRT solutions

In the following paragraph, an analysis of the main scientific literature on DRT solutions is conducted. Each paragraph shows the most relevant technical aspects for SMACKER activities and project objectives.

3.2.1. OECD, "The Future of Demand Responsive Transport"

This OECD report dedicated to DRT is very interesting as it provides an international perspective on how a DRT service works, as well as on the different strategies that is possible to draft in order to plan and develop a DRT service in different urban and rural contexts. This report is mainly focused on some international case studies: Finland, UK, Norway, France and Japan. It provides also interesting recommendation for a correct planning and design of a successful DRT service.

Importance of design the DRT service on the basis of a deep transport demand analysis

Several scientific works on DRT analysed in the OECD report highlight the existence of two different DRT development paths:

- One DRT development path sees greater use of DRT as a **lifestyle choice**, which competed with alternative modes of travel on factors such as **convenience** and **cost**;
- A second DRT development path sees DRT as a **necessary tool** to deal with market failure and public policy imperatives, such as environmental concerns.

These two different DRT development paths "*cross each other in many ways. Moreover remains a distinct difference between a narrative about necessity (for example, finding a viable way to address loneliness and isolation in a rural community) and choice (for example, commuters stopping using their car to get to their local station and choosing another means which lessens the hassle and cost of congestion and parking). Considering these two different DRT development paths is fundamental in order to plan an effective and efficient DRT service*".

Moreover, it is important to analyse the DRT market niches in depth. The OECD report identifies three different market niches where DRT is appropriate:

- Low-tech, small-scale simple DRT systems can be applied in areas where captive users are happy to use any form of public transport but are only willing (or able) to pay low fares.
- Niches (e.g. employer shuttles, airport shuttles) where commercial operators can target users who appreciate luxury and are willing to pay a premium for a private service.

- Large-scale, complex network DRT systems require high-tech equipment if they are to operate efficiently. As a result, they will be relatively expensive to operate.

The demand analysis needs to consider also the technological trend and the growing role of the private transport actors in providing DRT services in rural areas. "*Mobile phone applications have changed consumer expectations and behaviour. These applications have been created out of user needs and are central as they give visibility to all the existing mobility services, allowing for consumers to choose the ones best fitting for their heterogeneous needs. This has also been an impetus for new actors and innovative services accessing the public transport and taxi markets (e.g. KutsuPlus, Bridj, Uber, Olacab, Lyft). However, current legislation for public transport provision has in many cases been created before smartphones were commonplace. This in turn has created a much needed discussion on the need of change in legislation and current practices*".

It is important to analyse the users transport needs in depth. "*Evidence from Norway suggests that the characteristics of a typical user of DRT is that someone who does not own a car or have a driver's license. Interestingly, DRT is also valued by parents owning a car as it relieves them from having to drive their children to activities. More generally, younger users of DRT use it for participating sports activities or visiting friends (often in the evenings). In Norway, sports teams have adapted their schedules to fit the transport offer. Elderly customers use DRT for accessing medical services, shopping and some social activities (mostly in the morning). Most of the users, according to the Norwegian follow-up study, were satisfied with the services offered. Furthermore, DRT services were considered as supplements to other public transport services and private transport*".

DRT services economic sustainability

The OECD report conducts an interesting analysis on DRT main **failure factors**. The report evidences as "*most schemes were dependent on financial sponsorship from the Government and once the initial funding was removed they soon disappeared*".

Moreover, the OECD report shows several solutions to be integrated in order to plan a more economic effective DRT model. For example, "*experiences indicate a **willingness** for both car users and existing bus users to use DRT services at a **higher fare** than existing bus fares. There is a potential new market for DRT in railway station and airport access, workplaces outside the urban areas and an integrated DRT supply for the general public*". This is strictly related to the "*rising operating costs for bus services and constraints of public funding have eroded the ability of local authorities to subsidise public transport at previous service levels. This has led to a vicious circle of increasing fares, increasing subsidies or cutting back the existing services levels*".

Other innovative solutions could be related to the combination of freight and passengers transport systems in rural areas. "*Today freight, mail and passengers are moving separately. In areas of particularly low density population, combining transport services primarily provided for other purposes with passenger transport services can be an attractive option. In some countries the postal service operator is also a major bus operator. Combining postal services with passenger transport might be appropriate especially in cases where population is aligned on a linear corridor. In the United Kingdom, some experiments were made on postbus operation, where minibus replaced mail vans on routes connecting local sorting centres and collection points (White, 2011). While most of these services have now ceased in the UK, they might provide alternative options for demand-responsive transport*" and to create more strong DRT service business models.

"*It is important to note that rural transport provision is not necessarily only a task for the public sector. Volunteer-driven minibuses have also been emerging as a solution for rural areas but they are not necessarily comprehensive in their coverage. Voluntary approaches are often constrained by lack of sufficient number of volunteers to cover broader areas and services. However, voluntary approaches have been relatively successful in Japan, for example, where a tradition of volunteer work is strong*".

However "*New concepts will not remove the need for public funding for core services in many rural areas – but they can stop the increase in unit costs for providing those services. Sustainability of funding is still a key to support economic activity and promote social equity also in rural areas*".

Big data and more informed decisions on DRT solutions development

DRT systems have been particularly stimulated by the improvements of route planning softwares and new information tools, enabling more efficient journey planning in response to users' needs.

"*Big data can help governments, businesses and individuals to make more informed decisions. Better data can help transport authorities to understand commuters' behaviour, provide targeted information and identify policy interventions. In fact, the biggest gains from using big data may come from changing user behaviour. From the government perspective, there is need for better data to support decision-making, at least for the following purposes:*

- *Understanding better the demand (needs by different user groups);*
- *Better planning of services to match user needs;*
- *To make the market case for privately operated services (profitability)*".

Importance of communication to final users

The success of a DRT solution is strictly realated to the success of its communication campaigns and the ability to provide high quality DRT services, mainly in relation to the comfort of the vehicles used.

"*One solution is to improve service quality and supply. While the number of passengers has generally declined for 'conventional' public transport, international experiences show that new marketing concepts and innovative product developments can increase the number of passengers and reinforce the commercial viability of the industry. Types of improvements include higher service levels (for example through increasing comfort by reducing seating density) and using smaller vehicles or simply better marketing and information provision and focus on service reliability (for example through providing real-time travel information with mobile applications). Some of these experiences have been successful and resulted in improved frequencies and connections in rural areas*".

3.2.2. ENEA, "Demand Responsive Transport Services: Towards the Flexible Mobility Agency"

The ENEA report focuses on DRT technical and operational aspects. It gives a clear overview of all the important aspects of DRT service planning, from the user needs analysis to a review of organisational and institutional main issues.

As a first step of a DRT service planning, the ENEA report suggests to start from the identification and the analysis of DRT service users, including all the actors playing an important role in the service (end users, operators, authorities and active destinations).

The Figure below shows a block diagram describing the relevant steps for a successful DRT final users analysis.

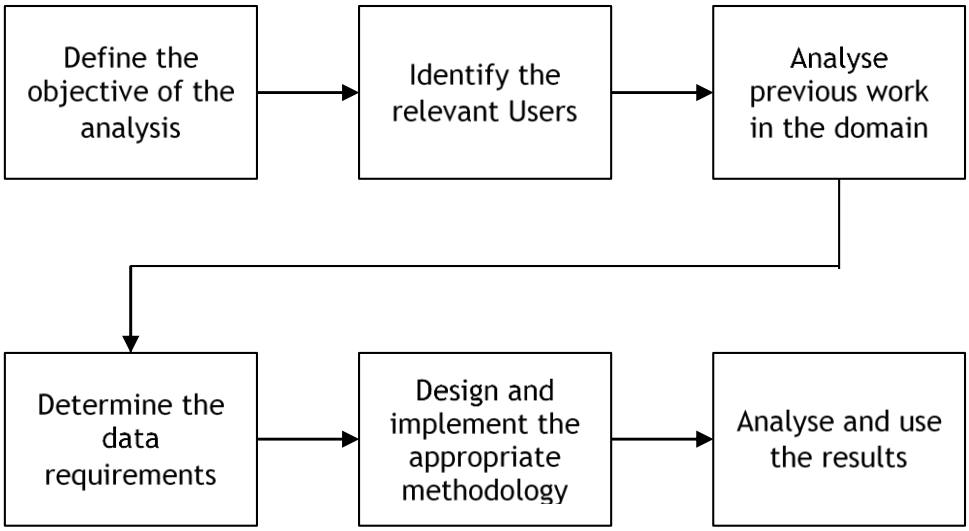

Figure 3: Relevant steps for a successful DRT final users analysis [ENEA, 2004]

According to the ENEA report, the aim of this phase is to "*allow the project team to understand their users, and to use this knowledge to design a system to meet the needs.*" The findings emerging from this analysis are basic pillars for answering these DRT questions:

- *"Will the system perform the needed function for the target user?*
- *Will the users be able to use it (understanding, skill, opportunity, safety)?*
- *Will the users accept it (attractive, price, alternatives, perception, need)?"*

ENEA identifies four main elements to be considered for a DRT service development:

- Route and time concept;
- Booking concept;
- General intermodal integration;
- Vehicle allocation concept.

The first two aspects concern respectively the planning of the service, in particular route and timetable, and the booking system that can be more or less flexible according to the user needs. Furthermore, a DRT service can be **integrated with others transport services** already present in the area or it can be operated as **stand-alone transport system**. The last point concerns the choice of having a fixed or extendable dynamic vehicle allocation, according to the characteristic of end-user classes and the flexibility of the number of the vehicles that can be used for the service. The DRT services effectively used or tested are a mix of the characteristic listed above.

From the operational side, ENEA shows as one of the most important characteristics of a DRT service the "**architecture system**" supporting it. According to the guidelines provided by ENEA, a system architecture can be analysed from four complementary points of view:

- *"The **functional architecture** that describes the various sub-function of the system and the flow of data between them;*
- *the **information architecture** that indicates the various data models for the sets of data that have been identified;*
- *the **physical architecture** that identifies the physical unit performing the function in the functional architecture and the communication paths between them;*
- *the **communication architecture** that describes the characteristics of the various channels that have been identified in the physical architecture".*

During the planning phase of a DRT service there are several organisational and institutional issues to be defined and cleared. The Figure below shows how there are several steps and issues to be taken into account

when developing DRT. It is worth noticing that, according to the report, developing an effective and working DRT service can be a **lengthy process**, usually taking no less than **two years**. The main issues to be tackled in order to implement an effective DRT service can be summarized in the following list [ENEA, 2004]:

- *Juridical status of DRT;*
- *Potential operators;*
- *Potential buyers of the DRT service;*
- *Impedance with other public transport modes and service;*
- *Pricing issue;*
- *Payment and ticket systems;*
- *Privacy protection issues;*
- *Operational area;*
- *Status of TDC (Travel Dispatch Center);*
- *Dispatching issues;*
- *Compulsory competing;*
- *Cooperation with different actors;*
- *Information.*

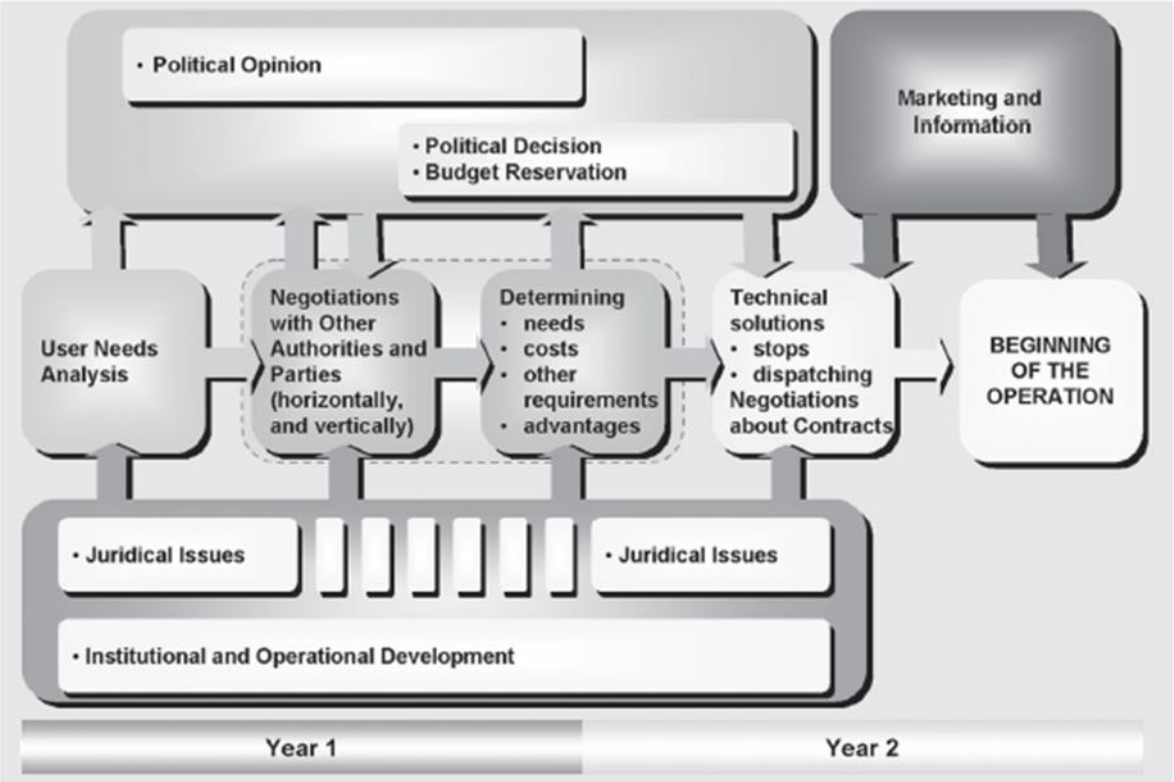

Figure 4: DRT development process [ENEA, 2004]

In conclusion, in order to design an efficient DRT service "*it is important that all the steps described are taken. Based on experience it can be said that during the DRT development process the technological and telematics possibilities and tools develop very quickly and it would be important to follow this technological and telematic development and to utilise new opportunities when making political, juridical and operational decisions. The steps cannot be taken without financing. Thus in the very early stage of the DRT development it is essential to arrange the financial issues. The technological development, juridical framework, institutional and organisational issues have effects on the operational framework and should be taken into account in the DRT development work. Thus, several external factors, frameworks and issues affect the development of DRT. It cannot be isolated from the social frame of reference. On the other*

hand there are several issues that have to be taken into account and decided internally during the development process".

3.2.3. TRB, "A Guide for Planning and Operating Flexible Public Transportation Services"

The Transportation Research Board (TRB)[1] report provides a guide designed for public transportation suppliers in order to "*identify best practices and barriers to effective implementation of flexible public transportation services*". Starting from the result of a web-based survey conducted on over 1'100 public transport operators, the report analyzes the current state of flexible public transport service in the United States and Canada and provides a framework/decision matrix for this public service. The conclusions, even if referred to an American context, are very interesting also for the EU context. The TRB report provides then a detailed guide for implementing the service, as well as some best practices gathered by ten transport agencies across the United States.

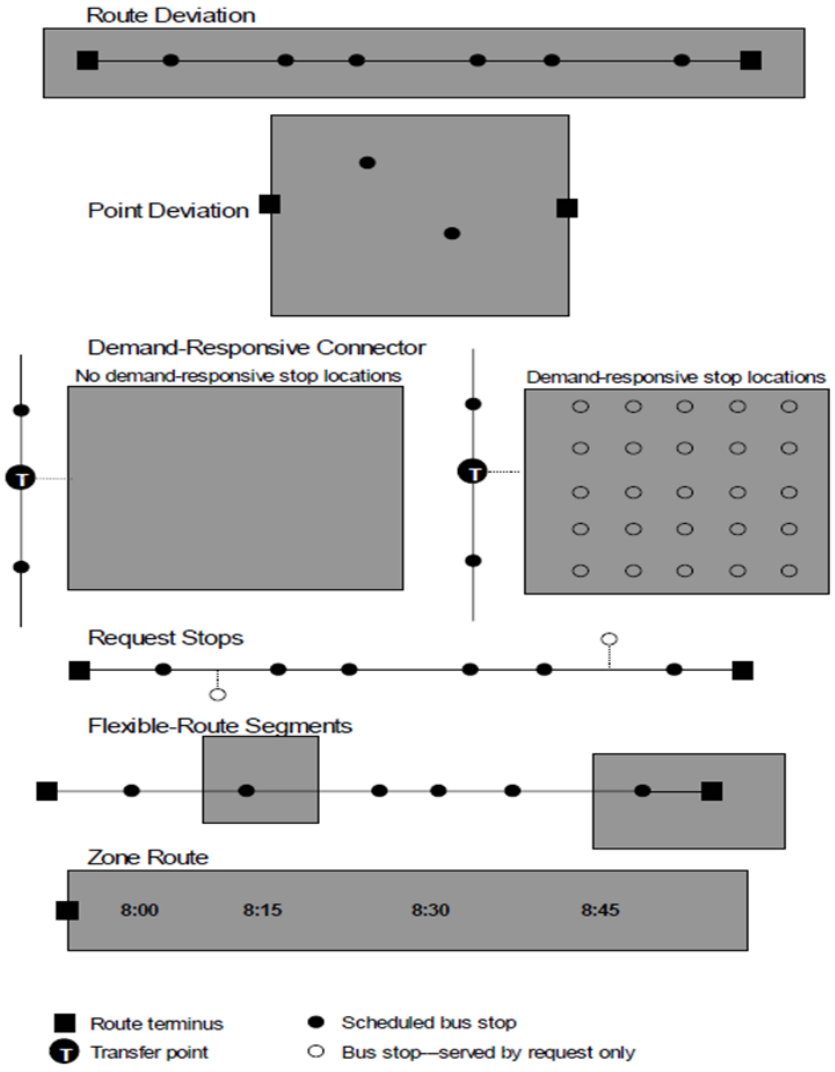

Figure 5: Graphic schemes of the different DRT services [TRB, 2010]

[1] The TRB is a program unit of the National Academy of Sciences, Engineering and Medicine based in Washington D.C. (USA), a non-profit organization that provides independent, objective, and interdisciplinary solutions.

According to the report: "*flexible public transportation services encompass a wide range of **hybrid service types** that are not fully demand responsive or fixed route*". The different kind of DRT services are summarized by TRB in the following operational categories:

- *"**Route Deviation**. Vehicles operating on a regular schedule along a well-defined path, with or without marked bus stops, which deviate to serve demand-responsive requests within a zone around the path. The width or extent of the zone may be precisely established or flexible;*
- ***Point Deviation**. Vehicles serving demand-responsive requests within a zone and also serving a limited number of stops within the zone without any regular path between the stops;*
- ***Demand-Responsive Connector**. Vehicles operating in demand-responsive mode within a zone, with one or more scheduled transfer points that connect*
- *With a fixed-route network. A high percentage of ridership consists of trips to or from the transfer points;*
- ***Request Stops**. Vehicles operating in conventional fixed-route, fixed-schedule mode and also serving a limited number of undefined stops along the route in response to passenger requests;*
- ***Flexible-Route Segments**. Vehicles operating in conventional fixed-route, fixed-schedule mode, but switching to demand-responsive operation for a limited portion of the route;*
- ***Zone Route**. Vehicles operating in demand-responsive mode along a corridor with established departure and arrival times at one or more end points".*

The interviewed transport agencies (139) indicated that they have operated flexible public transport service with the following relevant aspects:

- *"Most respondents were **public agencies**, but nearly one-third were private, non-profit entities.*
- *Most agencies were small and served areas of low density.*
- *In agencies that operated other modes of service, flexible public transportation service represented a **small proportion of total trips**.*
- ***Route deviation** is the most common type of flexible public transportation service.*
- *Most agencies operate flexible public transportation service in **rural areas**, small towns, and suburban areas.*
- ***Senior citizens** and **persons with disabilities** are the most frequent rider types.*
- *Productivity as measured by passengers per hour averaged **4 passengers per hour**;*
- *Most agencies **limit the distance** that buses can deviate from the route for flexible public transportation trips. However many analysed cases have no limits or informal limits;*
- *Most agencies do not charge a **premium fare** for flexible public transportation;*
- *Flexible public transportation **drivers** do not receive **additional skills** training;*
- *Most agencies use **small body-on-chassis buses** for flexible public transportation service;*
- *Most agencies require **previous-day, advance notice** to arrange flexible public transportation service pick-ups;*
- *Passengers most frequently call a **reservation agent** or dispatcher to make a request;*
- ***Voice radios** are the most common method of contacting drivers;*
- *Most agencies coordinate flexible public transportation service with **other services**, if applicable.*
- *The **use of technology** to implement flexible public transportation services is limited.*
- *Most agencies implemented flexible public transportation service in response to **community needs**;*
- *Agencies often **promote** flexible public transportation service through a variety of means, including community presentations and on agency websites."*

An interesting matrix shows the viability of flexible public transportation services in rural areas (where density is lower than **500 persons per squared mile**), considering demographic and economic data as well as the purpose of the trip. Looking at Figure below, *"for rural areas, the trip demands that best fit flexible public transportation service primarily come from the traditionally transit-dependent populations of elderly persons, persons with disabilities, and low-income persons, although there are youth activities that*

could be considered viable for flexible public transportation service". This is due to the characteristic of the trip's purpose, indeed "*where transit-dependent populations are making trips that are not time sensitive, flexible public transportation service is viable. When populations are less transit-dependent or trip purposes are more time sensitive, the viability of flexible public transportation service diminishes*".

<table>
<tr><th>Demographics/Trip Purpose</th><th>Youth
< 18</th><th>Adult
18–64</th><th>Elderly
65 and over</th><th>Persons with Disabilities</th><th>Low-Income Persons</th></tr>
<tr><td>Work</td><td colspan="5" rowspan="2">Low Potential for Flexible Public Transportation</td></tr>
<tr><td>School</td></tr>
<tr><td>Non-Emergency Medical</td><td>High</td><td>Medium Potential</td><td colspan="3" rowspan="4">High Potential for Flexible Public Transportation</td></tr>
<tr><td>Shopping/Groceries</td><td colspan="2">Low</td></tr>
<tr><td>Shopping/ Other</td><td rowspan="2">High</td><td rowspan="2">Low</td></tr>
<tr><td>Social</td></tr>
</table>

Figure 6: Matrix of the DRT potentials bases on users typology and travel reasons [TRB, 2010]

The report suggests to local transport agencies some key steps to be followed before the implementation of a new flexible public transportation service. This procedure is composed by the follwoing actions:

- Analyze existing conditions;
- Obtain input from policymakers and the community;
- Plan and schedule flexible public transportation services;
- Determine capital needs, vehicles and technology;
- Understand the costs;
- Market the new service.

Only by following these steps it is possible to implement effective and reliable DRT services in low density areas.

3.2.4. Interreg Europe, "A Policy Brief from the Policy Learning Platform on Low-carbon economy"

The Interreg Europe report summarizes the main benefits of DRT systems for European regions and shows the actions undertaken at the European level in order to ease the implementation of these transport systems.

At a regional level, **there is not a unique DRT solution** that can be tailored to meet local needs. Starting from the initial application of DRT systems, namely the opportunities for people with limited mobility or those who are socially excluded to improve accessibility and life quality, the report highlights parameters that have to be adapted in order to find a DRT system solution that best fits the characteristic of a region and/or a city.

Parameters	
How does the user book their journey?	• Telephone call • Internet (website/app)
When is booking required?	• On the day/when required • In advance • Repeating booking
How frequently should the service run?	• Only when requested • Set number of journeys per day
How flexible is the route?	• Fully set, but only runs when there is demand • Deviations possible within a set corridor • Fully flexible
Where are users picked-up or dropped-off?	• Many-to-many • One-to-many / many-to-one • One-to-one
What area is the service covering?	• Rural • Suburbs • Mixed
Who are the main users?	• All public • Disadvantaged groups • Private groups
What size of vehicle should be used?	• Car • Minibus • Bus
What is the price for the user?	• Free • Paid
How is the DRT system financed?	• Subsidised • Partly-subsidised • Commercial
What competition is there with other transport solutions?	• High • Low

Table 2: DRT main development parameters [Interreg Europe, 2018]

In addition to the social benefits described above, the report highlights "environmental benefits through reducing the number of private vehicles on the road, and by supporting multimodal transport in cities, acting as the first/last mile solutions for linking communities with broader transport networks".

In the final recommendations it is also stressed the importance of the role of public authorities. "By their nature, the potential user groups are often dispersed and fragmented and thus difficult to identify for private operators. Regions should take stock of the performance of their transport systems and consider where public transport is used, and at what cost, to see where it may be cheaper and more environmentally friendly to use a DRT system". Furthermore, "the leading partners of DRT initiatives will need to bring all stakeholders together and manage the process of co-operation. 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".

3.2.5. Community Transport Association, "The Future of Demand Responsive Transport"

Considering the growing of Demand Responsive Transport solutions and the travel behaviour changing that is occurring, the Community Transport Association and the Institution of Mechanical Engineers have created "*a new partnership project to consider what was driving the interest and growth in demand responsive transport and what that meant for access and inclusion in the UK's passenger transport network*".

In order to meet the project objectives two types of actors have been involved: working groups, where representatives from community and commercial transport, consultants and academics were involved, and a range of potential stakeholder, including charities working with people with disabilities, Mobility as a Service experts, vehicle manufacturers, local authorities and transport app developers.

According to the report findings, the demand responsive transport could represent a pillar of a **more integrated local passenger transport network** that can meet more users' needs. In addition to reducing the use of private vehicle, DRT system could have a relevant role also in the "first mile-last mile" journey phase. For example, "*someone may be encouraged to use a train if a demand responsive solution can enable certainty and confidence for them getting to and from the station*". DRT service has to be **accessible and inclusive**. "*By putting the needs of those who face the most disadvantage central to the design of any new service or infrastructure from the outset, we can create many benefits and save time and money through not having to remedy so many problems that arise down the line*".

3.2.6. EPSON, "TRACC Transport Accessibility at Regional/Local Scale and Patterns in Europe"

The aim of the EPSON Project TRACC is to analyse the accessibility at different scales (global, European and regional) through a series of indicators appropriately calibrated. Accessibility *is defined as "the main product of a transport system. It determines the locational advantage of an area (i.e. in ESPON a region, a city or a corridor) relative to all areas (including itself)",* whereas indicators *"permits to measure the benefits households and firms in an area enjoy from the existence and use of the transport infrastructure relevant for their area".*

The growth of accessibility into peripheral/low density areas is a primary aim of DRT system, the main policy and research implications of the EPSON project potentially related to DRT system are therefore summarised below.

"Local and regional peripheries do not match EU peripheries*. No significant differences can be observed for performance in regional and local accessibility between regions located at the European Periphery and regions located at the European Core. Regional case studies have revealed relatively homogeneous patterns within regions. Regional and local accessibility in case studies is much more dependent on the local conditions of population and economic activity than to their overall European localisation.*

The Urban-Rural divide still persists at regional level*. Accessibilities for capitals regions or for main agglomerations differ significantly from those for rural, peripheral and landlocked regions, as well as for intermediate areas. Minimum services are available with reasonable cost in most areas of Europe, even*

remote rural or sparsely populated, but the possibility to choose amongst different alternatives is concentrated in highly populated urban areas.

***Inner peripheries in all regions**. Inner peripheries with low accessibility values are not only located in the far North or in the Alpine space, as expected, but also in most European countries. The extent of these inner peripheries is substantially larger for rail than for car.*

***Public transport accessibility below car accessibility**. Accessibility patterns for cars and public transport differ to a large degree, both with respect to the level and also with the spatial patterns. Accessibility levels by car are in general higher at regional and local level than those for public transport, but public transport is still able to provide high levels of accessibility within metropolitan areas and in city centres. [...] Most of the case studies and most of the indicators applied demonstrate that accessibility by car is superior to accessibility by public transport. Only in a few metropolitan areas public transport is providing comparable accessibility to the population".*

3.2.7. LAST MILE, "State-of-the-Art of regional public transport systems and particularly flexible system"

This report analyses the state-of-the-art of existing Flexible Transport System (FTS) in six rural and touristic regions of Europe in order to identify the best practices on flexible transport solution in the tourism sector. The regions identified as case studies are Varna District (Bulgaria), Upper Sûre + Our Nature Parks (Luxemburg), East Tyrol (Austria), Košice Region (Slovakia), Westpomeranian Voivodeship (with main focus on Szczecin Metropolitan Area - Poland) and Catalonia (Spain). The key feature of these regions is that they are touristic areas with low population density, where an easy accessibility cannot be offered by a conventional public transport service. In this sense, "*FTS is considered a solution to cover the last mile of tourists' travel, but also to provide an alternative mode of transport for residents*"

Benefits arising from a flexible transport system can be identified in positive environmental effect, improved accessibility for residents (providing an alternative to car use) and regional economy, in which tourism can play a relevant role.

Regarding the design of a flexible transport service, the report emphasizes the importance of the selection of the right business model, which has to reflect the local framework condition. In this sense, "*there is the possibility to implement stand alone operator; cooperation framework where various operators or authorities work together sharing resources, travel dispatch centre, staff and systems; or tendered services operated under subsidy from authority*".

Starting from the SWOT analysis, that is shown later in this paragraph, it can be stated that "*the regional profiles analysed show relatively good accessibility condition to the local public transport system around the cities and central settlements within areas studied, but some hotspots in rural areas present inadequate connections to the public transport network*"

From an administrative point of view, "*local governments present positive willingness to develop sustainable flexible mobility measures to cover the last mile in rural areas. Although expectations and needs of individual municipalities influence the degree of cooperation between them. In addition, poor cooperation and communications between relevant regional stakeholders make difficult to achieve sustainable mobility, especially addressed to tourism*".

In conclusion, one of the common weakest point in the analysed case study is the presence of *"poor legal framework for Flexible Transport System. It means huge difficulties to implement FTS for the municipalities, which do not have enough administrative and economic capacity to develop it*". However, implementation of flexible transport services for tourists could increase the tourist potentialities of the regions.

Strengths	Weakness
- In general, relatively **good accessibility** conditions to the local public transport system in cities and central settlements. - Positive perception and willingness of the local governments in developing sustainable mobility measures to cover "last mile" travels. - Good experiences of DRT managing authorities.	- Geographical context making it difficult to implement public transportation systems (low population, dispersion of settlements, services concentrated in main cities). - Poor cooperation and communication between relevant regional stakeholders for achieving sustainable tourism mobility. - Poor legal framework for Flexible Transport System. - Lack of experience in implementation and operation of such services by the transport organizer and by the passengers. - Different expectations and needs of individual municipalities can affect willingness to cooperate. - Dominating car-based mobility of the tourists.
Opportunities	**Threats**
- Technological advances and increasingly higher proportion of people using mobile devices makes it easier to implement modern and easy-to-use systems and dispatch systems. - Some promising concepts being implemented successfully (e.g. E-mobility and e-carsharing in East Tyrol). - Implementation of flexible transport services for tourists could improve the image of the offer and increase tourist attraction of regions. - There are EU programs promoting sustainable transport solutions. - Increased considerations about sustainable mobility guidelines. - The complementarity between the peak hours when commuters need transport services and the transport needs of tourists.	- Lack of competitiveness of public transport in relation to car rentals. - The seasonal nature of tourism makes the transport system unprofitable during some months. - Spatially differentiated population development within regions. Shrinking rural regions.

Table 3: DRT SWOT analysis [Interreg Europe Last Mile project, 2017]

3.2.8. TRB, "Why do demand responsive transport systems fail?"

The report summarises several DRT case studies analysing "*where a DRT service failed to develop beyond the initial stages, or it was fundamentally compromised*". Then an interesting marketing analysis of failure factors is drawn up, where the failure reasons are classified into different categories (internal and external categories).

The report highlights that in order to launch an effective DRT service, it is of crucial importance to have a clear overview of the market where the DRT service will be introduced. Furthermore, the DRT service has to be planned considering the avaialbility of economic resources in the medium and long terms, indeed "*there is a very dangerous temptation to offer too flexible a service and to include costly technological systems, when they may not be needed*".

According to marketing theory, all financial schemes are influenced by three different environments. In the table below the most common failure reasons raised from the analysed case studies are gathered for the marketing environment. The table is therefore an useful tool to understand which difficulties can be found in the relationship with each actor belonging to the marketing environment.

Environment	*Stakeholder/Forces*	*Common failure reason*
Internal	Employment, equipment, finance, functional responsibilities	• Technical and technological problems • Lack of planning • Poor marketing • Disenchantment of bus operator • Too ambitious a service planned • Inflexible operator • Fares too low • Insufficient stakeholders commitment • Area too large to serve • Too complex market • Market niche too small and irregular • Reliability problems • Uncertain rules of use • Lack of concentrated demand
Micro environment	• Customers • Competitors • Intermediaries • Suppliers	• Competition restriction • Inter-authority rivalry • insufficient resources from Government • Lack of coordination between councils • Withdrawal of stakeholder support • Confusion over licensing regime • Inflexible funding arrangements
Macro environment	Economics, technological, social, cultural, political, legal forces	• Dispersed low density land use • Dispersed low density patchy land use development and cul-de-sacs • Cultural aversion to sharing taxis/services

Table 4: DRT main failure reasons [Interreg Europe Last Mile project, 2017]

This table shows as "*DRT also requires more marketing effort and skills than is traditional in conventional bus operations, but above all, it requires new skills in working in partnership. It is the latter area where the root of DRT failure is often to be found*".

3.3. Summary of the DRT litterature analysis. Reports interesting factors

In the following paragraph a brief summary of the main interesting factors of each reportsin relation to the DRT topic are summarized.

Document title	Why read these reports?
OECD (2015), International Experiences on Public Transport Provision in Rural Areas	• Factors of success of DRT case studies • Design of a sucessfull urban DRT service • Economic sustainability of a DRT service • Role of Big data in promoting effective DRT services
ENEA (2004), Demand Responsive Transport Services: Towards the Flexible Mobility Agency	• DRT technical architecture • Preliminary analysis for the launch of a new DRT service • Technical aspects to be considered for the implementation of an effective DRT platform
TRB (2010), A Guide for Planning and Operating Flexible Public Transportation Services	• Criteria for the definition of the DRT flexibility levels • Urban planning parameters for the selection of the areas where a DRT service can be succesfully implemented
Interreg Europe (2018), A Policy Brief from the Policy Learning Platform on Low-carbon economy	• DRT Pre-feasibility study. Main development parameters • Decision support guidelines for DRT development
CTA (2017), The Future of Demand Responsive Transport	• Key actors to be involved for the development of a sucesfull DRT service
ESPON (2015), TRACC. Transport Accessibility at Regional/Local Scale and Patterns in Europe	• How to identify peripheral areas (both urban and rural)
LAST MILE (2017), State-of-the-Art of regional public transport systems and particularly flexible systems	• SWOT analysis models for the assessment of DRT services
TRB (2007), Why do demand responsive transport systems fail?	• Analysis of the DRT services failure factors

Table 5: Summary of the DRT litterature analysis. Reports interesting factors

4. EU projects on DRT services in rural and peripheral areas

This chapter is dedicated to the analysis of the main EU projects with a specific focus on DRT (projects on public transport and/or sustainable mobility were not considered).

4.1. EU projects on DRT in rural and peripheral areas

The first step of the analysis of EU projects strictly related to the development of DRT solutions was the selection of such projects. Several EU projects databases were consulted using "Demand Responsive Transport" and "Flexible Transport Systems" as keywords. The preliminary list of the EU projects was integrated thanks to the SMACKER partners' experiences. The list of the analysed project is available in the Tablebelow.

EU Programme	Project acronym & link	Main objective
Interreg Europe	Regio Mob	Tele-Bus on-demand transport
Interreg Europe	Last Mile	Sustainable mobility for the last mile in tourism regions
Interreg Med	LiMIT4WeDA	Light Mobility and Information Technology for Weak Demand Areas
Interreg Central Europe	Rumobil	Support the establishment of multilevel governance that is transparent, accountable and responsive to the need of the population
Interreg Central Europe	Peripheral Access	Accessibility of peripheral and rural areas by promoting innovative multi modal solution using new technologies and better cooperation schemes
H2020	Inclusion	Understand, assess and evaluate the accessibility and inclusiveness of transport solutions in European prioritised areas
H2020	Avenue	Design and carry out full-scale demonstrations of urban transport automation by deploying fleets of autonomous minibuses in low to medium demand areas of 4 European demonstrator cities
EU Commission	Smarta	Smart Rural Urban Areas
Interreg Baltic Sea	Mamba	Maximising mobility and accessibility of services in rural areas of the Baltic Sea Region
South East Europe	Access2Montains	Achieve durable, environmentally friendly tourism, as well as to ensure accessibility and connection to, between and in sensitive regions of the Alps and the Carpathians.
FP5-IST	Fams	Implement and trial the concept of a Flexible Agency for collective, demand-responsive mobility services

EU Programme	Project acronym & link	Main objective
Interreg IV C	Move on Green	Improve the design and effectiveness of regional policies on sustainable transport in rural and mountain areas

Table 6: Summary of the main EU projects related to DRT (Source: ITL elaboration)

In the selection of relevant EU projects on DRT, old projects (more than 10 years since their conclusion) were not considered.

4.1.1. Analysis of the EU projects on DRT

In this paragraph, a desk analysis for each relevant identified DRT EU project is conducted. For each EU project focussing on DRT solutions, a brief form was completed in order to collect all the relevant information in relation to the goals of the SMACKER project.

Project Title	Regio-Mob
EU Financing programme	Interreg Europe
Main topics	DRT policy and institutional aspects
Specific project objective	To contribute to the consolidation of sustainable mobility in partners' regions by improving their policies performance as a result of a shared learning process.
Main institutions involved	ANCI Lazio (LP); Region of Western Macedonia; Regional development agency South-West Oltenia (Romania); Institute of traffic and transport Ljubljana; Niepolomice Municipality (Poland); South-East Scotland Transport Partnership (SESTRAN)
Project Timescale (start / end date)	1 April 2016 - 31 March 2020
Locations (Country)	Italy, Greece, Romania, Slovenia, Poland, Scotland
Relevant output available online	The Library section (https://www.interregeurope.eu/lastmile/library/) contains project's Newsletters, brochures, workshops material and publication about good practices on sustainable mobility. Detailed information on the project's good practices can be found in the dedicated section (https://www.interregeurope.eu/regio-mob/good-practices/).

Table 7: Regio-Mob project description

Project Title	Last Mile
EU Financing programme	Interreg Europe
Main topics	DRT best practice testing and development
Specific project objective	To find innovative and flexible solutions for sustainable regional mobility systems to ensure that visitors travel the 'last mile' of their travel in a sustainable manner, and to provide alternatives to cars for residents and their daily trips as well.
Main institutions involved	Environmental Agency Austria (LP); Regional Management East Tyrol; Agency for the support of regional development Kosice (Slovakia); Club "Sustainable Development of Civil Society" (Bulgaria); General Directorate for Transports and Mobility - Ministry of Territory and Sustainability - Government of Catalonia; Nature Park Upper Sûre (Luxembourg); Westpomeranian Voivodeship – Regional Office for Spatial Planning of Westpomeranian Voivodeship (Poland)
Project Timescale (start / end date)	1 April 2016 - 30 September 2020
Locations (Country)	Austria, Slovakia, Bulgaria, Luxembourg, Poland, Spain
Relevant output available online	The Library section (https://www.interregeurope.eu/lastmile/library/) contains project's Newsletters, action plans, press releases, brochure and factsheets. Detailed information on the project's good practices can be found in the dedicated section (https://www.interregeurope.eu/lastmile/good-practices/).

Table 8: Last Mile project description

Project Title	LiMIT4WeDA
EU Financing programme	Intereg MED Programme
Main topics	DRT solutions in low density areas
Specific project objective	The project LiMIT4WeDA (Light Mobility and Information Technologies FOR Weak Demand Areas) copes with the mobility problems in areas affected by weak demand of transport, characterized by inefficient public transport systems and widespread use of private car. Aim of the project is to enhance, support, integrate local public transport making it more flexible and less expensive through: creation of networks, experimentation of light mobility, infomobility and intermodal transport for people, use of new technologies and sensitization of decision makers at different levels.
Main institutions involved	Lazio Region, Murcia Region DG Transports and Ports, Province of Pavia, Malta Intelligent Energy Management Agency, Innovation Busines Center Epirus, European Association of Elected representatives of Mountain Regions, The Troodos Regional Tourism Board, Cyprus Center for European and International Affairs, Municipality of Perugia
Project Timescale (start / end date)	2007-2013
Locations (Country)	Spain, Italy, Malta, Cyprus, Grece, France
Relevant output available online	Work Packages technical documents (https://interreg-med.eu/projects-results/deliverables-database-2007-2013/)

Table 9. LiMIT4WeDA project description

Project Title	Rumobil
EU Financing programme	Interreg Central Europe
Main topics	DRT best practice testing and development
Specific project objective	RUMOBIL will support transnational cooperation between public authorities and their transport entities and will do it by providing them with a platform to exchange knowledge, to generate learning through launching pilot applications of state-of-the art tools and solutions, and to revise their transport policies to better suit changing mobility needs. Main outputs of RUMOBIL will therefore be pilot actions.
Main institutions involved	Ministry for Regional Development and Transport of Saxony-Anhalt (LP - Germany); Mazowieckie Voivodeship (Poland); Pro-rail alliance (Croatia); HŽ Passenger Transport Ltd (Croatia); Vysočina Region (Czech Republic); JIKORD s.r.o. (Czech Republic); The Institute of Technology and Business in České Budějovice (Czech Republic); T Bridge S.p.A (Italy); Agency for mobility and local public transport Modena S.p.A. (Italy); University of Žilina (Slovakia); Žilina self-governing region (Slovakia); Self-government of Szabolcs-Szatmár-Bereg County (Hungary); Municipality of Nagykálló (Hungary)
Project Timescale (start / end date)	1 June 2016 - 31 May 2019
Locations (Country)	Germany, Poland, Croatia, Czech Republic, Italy, Slovakia, Hungary
Relevant output available online	Documents on project's strategy, Scientific papers, investment factsheets, pilot final reports (https://www.interreg-central.eu/Content.Node/rumobil.html).

Table 10: Rumobil project description

Project Title	Peripheral Access
EU Financing programme	Interreg Central Europe
Main topics	DRT best practices testing and development
Specific project objective	Peripheral Access analyses the situation of rural, remotely located or border regions, scarcely populated and facing the challenge of poor public transport connections, and implements concrete action plans and innovative pilot actions in three fields of action that represent key success factors for sustainable mobility: multimodality and integrated transport; enhanced use of intelligent communication technology and intelligent technology system; and better cooperation through transport associations and cross-border marketing.
Main institutions involved	Regional Management Metropolitan Area of Styria Ltd; KORDIS JMK (Czech Republic); Institute for Transport Sciences Non Profit Ltd (Hungary); Region of Lubin; Regional Development Agency of the Ljubljana Urban Region; Authority for local public transport Vogtland; German Association for Housing, Urban Development and Spatial Affairs; Trieste Trasporti P.L.C.; Venice International University
Project Timescale (start / end date)	1 June 2017 - 31 May 2020
Locations (Country)	Austria, Czech Republic, Hungary, Poland, Slovenia, Germany, Italy
Relevant output available online	Work Packages technical documents (https://www.interreg-central.eu/Content.Node/Peripheral-Access.html).

Table 11: Pheriperal Access project description

Project Title	Inclusion
EU Financing programme	Horizon 2020
Main topics	DRT best practice testing and development
Specific project objective	The main objective of INCLUSION project is to understand, assess and evaluate the accessibility and inclusiveness of transport solutions in European prioritised areas. The project is identifying gaps and needs in order to propose and experiment with a range of innovative and transferable solutions. Accessible and inclusive public transport for all and especially for vulnerable categories is key to ensure equity of transport and social inclusion.
Main institutions involved	BKK (Hungary); BusItalia Sita Nord SRL (BUSIT); BusUp (Spain); European Metropolitan Transport Authorities (EMTA); HITRANS (Scotland); MemEx (Italy); MOSAIC FACTOR SL; Polis; Rupprecht Consult (Germany); Softeco (Italy); Taxistop (Belgium); Verkehrsverbund Rhein-Sieg GmbH (VRS) (Germany); University of Aberdeen
Project Timescale (start / end date)	1 October 2017 - 30 September 2020
Locations (Country)	Hungary, Italy, Spain, Scotland, Germany, Belgium
Relevant output available online	Information on Pilot Labs (http://www.h2020-inclusion.eu/inclusion-pilot-labs/), newsletters and communication material.

Table 12: Inclusion project description

Project Title	Avenue
EU Financing programme	Horizon 2020
Main topics	DRT best practice testing and development
Specific project objective	AVENUE aims to design and carry out full-scale demonstrations of urban transport automation by deploying, for the first time worldwide, fleets of autonomous minibuses in low to medium demand areas of 4 European demonstrator cities (Geneva, Lyon, Copenhagen and Luxembourg) and later on of 3 replicator cities.
Main institutions involved	University of Geneva; NAVYA (France); Centrale Supélec; Hochschule Pforzheim (Germany); TPG (Transports Publics Genevois); Bestmile Mobility Services Platform; Siemens AG; CEESAR; Republic and Canton of Geneva (EtatGe); VIRTUAL VEHICLE Research Center (VIF); AVL LIST GmbH; MobileThinking SARL (MT); Centre for Research and Technology Hellas (CERTH); Autonomous Mobility; Sales-Lentz (Luxembourg); KEOLIS LYON
Project Timescale (start / end date)	1 May 2018 - 30 April 2022
Locations (Country)	Switzerland, France, Luxembourg, Denmark

Relevant output available online	• Detailed information on:
	  ○ demonstrator sites (https://h2020-avenue.eu/publications/)
	  ○ public deliverables (analyses, reports and handbooks, etc.) (https://h2020-avenue.eu/public-delivrables/).
	• Press kit (brochures, posters and press releases) https://h2020-avenue.eu/press-kit/

Table 13: Avenue project description

Project Title	Smarta
EU Financing programme	EU Commission
Main topics	Policy and institutional aspects/technical aspects
Specific project objective	Understand the current relevance and future potential of on-demand and shared mobility services integrated with public transport in the European rural areas.
Main institutions involved	MemEx (Italy); University of Aberdeen; Transport and Mobility Leuven; European Integrated Projects EIP; Vectos (UK)
Project Timescale (start / end date)	1 May 2018 - 30 April 2020
Locations (Country)	Italy, Belgium, UK
Relevant output available online	• SMARTA evaluation framework (http://ruralsharedmobility.eu/wp-content/uploads/2019/02/SMARTA-Evaluation-Framework.pdf) • Leaflet (http://ruralsharedmobility.eu/wp-content/uploads/2018/09/SMARTA-leaflet-2.pdf) • Good practice study cases (https://ruralsharedmobility.eu/index.php/good-practice/)

Table 14: Smarta project description

Project Title	Mamba
EU Financing programme	Interreg Baltic Sea
Main topics	DRT best practices testing and development
Specific project objective	The MAMBA project aims to meet the challenge of keeping up public transport and other services in many rural areas of the Baltic Sea by promoting sustainable "people-to-service" and "service-to-people" mobility solutions in rural areas. In practice, MAMBA partners will collaborate to improve the integration of existing mobility structures with innovative mobility solutions like citizen buses, mobility as a service (MaaS) and ride sharing applications.
Main institutions involved	Diaconie of Schleswig Holstein; Nordregio; Vidzeme University of Applied Science; County of Ploen; County of Cuxhaven; Regional Council of South Ostrobothnia; Seinajoki University of Applied Science; Regional Council of North Karelia; Vejle Municipality; Municipality of Trelleborg; Bielsko District; Bielsko-Biara Regional Development Agency; Institute for Climate Protection, Energy and Mobility; Road Transport Administration
Project Timescale (start / end date)	1 October 2017 - 30 September 2020
Locations (Country)	Germany, Sweden, Latvia, Finland, Denmark, Poland
Relevant output available online	Good practice cases (https://www.mambaproject.eu/products/)

Table 15: Mamba project description

Project Title	Access2Mountain
EU Financing programme	South East Europe
Main topics	Policy and institutional aspects/technical aspects/best practice testing and development
Specific project objective	Access2Mountain aims at developing appropriate conditions to increase the accessibility of mountain regions in the Alps and the Carpathians by sustainable transport and support the development of a high potential for sustainable tourism. It aims at setting up pilot projects to access tourist areas and to ensure sustainable local mobility at destinations.
Main institutions involved	Environment Agency Austria; Federal Ministry for Transport, Innovation and Technology (Austria); National Park Gesäuse (Austria); Mostviertel Tourism Ltd. (Austria); Miskolc Holding, Plc (Hungary); University of Camerino; European Academy Bolzano - Institute for Regional Development & Location Management; County Center for Tourism Information MARAMURESINFOTOURISM (Romania); Agency for the Support of Regional Development Kosice; Rzeszow Regional Development Agency; Timok Club; Carpathian Foundation Ukraine
Project Timescale (start / end date)	1 May 2011 - 30 April 2014
Locations (Country)	Austria, Hungary, Italy, Romania, Slovakia, Poland, Serbian Republic, Ukraine
Relevant output available online	• Final project's brochure and leaflet (http://www.access2mountain.eu/en/downloads/default.html) • Newsletters (http://www.access2mountain.eu/en/downloads/Newsletter.html) • Final studies of all WPs (http://www.access2mountain.eu/en/downloads/studies/default.html).

Table 16: Access2Montain project description

Project Title	FAMS (Flexible agency for collective demand responsive mobility services)
EU Financing programme	FP5-IST
Main topics	DRT policy and institutional aspects/technical aspects
Specific project objective	FAMS objective was to scale up technology, service and business models currently adopted in Demand Responsive Transport and support the evolution from single DRT applications towards the concept of a Flexible Agency for Collective Demand Responsive Mobility Services.
Main institutions involved	ATAF SpA; Angus Transport Forum; European Transport and Telematic Systems limited; MEMEX srl; Mobisoft OY; S.I.T.A. SpA; Softeco Sismat SpA
Project Timescale (start / end date)	1 March 2002 - 29 February 2004
Locations (Country)	Italy, UK, Ireland, Finland
Relevant output available online	• Final Brochures (http://www.ataf.net/System/5371/Newsletter_FAMS_1.pdf) • Final report (https://trimis.ec.europa.eu/project/flexible-agency-collective-demand-responsive-mobility-services#tab-docs)

Table 17: FAMS project description

Project Title	Move on Green
EU Financing programme	Interreg IVC
Main topics	Policy and institutional aspects/best practice testing and development
Specific project objective	Move on Green will improve the design and effectiveness of regional policies on sustainable transport in rural and mountain areas. Objectives of the project are: • Reduce emissions and waste and minimize the impact on both the environment and local landscapes. • Allow the basic needs of both individuals and society to be met safely and in a manner consistent with human and ecosystem health. • Support competitive economy options as well as balanced development in rural areas. • Offer a number of transport alternatives which are affordable and operate efficiently.
Main institutions involved	Province of Teruel; SODEBUR – Society for the Development of the Province of Burgos; Thessaly Region; Epirus Region; Shetlands Islands Council; Euromontana, European association for mountain areas; Central Transdanubian Regional Innovation Agency – KDRIU; Regional Management of Burgenland; BSC Business Support Centre Ltd. Kranj; West Pannon Regional and Economic Development Supplier Public Nonprofit Ltd; Vidzeme Planning Region; Podkarpackie Region; Ministry for Infrastructure and Agriculture of Brandenburg
Project Timescale (start / end date)	2012 - 2014
Locations (Country)	Spain, Greece, UK, Belgium, Hungary, Austria, Slovenia, Latvia, Poland, Germany
Relevant output available online	• Good practices details (https://www.euromontana.org/en/project/move-on-green-2/mog-good-practices/) • Guidelines, Newsletters and press releases (https://www.euromontana.org/en/project/move-on-green-2/mog-press-room-documents/)

Table 18: Move on Green project description

4.2. Conclusion on EU projects focussing on DRT

The projects analysed show that there is a large experience at EU level in defining, planning and implementing DRT services. As an evidence from the synthetic analysis conducted above, all the different EU countries are involved in these projects starting from the early '2000. Many different projects on DRT are developed mainly focussing on the development and assessment of DRT pilots in different local contexts. The developed pilots are mainly related to the regional territorial scale, even if the pilots are mainly developed in urban areas. The involved partners are mainly public authorities but in some projects also private and public-private transport companies are directly involved. The specific DRT case studies developed in these EU projects are analysed more in depth in the following chapter.

5. Best and bad practices: evidences from EU DRT pilots

In this paragraph, based on the analysed EU projects and thematic literature, a brief synthesis of the main DRT pilots developed at the EU level is conducted. A focus on "bad practices" has also been developed, although it is not easy to identify cases where the failure aspects are carefully analyzed and described.

5.1. Best practices on DRT in Europe: collection from the main EU projects

The literature on these aspects is once again quite wide. In this report, a selection of some relevant DRT best practices from EU projects is presented. These best practices are selected based on the following criteria:

- **Transferability potential** to others Central Europe regions and cities;
- Evidences on the **success factors**;
- **Relevant impacts** on social, environmental and economic dimensions.

Moreover, the DRT best practices are presented in relation to the single EU project analysed, the cases are described in a synthetic way providing only the most relevant information, whereas more information are available in the bibliography (chapter **Errore. L'origine riferimento non è stata trovata.**).

In the end of this paragraph, a table summarizes all the analysed projects.

5.1.1. Interreg Regio-Mob project

The REGIO-MOB analyses the following DRT best practices:

- **Demand responsive transport service for persons with disabilities, Ljubljana Region**. Demand-Responsive Transport for persons with disabilities is a service firstly being implemented in 2008 on the city bus lines and later on also offered on regional public transport connections in the Ljubljana urban region. Supported demand-responsive transport was implemented in the context of transport services, provided with adapted low-floor vehicles. Together with public transport identification Cards for passengers with disabilities, the service provides more carefree and safer mobility to people with disabilities on the Ljubljana buses. Additionally,"The Kavalir" network in Ljubljana provides small electric vehicles for people with limited mobility and elderly people to move around the pedestrian city centre. The free service intends to make shopping and social activities easier for those who may have been adversely affected by limited vehicle access to the city centre. The vehicles can be booked via phone and the driver will stops where requested by the users. Results indicated that there were about 3-4 persons with disability including people on wheelchairs, mentally handicapped persons, people with head injuries and the sensory impaired, calling every day and have a request on the service. Parents and children with mental disabilities appreciated this special card and started using it a lot.
- **Tele-bus, Krakow**. The service is available in three districts with low-density residential and industrial areas where a conventional public transport service is not foreseen. Dedicated to DRT only, the daily service operation is managed by the transport dispatch center (TDC) which belongs to the Tele-Bus operator – Miejskie Przedsiebiorstwo Komunikacyjne SA MPK (Public Transport Operator in Krakow). Customers book the service via TDC using a special free phone number. The online booking must be made at least 30 minutes before the planned start of the trip. The Tele-Bus visualization concept is based on a special corporate identification system applicable to all elements of the service, i.e. vehicles, bus stops, and customer information material. Corporate blue and green colors of the Tele-Bus distinguish the flexible service from conventional PT.

- **Bus real time passenger information, Edinburgh**. Real Time Passenger Information addresses the need to provide public transport users with the real time arrival of the bus. This provides the user with the confidence to know that their bus will actually turn up and when it will turn up. This information is provided via a website and mobile app (apple and android) and more recently, is displayed via digital screens in public and commercial premises, with the aim of encouraging increased bus patronage and fewer private car journeys in the metropolitan area.

5.1.2. Interreg MED Limit4WeDA project

The Interreg MED project Limit4WeDA analyses the following DRT best practice:

- **Demand responsive service in week demand areas, Perugia**. The pilot action referred to a new public transport system through which a weak-demand service became a performing and sustainable transport service, which improved the quality of life, particularly, for disadvantaged people. No fixed timetable nor fixed paths are needed for this new public transport system. Users book the service through a call center by freely choosing the place and time of departure/arrival, thanks to software managed by the operator of the call center sending messages to a terminal onboard the bus. Two kinds of booking are possible: an “early” booking to book the bus in advance and a “real time” booking to book the next bus arriving. Beneficiaries are disadvantaged people living in rural and urban areas with low population density, economically needy people and people with disabilities and public administrations at local/regional level. Pilot action operated by 4 low-floor minibuses. The cost per year was approximately 400'000€. The cost advantage compared to the replaced traditional bus service was approximately 40'000 € per year. Still, the fares are kept on the level of normal bus line services.

5.1.3. Interreg Europe LAST MILE project

Interreg EU LAST MILE project developed and analyse the following DRT best practices:

- **Train with stops on demand from Lleida to la Pobla, Regional Government of Cataluña.** The railway line Lleida - La Pobla de Segur has a long history. It currently connects some municipalities located in the High Pyrenees, between Lleida and La Pobla de Segur. The train with stops on demand improve the flexibility and efficiency of the service, to access to the rural areas with tourist interest and to complete the last mile using an alternative transport mode different to the private car. There are very important campaigns to promote the service, for example 'Lo tren de tots'. The main characteristics are:
    - Fixed route and regular timetable with stops on demand between fixed stops;
    - Connection with the fast train to Barcelona and Madrid;
    - Timetable based on actual transport demand, with no services at times of least demand or when routes are covered by buses;
    - Coordination with the other forms of public transport (connection between train and busses);
    - Constant quality control measured on a daily basis.

  The rail staff is trained to perform multiple functions, which optimizes the work and minimizes the workforce. Special adjustments of the couches and platforms for disabled people and well-fitting bikers needs. The Government of Catalonia has bought 3 new trains for a total of 15M€ and has also invested 1,5M€ to improve the train stations and accessibility.
- **Door-to-door night bus on request, Sales-Lentz, Luxemburg**. The nightrider is a demand-responsive service operated by a local bus operator and covering the whole country of Luxembourg

with around 40'000 passengers a year. The service brings people to parties, concerts, restaurants or other activities at weekend nights and picks them up again all over the night. The nightrider is a door-to-door service and combines driving requests into one trip if possible. The system was created with support from the Ministry of transport. Beneficiaries of the project are foremost younger residents, particularly of areas which are not or insufficiently connected to public transport. Due to the financing of some municipalities, night cards are affordable and the service offers a fast and convenient alternative to car use. Some municipalities are supporting their inhabitants by subsidizing the so-called 'night cards' a sort of membership, which allows the user to go as often as they want in a year by Night Rider by paying a reduced annual fee. The municipalities are paying the remaining price for every trip the user has ordered. Holding a 'night-card' is no precondition to use the service, but an economic advantage. Therefore, tourists can use the service as well. Without nightcard, the user fare is calculated by kilometer (around 1,3 €/ km). Until 2009, the service was financially supported by the Ministry of Transport. Today the municipalities pay a prorated contribution to ensure the cost recovery of the service, when offering the 'nightcard' to inhabitants. Users without night card pay the full price.

5.1.4. Horizon 2020 Inclusion project

The Horizon2020 project INCLUSION (2017-2020) is working on developing the following DRT best practices. As the project is still ongoing, the best practices analysed are still under development/implementation.

- **Participation processes for the definition of a new DRT service in rural areas, Florence**. In order to improve the inclusion and integration of the vulnerable end-users (i.e. migrants and low income), Busitalia developed a collaborative co-designed path to identify and solve together with the users some critical issues of access and use of public transport concerning the bus lines 30 and 35. This was done through a specific participatory process. With the involvement of local government, voluntary and users' associations and cooperatives, Busitalia organised a specific focus groups for listening to the specific needs of the target users and developing new proposals for improving the users information. As regards the S. Piero a Sieve Municipality and the surrounding rural areas, the pilot installed user information panels in order to improve the quality of the user information and the affordability of the service and consequently reduce the dependency from the private car. In parallel, Busitalia will be enhancing the existing **APP Ataf 2.0**: new functionalities for user's feedback and service assessment was introduced, tested and validated on the two bus lines and on the lines connecting the S. Piero a Sieve area with the main public transport hub. Busitalia coordinated all local activities for the pilot setup and operation. ATAF, the operator managing the public transport system in the entire Florence Metropolitan area and a third party of Busitalia, was in charge of the implementation of Florence pilot lab activities planned in Inclusion project. These set contributed on one hand to improve the accessibility of the rural area of San Piero, on the other on identifying strategies and solutions for achieving the social inclusion of the end-users and for improving the mobility experience the vulnerable users.
- **DRT services supporting public events organizations, Barcelona**. The focus of Barcelona Pilot Lab will be on lowering territorial accessibility barriers in the conurbation in the occasion of public events, due to poor or inflexible transport offer. Target users groups will be vulnerable users' categories such as young people, teen-agers and people with no access to own mobility solutions, as well as the general public suffering from transport accessibility obstacles for the above mentioned reasons. This Pilot Lab aims to identify the real transport demand of one of the targeted groups, through information mining from social networks. The goal is to identify and quantify the real bus transport demand well in advance, so as to be able to launch and offer routes that better meet their needs. **BusUp** – the Spanish Start-up company involved in the Barcelona pilot lab together with MOSAIC - aims to improve the on-demand bus service offering and increase the number of passengers served. By doing so, BusUp expects to be able to offer an alternative, more affordable and sustainable solutions to the groups of users whose current transport alternative is the car.

- **DRT services for families with young children, Rhein-Sieg Region**. The main goal is to identify the frame conditions for a new bus line or other offers like Pedelec-rental that are tailored to the needs of families with young children. The Pilot Lab will include an in-depth analysis of the implementation area, a survey to identify the needs of the target group, a survey to identify the location of potential bus stops and a schedule which is tailored to the opening hours of the kindergarten. Additionally, it may be helpful to discuss the tasks with an in-person-group. A communication plan will be elaborated; collaboration/communication with the municipalities, as well as with further potential partners like kindergartens and elementary schools, has to be established; recommendations will be published, and a test-run of the new bus line and/or a Pedelec rental offer with a limited user group will be made to receive feedback and assess its potential impact.

5.1.5. Horizon 2020 Avenue project

The Horizon 2020 project AVENUE is an ongoing project (2018-2022) and it is working on the development of the following case studies in different demonstration sites:

- **Real time DRT bus monitoring system, Lyon.** The area around the Groupama Stadium is currently being intensely developed and the different kinds of activities foreseen are expected to cause small flow of passengers all along the day. The pilot would help speed up travelers' flows and prevent congestion at the bus station Décines Grand Large. The new AV service in the area would transport people between the tram station Décines Grand Large and the Groupama Stadium, being complementary to another bus line. At the beginning of the pilot project, two shuttles will run between two stops, one at the tram station and one at the stadium. In a later use case, a third stop could be added. An on-demand shuttle service will also be tested during the project, in order to offer a better service to customers by letting them order the shuttle under specific condition (during off-peak periods for instance). By the time the AVENUE project will start, a mobile application will exist for the service. Thanks to it, the customers will be able to see the position of the shuttles on the route. An extension of the application could let them know the time of arrival at each station and let them order it during off-peak hours.
- **Autonomous shuttles, Luxembourg.** Since November 2018, the private company Sales-Lentz is running 3 autonomous shuttles on two different sites:
    - Pfaffenthal, a valley in the city of Luxembourg, where two shuttles run on a short track connecting the train and funicular station of Pfaffenthal with the panoramic lift in Pfaffenthal, that goes up to the city of Luxembourg.
    - Contern, an industrial area located around 10 km east of Luxembourg City, where one shuttle connects the train station of Contern-Sandweiler with "Campus Contern", a real estate development company.

  The pilots are still under development and no more data are available.
- **Extension of an existing DRT service, Geneva.** The company TPG started the work by directly integrating an operation of autonomous bus service in the Meyrin area. The current service is provided with a very low frequency (every half hour) and a low speed (max 25 km/h), operating however in an uncontrolled environment (in contrast with many other pilots around the world), with roads shared by other vehicles, bicycles, pedestrians, etc. In 2019, we will start the expansion of the existing service to cover a larger area, with higher bus frequency.
- **DRT autonomous mobility cloud, Copenhagen.** The overall aim of the Copenhagen test site is to test and implement the autonomous mobility cloud – and thereby to create a better connection between selected areas of Copenhagen and existing public transport solutions. The Copenhagen test site is located in an area of the city called Nordhavn. Nordhavn is an active industrial port undergoing

a transformation into Copenhagen's new international waterfront district, with residential and commercial buildings. When Nordhavn's transformation will be complete, the area will house more than 40,000 residents and 40,000 employees. As a test site for full-scale autonomous transportation solutions, Nordhavn's vision is brought to life in a way that literally moves people. The area will experience improved mobility internally and externally by integrating existing public transport solutions. By offering cloud based autonomous mobility that is more flexible and on demand than we are used to, the users in the area will experience a whole new and better way of getting from A to B, thanks to new technologies.

5.1.6. Interreg Baltic Sea Mamba project

With decreasing and ageing populations in many rural areas in the Baltic Sea Region, it is becoming increasingly difficult to keep up public transport and other services that depend on mobility, such as home care or home deliveries. This reduced accessibility of services impacts life quality of people living outside urban centres. The MAMBA project (2017-2020) aims to meet this challenge by promoting sustainable "**people-to-service**" and "**service-to-people**" mobility solutions in rural areas. In practice, MAMBA partners collaborate in improving the integration of existing mobility structures with innovative mobility solutions like citizen buses, mobility as a service (MaaS) and ride sharing applications. The pilots related to DRT solutions developed in the project are:

- **Rural ride sharing and transport-on-demand. Bielsko-Biała Regional Development Agency and Bielsko District, Poland**. The Polish pilot actions aim to increase mobility services between rural areas and cities while limiting travel by private cars to protect the environment. They also seek to enable older and single people to move around more freely, thereby limiting social exclusion. In practice, the action includes development of an innovative mobile app to increase personalization and flexibility in commuting. This will be integrated with existing transportation systems and coordinated with local ride sharing systems and a new transport-on-demand service that can be booked via a Mobility Centre. The aim is to collect passengers from their homes and transfer them to bus stops and train stations where regular public transport is available;
- **Transport-on-demand. County of Plön, Germany**. This pilot action will establish a transport-on-demand service in Plön by offering taxis to and from major bus stops. The aim is to increase the supply and use of public transport in rural areas, especially in the evenings and on weekends. The service has already been tested in other German regions, but this is the first time in the county of Plön;
- **Transport-on-demand (ToD). Vidzeme Planning Region, Latvian Road Transport Administration.** In the Vidzeme Planning Region, 57% of the population lives in rural areas, many with limited access to services. After introducing the transport-on-demand idea, two municipalities of Vidzeme region showed high interest to become pilot territories. Both of them are located in the border area with low population density and with poor public transport service – either buses are running very rarely or there are no bus traffic at all. In order to find the most suitable transport-on-demand model, Vidzeme planning region will pilot two different models in area of Mazsalaca and Alūksne counties.
- **Bottom up DRT services, Mazsalaca county.** In Mazsalaca county the model will be formed by the local inhabitants themselves and the trips will be based on their mobility needs. Inhabitants will be able to use ToD service in the whole county area, also on weekends. Meanwhile in Alūksne area ToD will be piloted in concrete territories and the trips will be fixed by days for each of the territory. In both cases the service is designed closely with the local communities, including representatives of the municipalities as well as the end-users themselves to be sure the planned service will meet the needs and will be highly used when the service will be launched. The planned service will increase residents` access to local transport hubs as well as essential community and medical services, library, schools, recreation, etc. It should also meet the needs of local authorities, public transport planners and transport providers and enhance attractiveness and tourism in the region.

5.1.7. South East Europe Access2Mountain project

The Access2Mountain project (2011-2014) aims at developing appropriate conditions to increase the accessibility of mountain regions in the Alps and the Carpathians by sustainable transport and support the development of a high potential for sustainable tourism. It aims at setting up pilot projects to access tourist areas and to ensure sustainable local mobility at destinations.

Within its objectives, there is also developing soft tourist mobility in sensitive pilot regions through competitive small railways and intermodal transport. Within its outputs, studies on the feasibility of intermodal routes, possible new offers and ticketing services, and new integrated transport-tourist packages in model-regions.

The project does not specifically deal with DRT, however in one pilot region, i.e. **"Alpenregion National Park Gesäuse" in Austria**, a shuttle bus service to/from the main railway station, a door-to-door taxi service and an e-scooter rental service were offered, supported by a website and a smartphone app. Despite the initial lack of web and marketing support, 1638 passengers took advantage of the shuttle from June to October 2013, averaging nearly 3.5 passengers per trip.

5.1.8. FP5-IST FAMS project

FAMS (Flexible Agency for collective demand-responsive Mobility Services) was a project (2002-2004) funded by the European Commission whose objective was to scale up technology, service and business models currently adopted in Demand Responsive Transport and support the evolution from single DRT applications towards the concept of a **Flexible Agency for Collective Demand Responsive Mobility Services**. Starting from the existing DRT management components and architectures, technology adaptation was carried out to achieve networking of the different transport operators involved in DRT and Flexible Transport services and to allow sharing of information and service interoperability among them. Such adaptation allowed scaling-up from state-of-the-art Travel Dispatch Centre technology to the Flexible Agency for Mobility Services. The FAMS Agency enables operation of a Virtual/Extended Enterprise of transport operators. Despite the physical location of the operators, the different types of fleet, booking systems, services provided, etc., the Agency manages the entire service chain – from customer booking to service planning, monitoring and control, operating as unique entity, as "one operator with one fleet and one booking system", providing an effective response to the mobility needs of the different user groups. Three are the main components/subsystems of the FAMS Agency Architecture:

- a **common FAMS Service Centre (TDC)** sharing a number of services for:
  - service and route planning;
  - service monitoring and management;
  - common information and data management.
- **e-Business services** between the Agency's DRT management service components and the different actors involved in the DRT process chain, both operators and users. These include:
  - Business-to-Business (B2B) services, allowing interaction and teamwork among the different transport service providers co-operating through the Agency;
  - Business-to-Consumer (B2C) services, supporting access to information and services different associations, user groups, communities, etc;
- a **communication network** among the TDC and the vehicles operating the services, based on cellular technology – GSM and GPRS.

The FAMS Trial Project involves two different testing sites:

1. The trial site in **Florence Metropolitan Area (IT)** has the base DRT technologies already in place and already gained valuable knowledge about DRT through previous demonstration projects. This site is in the ideal situation to scale-up the local systems, develop and trial the technological

infrastructure and the collaborative service models underlying the Flexible Agency concept. Four different transport providers - ATAF, SITA, LiNEA and CAP - operate in Florence through the FAMS action, with different DRT services in six different areas. A private transport provider cooperates as well through the FAMS action for the provision of special services for disabled and elderly users.

2. The trial site in **Angus region (UK)** is new to DRT applications, although local plans exist to introduce DRT and the Flexible Agency in the site. This site covers the rural Angus area surrounding Alyth, Kirriemuir and Brechin allow evaluation of transferability issues, both on the technical and organisational level.

5.1.9. Interreg IVC Move on Green project

Move on Green Interreg project (2012-2014) intends to improve the design and the effectiveness of regional policies on sustainable transport in rural and mountain areas. Objectives of the project is to offer a number of transport alternatives that are affordable and operate efficiently. The partnership assembled several initiatives in greening or improving mobility in rural areas and some of these are related do DRT in rural areas:

- **DRT Virtual Transport Centre, Province of Burgos, Spain**. The Development Department of the Regional Government of Castilla-Leon implemented a new transport management system based on previous requests from citizens, directed and organized from a **"Virtual Transport Centre"**. The Centre sets out to centralize management of the transport services that cover the most isolated and poorly connected rural areas in the region. The center is called "Transport on demand virtual centre" and was managed and directed by the Regional Transport administration. Idea of the project was to reach all "important settlements", i.e. places with four or five people upwards. The system was made up of the following elements: Transport on Demand Virtual Centre Exchange (collection of reservations, organization of journeys, management of communication); On-board unit + driver console (enabling data concerning the position every time a stop in the route is reach, messages received and sent by drivers – warnings, queries, etc.); User "Information Terminals". The service had 685 routes in operation in the 9 provinces of Castilla Leòn, investment of over 15 million euros from the Development Department of the Regional Government. The service implemented throughout the Region reached one million users. In 2011, thanks to this service the 59.62% of conventional journeys were avoided, i.e. 126.706 journeys did not take place with empty vehicles.
- **TPL and taxi integration. Central Doubs, France**. TADOU is a service of local transport by taxi on demand available in the Central Doubs area, where no other public transport service exists. The service aims at fighting the isolation of people without private means of transport and of disabled persons by offering a cheap offer of transport. The commission of land planning and mobility (commission TADOU), made of 20 elected people from the territory, was involved in the implementation of the project. TADOU selected the taxi company to carry out the service and its staff provided the service of central office to collect demands. The service worked from Monday to Saturday from 6 am to 7:30 pm except bank holidays. Any inhabitant can use the TADOU service up to 20 times per month after having registered to the service.in order to make the service more efficient, the booking office can group together trips and may modify the books travelling time. Financially, the serviced was ensured **50%** by the Council of the Department of Doubs and **50%** by the municipalities of the territory. The users also participated to running costs. TADOU was used by about 400 users per month and had a positive impact for social life (by creating social links) and for the local economy (it was very much used for reaching medical centers, pharmacies, supermarkets and local shops).
- **DRT for children at school. South Burgenland, Austria**. The DRT for four villages in the southern part of Burgenland started as a pilot action for compensating the lack of public transport, support transport of children to school and ensure accessibility to public utilities for residents without car-access. The pilot project was a "Dorf-Bus" and it ran from Monday to Friday between 7 am and 4:30 pm as a door-to-door service and request must be announced by phone call. Because of its positive

impact, residents decided to turn it into a permanent institution. The annual cost is 35,000 €, 5,000 of membership fees, 8,000 of funding, 6,000 of sponsoring and 16,000 of costs shared by the community.

- **DRT in low density areas. Regional Unit of Ioannina, Greece**. The Regional Unit of Ioannina is characterized by low population density, mountains morphology and wide dispersion of settlements (isolation). Territorial mobility is principally made of local buses and private long distance service buses, but villages and settlements are not served or rarely served by public transport. Quite often, the closest bus line is dozens of km away and a wide share of population, mainly elderly, remain unserved. The private long distance bus service (KTEL) participated to the Interreg project TWIST and started operating and providing a new "on demand" service at a pilot phase, then officially established and expanded to a broader area. New routes have been activated and cover an area that was rarely served. Now passengers who want to use the service can inform the local KTEL in advance. The service has enriched the line offering pick-up points in predefined localities at which the bus only passes on passenger request. The service can be reserved within the district by calling the KTEL bus station in Ioannina.

5.2. Bad practices at international level

Although several experiences did not have success, it is not easy to identify bad practices in DRT services development and planning. In fact, that failures are usually not promoted like as the success, in order to avoid problems and/or critics. Nevertheless, it is possible to say that many of the DRT pilots developed and tested in the past years all around Europe were strictly related and dependant from national, regional or EU funds. Thus, the main reason of stop of activities are related to the lack of public funds. There are not available data allowing to quantify the amount of DRT projects that stopped due to the end of the public funding.

Other bad practices are related to the definition of unbalanced management schemes among private and public DRT operators. As already highlighted, flexible transport solutions could be provided both by public and private transport operators. The role of the public authority is to find a right balance among these two transport operators in order to avoid conflicts and integrate all the different mobility offers in the best way. Even if not strictly related to a traditional DRT scheme, the case study of Innisfil (Canada) is very helpful for understanding the potential conflicts between public and private sectors in providing these kind of services. Here below, a summary of "bad" practices or experiences as presented in some interviews conducted by "The Guardian".

<u>The Innisfil experiment: the town that replaced public transit with Uber</u>

"Innisfil is a community of 40,000 north of Toronto. It is a typical small North American town, with widely spaced houses on large lots that makes efficient public transit a logistical challenge. The town desperately needed transit. But the option on the table – three bus routes – would cost the council nearly $1m. So they tried to think creatively.

In 2017, the town in Ontario, Canada, embarked on an ambitious – and, to its critics, fraught – experiment. It handed responsibility for public transit to the ride-sharing app ***Uber****.*

Instead of buses or trains plying regular routes, it is Uber's roving cars that function as the transit fleet. When a rider opens the app, Innisfil Transit pops up as the cheapest option to travel between a network of popular areas called "hubs", such as libraries, the recreation centre or municipal buildings.

The costs per ride vary, but on average passengers pay an average of CAD$5 (£3), with the city subsiding the rest. Trips outside subsidised areas receive a flat $6 discount.

Two years later, the Innisfil authorities argue that the project has been a success. Ridership is high – in 2018 there were 85,943 trips – and many residents have embraced the service".

So far, everything seems to work in a proper way. The public authority provides a reliable public transport service in low density areas saving the money for the planned investments of expanding the traditional bus public transport system. But something else happened in the meantime and went beyond the plan of the Innifish municipality.

"But beyond the excitement of essentially having subsidised taxi service, experts paint a more troubling picture of questionable economic and environmental sustainability. The city has now spent more on Uber than the traditional transit option it was considering, and has dramatically increased the number of cars on its roads, with worrying implications for air quality and the climate crisis.

What's more, Innisfil Transit has now attracted attention as the latest step in a growing assault on public transit systems by ride-sharing companies. Urban planners fear Uber isn't just taking riders away from public transit but that it is hoping to replace public transit altogether.

But success has come at an ironic cost to the town. Because Innisfil subsidises each ride, the more successful it is, the more the town pays to Uber. That figure is now projected to reach $1.2m for 2019 – more than the bus programme would have cost, and well above the $900'000 the city allocated. With ridership increasing each year, costs will only rise.

If you operate a regular bus system, you have a much better idea of what those costs will look like five or 10 years from now," said Christof Spieler, an urban planner and author of Trains, Buses, People. "But if you have a system with too many people using it, and you can't afford to provide the service, how will you handle that?"

In the meantime, the town has taken the extraordinary step of deterring people from using Uber too much, capping the number of rides a resident can take per month. For mall worker Arrega, who has been "working like crazy", that often means exceeding the limit midway through the month, although the town allows riders to apply for an exemption. It has also increased the cost of a ride by $1.

In the meantime, Innisfil officials have openly mused about fixing some of the problems of Uber – by turning to Uber. The latest suggestion to the cost overruns? UberBus: a bus that runs a fixed route, just like a normal city bus". [Source The Guardian]

This Innisfil "bad practice" provides many interesting elements for understanding how to correctly plan a DRT service balancing public and private operators in the right way (when possible).

5.3. Summary of the analyzed DRT case studies

In the following paragrapgh a syntesis of the analyzed case studies and main DRT topic adressed by each case study are summarized.

EU Projects	Case Studies and main pilots topics
Interreg Regio-Mob project	• Demand-Responsive Transport Service for people with disabilities in Ljubljana Urban Region • Tele-bus (Krakow City). • Bus Real Time Passenger Information in Edinburgh, Scotland • Light Mobility for Weak Demand Areas (Lazio Region, Italy)
Interreg MED Limit4WeDA project	• Demand responsive service in week demand areas, Perugia

EU Projects	Case Studies and main pilots topics
Interreg Europe LAST MILE project	• Train with stops on demand from Lleida to la Pobla (High Pyrenees) (Regional Government of Cataluña) • Nightrider, door-to-door night bus on request (Sales-Lentz - bus operator, Luxemburg)
Horizon 2020 Inclusion project	• Participation processes for the definition of a new DRT service in rural areas, Florence, Italy • DRT services supporting public events organizations, Barcelona. • DRT services for families with young children, Rhein-Sieg Region, Germany
Horizon 2020 Avenue project	• Real time DRT bus monitoring system, Lyon • Autonomous shuttles, Luxembourg • Extension of an existing DRT service, Geneva • DRT autonomous mobility cloud, Copenhagen
Interreg Baltic Sea Mamba project	• Rural ride sharing and transport-on-demand. Bielsko-Biała Regional Development Agency and Bielsko District, Poland • Transport-on-demand. County of Plön, Germany • Transport-on-demand (ToD). Vidzeme Planning Region, Latvian Road Transport Administration • Bottom up DRT services. Mazsalaca county
South East Europe Access2Mountain project	• Integration of different transport flexible services in Alpine areas, Alpenregion National Park Gesäuse", Austria
FP5-IST FAMS project	• Flexible Agency for Collective Demand Responsive Mobility Services, Florence Metropolitan Area (IT) • Flexible Agency for Collective Demand Responsive Mobility Services, Angus region (UK)
Interreg IVC Move on Green project	• DRT Virtual Transport Centre, Province of Burgos, Spain • TPL and taxi integration. Central Doubs, France • DRT for children at school. South Burgenland, Austria • DRT in low density areas. Regional Unit of Ioannina, Greece
Bad practices at international level	• The Innisfil experiment: the town that replaced public transit with Uber

Table 19: Case Studies and main pilot topics

6. Conclusions and lessons learned (global to local)

The case studies and scientific reports analysed in this report provide relevant information on how to plan, develop and implement a successful and reliable DRT service in a rural/peripheral urban area.

First of all, it is important to notice how all the successful cases are based on the coexistence of three fundamental pillars:

- **Fleets management ICT technologies** able to manage the planning and routing of the different vehicles involved in the DRT service in an effective, coordinated and efficient way;
- **Vehicles on-board unit** able to monitor the position of every single vehicle involved in the development of the DRT solution in an accurate and precise way;
- **Information tools** able to provide the relevant information to final users allowing an easy booking service in a reliable way.

These three fundamental aspects have to be developed together and in strict connection among the different elements. If one of these pillars is missing or not adequately developed, the DRT service will probably see a reduction of the probability of success.

Another relevant reflection for the SMACKER project emerging form the analysed case studies is that the tourism topic is very poorly developed. The large part of the DRT pilots are related to the provision of public transport services in peripheral rural areas and for people with transport problems (young people, old people, etc.).

The development of effective and reliable DRT services tackles a large range of challenges. As very well summarized by MIND-SETS Knowledge Centre, the main challenges to be addressed by the DRT services are:

- *"When they are **overly flexible** in terms of schedule and /or route (and their travel times thus become too variable), they can become unsuitable to serve as feeder service to public transport hubs in urban areas;*
- *The **routing decisions for DRT are very complex to model and optimize**. Some of these complexities arise from the difficulty to predict behavioural responses to late-running services or no-shows by the clients;*
- *DRT services basically perform taxi services at public transport prices. As a result, they can be perceived as **unfair competitors** by traditional taxicab services;*
- *Despite the gradual extension of the scope of the services, there is a strong perception in some countries that **DRT is only for mobility impaired people**. This hampers the inclusion of DRT in the standard public transport offer.*
- *DRT is usually not included in **transport planning apps**;*
- *When DRT is provided by public transport companies who are used to serve captive markets only, there is **insufficient experience with marketing to attract new clients**".*

It is not easy to tackle these relevant DRT challenges but the analysed case studies provided in this report already give some elements of potential measures to adopt in order to overcome these challenges.

Analysing the main scientific literature on DRT, the large part of researchers agree on concluding that the DRT service will continue to grow at the international and EU level, due mainly to [MIND-SETS Knowledge Centre, 2019]:

- *"An increasing feeling that **conventional public transport is inflexible and unreliable**, especially taking into account that individual requirements can vary over time;*
- *With increasing **urban sprawl**, conventional public transport can become unviable;*

- *Public authorities show an **increasing interest in DRT** as a means to address inclusion of some specific targets groups, but also to achieve modal shift;*
- ***On-line bookings** could make DRT more convenient for the general public, but not for the target audience of "socially motivated" DRT (such as elderly people or mobility impaired ones);*
- *Some **niches** (such as airport shuttles) have already proved to be commercially viable;*
- *In Europe, there is potential to use DRT in **orbital journeys in suburban and peri-urban areas** while 'traditional' public transport is used for radial routes;*
- *DRT could expand into **goods delivery** (e.g. of library books, prescriptions and post/parcels) as an **additional source of income**. There may also be untapped potential for transport in the "night time economy";*
- *The most important component of variable costs are the wage costs of the drivers (at least, in the schemes that are not volunteer-based). With **automated mobility**, this issue will disappear, and this will increase the potential of DRT as a feeder mode for high capacity public transport".*

Moreover, the rapid growth of the ageing people will very much contribute to the increase of the DRT services dissemination and successes.

At last, it is fundamental to develop DRT services planning since the beginning of the DRT services, together with the business model and the governance scheme to be adopted. As demonstrated in the bad practices section, a large part of the DRT services fail when the public funds supporting the initiative ends. The presented case studies show how crucially important is to define in details all the potential revenues and contributions available on the market and their duration, and then plan the DRT service based on these economic data. Due to these reasons, it is recommendable to "start small and think big". Starting with basic, low-cost DRT services and improving them step by step while considering the available economic resources.

In the definition of the DRT service governance scheme, when possible it is important to involve also the private transport sector in order to share responsibilities and costs related to the provision and management of the DRT services. However, as highlighted in the Canadian "bad practice" reported above, it is important to find a good and correct balance between roles and powers.

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