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Improving Accessibility in Rural Areas Using New Technology Based Solutions.

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Abstract: Rural areas are facing different demographic changes which have direct impact on the accessibility of rural areas. New technology solutions, available also in rural areas, can at the same time help to improve the accessibility of rural regions. This article is presenting theoretical discussion about the situation in rural areas associability and overview on possible solutions based on application of new technologies and transportation systems like Demand-Driven Transport – DTR and Flexible Transport Solutions FTS.

Key words: rural areas accessibility, Demand Driven Transport, Flexible Transport solutions
JEL classification: H41; R42

1. Introduction

Today's demographic, social, economic and technological trends are changing the way transport problems are defined. At the same time, new possibilities for their solution and evaluation arise. The "New Transport Planning Paradigms" (Litman, 2013) describes a change in the transport planning and evaluation paradigm that is related to these trends. The original transport planning paradigm focused on mobility, focusing on maximizing the transport distance that an individual can pass for a certain amount of time and money. The new transport planning paradigm is based on the assumption that mobility is not a goal in itself, the goal is to make the required services and activities overall available. Naturally, there are different accessibility measures that are usually aimed at improving pedestrian and cycling, linking taxi and public transport, and so on (Duraton & Guerra, 2016).

Accessibility can be defined as "the potential of interactions opportunities" (Hansen, 1959), or as ease with which individual services are available from a particular location using an existing transport system (Dalvi & Martin, 1976). Accessibility is therefore the goal of the vast majority of transport activities. Accessibility is influenced by many factors (demand for transport and activities, mobility, transport options, available information, degree of integration of transport services, affordability, etc.) (Litman, 2018). Similarly, accessibility in rural areas can be defined as (Donnges, 2003) the ability of rural residents to achieve the necessary goods and services. Improving accessibility for rural areas is therefore aimed at cost-effective improvement of access to goods and services that rural populations need for their social and economic development. Improving accessibility for rural populations is directly linked to economic growth, improving social inclusion and mobility (Farrington & Farrington, 2005).

The aim of this paper therefore is to describe the new possibilities for improving accessibility in the rural areas with application of new technological approaches and transportation solutions. In the first part of the paper the issue of accessibility on the rural areas is discussed. In the next part several examples of new technologies used for improvement of accessibility in the rural regions from empirical studies are described.

2. Accessibility in rural areas

Accessibility in the rural areas depends directly on the localization of the home, the location of goods and services, and the transport system that links these two elements (Donnges, 2003). Current possibilities in information and communication technologies bring new challenges in the area of new transport system for rural areas. According to (Velaga, et al., 2012) many rural areas have limited access to public transport, which has a significant impact on residents with limited access to cars (children older people, people with disabilities). The use of new information and communication technologies and "smart" solutions can improve both the efficiency and quality of rural transport services (Wang, et al., 2015). One of the most widespread approaches to addressing accessibility in rural areas is demand-responsive transport DRT" and flexible transport services" Flexit Transit Servise FTS "(Papanikolaou, et al., 2017). These approaches are based on complementing or replacing a fixed transport system with defined transport routes and arrival and departure times by a flexible system based on the actual need to achieve, goods, or service. They are often used for specific groups of the population eg. visiting the hospital, transporting to the airport or shopping malls (Ryley, et al., 2012). The advantage of these systems is to increase the benefits to the population, as transport is available when they need it and often "door to door" (Velaga, et al., 2012). The correct application of the DRT systems is of benefit for end users (citizens) form different socio-economic groups, but also can be considered as the effective way from the public expenditure point of view. The successful implementation of the DRT system depends from several factors. According to the (Wang, et al., 2015) three factors that affect DRT use, can be identified: service-related or 'schemetype' factors; area-related factors; and individual-related factors. The first factor is related to the type of operation scheme and vehicle type. The second factor relates to the area, of DTR systems Implementation. The DTR scheme are more efficient in small and difficult to serve locations, or in times of low demand. Form consumers' point of view the most attractive for DTR solutions are elderly, mobility limited, disabled or low income citizens. Several studies have also investigated the third factor focused on characteristic of individuals, which use the DRT systems. It is again most of all elderly, disabled people and students which use the services for shopping, education and commuting. Most of the clients require the "door" to "door" service.

DRT schemes are not new; first application of DRT systems could be seen in 70´s last century. Availability of new IKT technologies enables the efficient use of the DRT systems. On the other side many DRT project failed. In (Enoch & Parkhurst, 2006) authors invetegeted 72 DRT project with aim to analyze factors why the projects were not successful. Marketing environment was used for analying the fail factors. They have splitedt the factor into three groups – Interna, Micro and Macro factors. Among the inters fail factors belongs the technical problems, lack of planning and poor marketing and wrong fee system. Internal factors are predominately problems of compatition and problems caused by local auhorities. The external factors caoused only minimum fails of DRT factors and only in areas with realy low population density.

According to the authors knowledge the application of DRT systems in Slovakia were not analysed in details yet. On another side there are many possibilities for application these systems in Slovak rural areas. Many boarder regions suffer from typical rural problems with accessibility. In Slovakia, according to the public passenger transport strategy, 2030 is only 30% of all public transport journeys, with particularly low levels being achieved in rural regions. At the same time, a more rapid decline in public passenger transport was recorded in rural regions, where tactile transport to centres throughout the day is not provided, but only selected social connections (SR, 2017) are operated. The problem is in the hands of self-governing regions, which are the right body for regular bus services while also ordering and financing suburban bus services. In rural areas in Slovakia, public passenger transport is largely provided by a traditional fixed system (mostly by bus) with a fixed timetable. According to our information, the possibilities of implementation of demand-oriented transport projects as a substitute or supplement to the traditional fixed transport system have not been systematically explored. Currently, projects aimed at creating a Sustainable Mobility Plan are being implemented in several regions. These projects involve a massive collection of data (both primary and secondary) on regional transport. There is, therefore, a unique opportunity for research to improve the accessibility of rural areas using new smart solutions.

3. New solution for improving accessibility in rural areas

The latest solution based on DRT is the Flexible Integrated Transport System FITS (Velaga, et al., 2012) . This approach can provide flexibility in choosing road, time, mode of transport, service provider, payment systems etc, and can provide sophisticated, comfortable and cost effective transport options for rural areas inhabitants. The core of the FITS system is virtual agency, which serves as the intermediator between customer and transport service provider of any kind. This virtual agency is responsible for orders collection, route planning, trip reservation and route optimization for vehicles etc. Current technologies allow managing these activities as web based solution available in real time. The problem can be in availability of reliable, fast and financially available internet connection in some rural areas.

The DRT systems are usually focused on some particular group of inhabitants (Eldery, Mobility impaired, Youth) for some specific goal of transport (health services, shopping, school etc.). These services are secured by public authorities, private sectors or volunteers. As an example of DRT in Rural Norway (Leiren & Skollerud, 2016) can be briefly described. The first important note is, that there is strong political pronounce, to maintain settlements in rural Norway. At the same time there is strong political focus on inclusion and citizenship based on the ideal that every citizen has the individual right to be able to participate in community life. Marker is south-eastern rural area with almost 3500 inhabitants. Apart from the traditional public transport inhabitants from more separated areas have access to the local DRT. At the beginning the system was restricted to elderly people, but after some time the public authority open the system for all inhabitants. System has two predefined roads, but customer can order pick-up up to 2 km from predefined road. The operation time starts at 10:00 am (just after the school transport is finished) and second service start about 3 hours later. If nobody demands the service, at least two hours in advance of the scheduled departure, there will be no trip. According to demanded number of passengers as well as their special needs system selects the most efficient vehicle type (taxi, minibus etc.).

Another example is from Scotland, where DRT services are very popular due to large areas with low population density. In (Velaga, et al., 2012) authors describes the situation in Scotland. According to this study there were about 140 DRT schemes operated in Scotland in 2006. The analysis showed that many of schemes were cancelled due to different reasons (economy efficiency, technology problems etc.). Most of the still running services are characterized by still low or no intelligent transport systems. The ride can for example be ordered only one day in advance. The systems are usually introduced in areas with no public transport or alternated the fixed public transport systems in areas with very low demand. It seems that the use of existing taxi services is the good strategy for public administration, due to use of existing infrastructure and reduction of operating costs. Based on analysis of existing DRT systems in Scotland the study offers also several challenges and opportunities for development of DRT systems in rural areas. It is very important to make holistic approach when planning the system. This must be represented by involving users, operators and transport authorities' in designing of the system. The good idea is also to have a top down view. Most of the services are operated on relatively small areas without connection to each other's. The national – or wider regional approach can encourage integration and coordination of services. Combination of different transport modes – connecting existing DRT service with rail service can also improve the efficiency and sustainability of the system. The usual challenge for local authority is to find transport service provider in rural areas and in areas with very low population density also to manage door to doors service. Another problem is demand estimation. The social composition and low density in some rural areas complicate the demand estimation. One of the reasen are also lower IT skills of gropes for which are DRT systems designated. For the moment there exists no fully accepted methodology for ex-ante or ex-post evaluation of DRT projects. This is very challenging for public authorities to implements new DRT projects within rural areas.

An example from middle-east Europe can be found in Poland in municipality of Niepolomice (Hunkin & Krel, 2018). The city representatives wanted to make public transport more efficient, convenient for users and more economy and ecologically efficient. The system of Tele-bus was introduced as an on demand bus service in three districts with very low population. Within the system the user can order journey between any of predefined 77 stops in coverage area up to 30 min. before required departure. The typical users of the systems are students, elderly people and commuting workers. The system is successful with increasing number of users. There were only 300 users a month in 2007 (when the system was introduced) comparing to more than 3500 users per month last year (2018).

4. Conclusion

The aim of this paper was to describe the new possibilities for improving accessibility in the rural areas with application of new technological approaches and transportation solutions. As it was showed in the paper the demand oriented transport systems and flexible transport systems are suitable solutions for solving accessibility problems in rural areas in sustainable way.

This solutions and systems are not new. In Scotland for example the first DRT systems were introduced in 60´s of the last century. The quick development of ICT and its availability in rural areas gives new possibility for introducing new DRT systems with massive use of ICT and internet. The ICT skills among older population are increasing and the situation will naturally go better in the future. On the another side the problems with associability of rural regions will growth. The reason is strong urbanization, so cost per passenger for ensuring the public transport in rural areas will grow in the future. So it is very probable, that the importance of DRT and FTS will also grow in the future.

The situation in Slovakia regarding to demographic and spatial distribution, is very similar to the rest of the Europe. The rural areas in Slovakia suffers from population reduction and aging of population. The current public transport system based on fixed time tables and roads will probably become unsustainable from economical as well as from the accessibility point of view. It is therefore necessary to start to consider new transport systems based on DRT or FTS also in Slovakia.

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