

SYSTEMATIC LITERATURE REVIEW ON DEMAND-RESPONSIVE TRANSPORT SERVICES.

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Overview

The issue of climate change, its impact on the world, and the emerging responsibilities for societies, states and the public are omnipresent in public as well as scholarly debates. In this context, transport is often singled out as a majorly important driver of climate change with 24 % of carbon emissions worldwide coming out of this sector (IEA, 2021). Besides greener fuels and modes of transport in general, increasing public transport use is regarded as a powerful means to tackle the reduction of carbon emissions (Hodges, 2010; The World Bank, 2014; UNFCCC, 1992).

Considering that in the EU, 29 % of citizens live in rural areas - a share that has been rising (Eurostat, 2018, 2020) - and that the provision of classic public transport in these areas is difficult and more importantly inefficient, possible solutions need to be explored urgently. One such solution are demand-responsive transport services (DRT), defined as intermediate services reacting on user demand and not bound to set times or courses (Ambrosino et al., 1997). Both public authorities and, increasingly so, scientific publications view DRT as alternative means of public transport in rural areas. Despite this focus, scientific investigations in this domain have fallen short of substantial contributions to methods to measure DRTs potential to contribute to the reduction of carbon emissions and equally socio-scientific approaches to explain and increase the user acceptance of DRT. Against this backdrop, the present article presents a systematic literature review (1) to give an overview of the development of the research field with a particular focus on user-oriented research, the applied explanatory frameworks, design and location of performed empirical studies. (2) It further examines the findings with respect to population density of study areas and (3) concludes by systemising the existing research gap regarding DRT, user acceptance and rurality.

Methods

This systematic literature review has been conducted following Petticrews' Practical Guide to Systematic Reviews in the Social Sciences (2006). The heterogenous development of the wording for DRT complicates an immediate and definite research effort and so an initial research for the variety of terms denoting this form of public transport was necessary. Following this preliminary analysis and the subsequent formulation of the search string, the literature search was conducted in the databases Web of Science, ScienceDirect and Taylor & Francis in July 2020. The 1,222 results were systematically refined to assure that only publications in peer-reviewed journals referring to demand-responsive transport of individuals remained on the list of results. These 231 articles were subjected to an initial quantitative analysis conducted in Excel. The scope of this first analytical step was to identify user-focused research, by analyzing articles' keywords and assigning them into a socio-scientific, technical or economic category. All articles with a socio-scientific approach were then subjected to a content analysis performed in Nvivo, a software designed to support qualitative analysis.

Results

On a general level, results clearly showed that research on DRT has a diffuse history. While the first article was published in 1985, until 2005 only 21 further articles have been published in peer-reviewed journals listed in the above stated databases. Numbers then grew from 2006 on but remained small still. Only in 2019, the first year showing more than 30 publications, a clear and ongoing acceleration becomes visible. When examining the development of user-focused research, 1992 yields the first publication and a steady stream of publications only establishes in 2017. An analysis of the most prominent journals lists *Research in Transportation Economics*, *Research in Transportation Business & Management* and *Transportation Research Procedia* as most influential, not only releasing the most articles on DRT but also showing the highest publication numbers for user-focused research. Turning to a focus on socio-scientific research reveals 18 % of articles with an user-focused approach (44 in total) – 12 % being interdisciplinary with ecologic and technical approaches. The content analysis of the 44 socio-scientific articles shows that DRT is perceived as a mostly socially motivated service for specific target groups (elderly and impaired people traditionally and commuters recently) and a suitable means of public transport in rural areas (geographic coverage, substitution of classic public transport and subsequently less expensive provision). Also DRT's potential to contribute to lowering emissions of the transport sector is frequently highlighted showing that these services are considered from more than just the economic point of view as imposed by the concept of the

Triple Bottom Line (Elkington, 1997). Moreover, financially unfeasible provision and, hence, public involvement are highlighted as central issues of DRT.

Out of the 44 socio-scientific articles 36 included empirical studies, of which 72 % again took place in urban areas. 31 articles required human participation, and of those almost half targeted actual users of DRT (48 %) and the general public (39 %), whereas only 8 studies investigated specific target groups. While 25 % chose a mixed methods approach, 31 % used qualitative methods and 44 % quantitative study designs. In this latter category, 20 studies applied revealed preference methods and 2 stated preference methods.

In the 44 analyzed articles, most empiric studies were performed in European countries with Great Britain taking a far lead with a count of 10, followed by Germany with 4 empirical studies. The USA ranked 8th place.

This articles' analysis of factors influencing user acceptance published in the analysed articles has not been conducted quantitatively and does not result in figures but an understanding of interrelations. The analyzed publications do not come to conclusive results, which, to some extent, must be attributed to differing study designs, areas and target groups. Age, education, income and travel purposes are identified to be of influence but not in a common manner. The same applies to population density, access to private cars and infrastructure.

The published suggestions to raise user acceptance show a strong user-focus: clearer and more information are promoted which connects to a call for increased accessibility of services and try-out options. These are argued to raise awareness and create positive feelings towards DRT, factors that appear to be of more importance than the actual design of the services provision (route, time, fares). Additionally authors highlight the need to study existing and potential users more thoroughly.

Conclusions

The spike of publications on DRT (with user-focus and in general) in 2020 shows the attention this research field is receiving as of late and clearly underlines the relevance of this systematic literature review at this stage. This systematic literature review shows the necessity for more user-focused research on DRT, in particular when attempting to establish this form of public transport in developed countries. The present research offers one pressing conclusion, which can be derived out of a mismatch between an understanding of DRT and actual empirical environment in which DRT is studied: Although DRT is viewed as a public transport mode for rural areas and specific target groups, empirical inquiries more often than not ignore this specific context. As most studies are performed in urban areas, the results are hardly transferable, an issue which equally concerns the examined populations. It is therefore clearly highlighted that more research addressing groups viewed as beneficiaries should be conducted in order to derive realistic implications and recommendations. The inconclusive results with respect to factors influencing user acceptance support this call for target-oriented empiric research, further strengthened by the given suggestions to raise user acceptance. Amongst other findings, the necessity of a distinction between DRT in rural areas and DRT in urban settings, where the general public is more open to public transport in general and can base its decisions on past (positive) experiences, is presented. Especially when seriously attempting to establish DRT as a contribution to reducing the transport sector's carbon emissions, the implications identified in this systematic literature review should be considered before planning further research activities in this growing research field.

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