

Progress in IS

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Progress in Sustainable Mobility Research

Interdisciplinary Approaches
for Rural Areas

 Springer

Progress in IS

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Foreword

Climate change affects us all. Lower Saxony, as an agricultural and coastal state, will also be increasingly affected if the negative trend continues. Many ecosystems that are already heavily used by humans are no longer able to adapt to climatic conditions within the required framework.

These briefly described phenomena need to be addressed by politicians at all levels. Through their roles as advisors, science and research can contribute important insights. In doing so, science and research should be assured of support from research policy at European, federal and state levels. Because only in close cooperation can we succeed in solving this great challenge of our time.

With the “Science for Sustainable Development” funding programme, Lower Saxony’s sustainability research has been brought into focus to a considerable extent. In three selection rounds so far (2013–2018), 18 projects have been selected, which will be funded for up to 4 years with a total of 28.1 million euros. One of them is the project “NEMO—Sustainable Fulfilment of Mobility Needs in Rural Areas”.

The aim of the programme is to promote research projects that—oriented towards the key objective of sustainable social development—address current, socially significant questions and problems and work on them at the highest scientific level. The programme is thus open to all scientific disciplines and does not make any specifications with regard to concrete sustainability-related topics. This can be seen as a successful combination of social relevance and scientific freedom.

In addition, the programme was designed to enable the participation of non-scientists without specifying the form or intensity of this participation. This created the possibility for transdisciplinary research without making it a requirement for the projects.

In the field of climate and sustainability research, knowledge must continue to be generated within the framework of inter- and transdisciplinary research in order to achieve acceptance by as many participants as possible.

This is also very clear in project NEMO. I am pleased that scientists from the TU Braunschweig, DLR Braunschweig, the University of Oldenburg and the University of Vechta were involved in the project, that a scientist from the University of Passau

also worked successfully in the project and that the population was involved to the highest degree.

In my opinion, the project is highly interesting because it combines existing mobile phone technology, apps and the Internet with existing offers such as collective taxis, call taxis, car-sharing agencies and women's night taxis in order to provide solutions for the mobility needs of rural areas with regard to infrastructural problems of public transport. The project is also highly relevant for Lower Saxony, since the results as well as the app could theoretically be applied in the wide rural areas of Lower Saxony (for example the Emsland, Wendland, South Holstein, Harz) besides the Wesermarsch district.

In the field of private transport in rural areas, the findings from the project can make a significant contribution to reducing carbon dioxide emissions. The NEMo mobility platform, which is also manifested in the "Fahrkreis" app, illustrates the contribution of the project beyond its usefulness in the scientific field. The publications, theses and three appointments resulting from the project as well as the following work will also disseminate the results achieved in the scientific landscape.

I was able to get a picture of the results of the project during my visit to the NEMo final event and was enthusiastic. I would be very pleased if the results of the research, the mobility platform and the app could be applied in other areas of Lower Saxony. I wish all the scientists involved every success in their further activities and the readers an informative reading of the following work!

Minister for Science and Culture of Lower Saxony
Hanover, Germany

Björn Thümler

Foreword

Something is wrong with our today's "mobility", which is sometimes appreciated and sometimes scolded but always required and often enough necessary. If we live in a big city, we appreciate the varied and colourful mobility offers in our area, which are easily accessible in many places by good public transport. At the same time, the density, noise and air pollution of private transport are a constant nuisance.

If we live in the countryside, less traffic, especially "thinned out" public transport, is an obstacle. The routes to work or training places, shopping, schools, day care centres, doctors or pharmacies and many leisure activities are difficult. The use of the individually available private car seems unavoidable to many. However, this individual option is associated with \ddot{U} - often underestimated – costs and is not even open to many citizens, for example, because he or she has no driver's license, or the ability to drive is no longer given for health or age-related reasons, or simply because there is insufficient money.

The now modern word "traffic turnaround (Verkehrswende)" often refers to the reduction of fossil fuels in favour of other resource-saving options such as electric mobility. These are certainly also worth striving for. But, even if every passenger car and every public transport vehicle were substituted by a technology described as sustainable, this would not change everything in the situations described earlier. But, the density of traffic in cities, on the one hand, and the undersupply in rural regions, on the other, remained exactly the same.

Around 47 million people in Germany, more than 50% of the German population, are living in rural areas. The question, therefore, arises why urban regions receive more attention than rural ones. Would it not be possible to increase the attractiveness of sparsely populated regions if the population staying there felt "better provided" with regard to mobility? Would life not be even more attractive if the way to work, to the doctor, etc. were easier?

This challenge, to ensure satisfactory mobility solutions in sparsely populated areas without increasing traffic density at the same time, is the main focus of project NEMo (Sustainable Fulfilment of Mobility Needs in Rural Areas). As existing and new, innovative providers of sustainable mobility working on—often competing—solutions, the NEMo approach links existing mobility capabilities with information

and communication technologies. Instead of competing, project NEMo combines different public transport modes, mobility companies and voluntary private services. Thus, the static time schedule of public transport service is expanded by new virtual stops, dynamic routes and adequate timing and thus connects very different means of transport. It creates some kind of “Internet of real movement possibilities”.

Research in the sustainability sciences has been long explained as very challenging due to its high degree of complexity, which can only be mastered by close cooperation of different research disciplines. A purely technical or scientific solution that is implemented by engineers, or a purely socio-political approach that regulates via enlightenment, guidelines and laws, or a purely economic approach that leaves the field to the “market” as the ultimate regulator does not seem to be sufficiently effective to most scientists.

For this reason, project NEMo is following an interdisciplinary and transdisciplinary approach that involves many different disciplines and perspectives. Computer science, sustainable entrepreneurship with corresponding business models, social and communication sciences, as well as legal experts worked closely together on the basis of their specific methods and from their point of view contributed to the success of the project through vital exchange over the entire duration of the project.

The results were not created in the so-called ivory tower. Scientific and practical knowledge were combined in a transdisciplinary sense. The pilot region Wesermarsch, from which more than 300 citizens actively participated, and the support from the local politicians and the public administration contributed to the success of project NEMo as well.

All this has resulted in an innovative mobility platform that is practically usable for citizens in rural areas. The former Federal President Horst Köhler said in a much-noticed speech at the International Transport Forum in 2010:

So, let's strip away old habits of seeing and thinking, let's at least try to question them. Let's look together for new ways to a mobility that is not a privilege for here and now, but that remains possible for everyone – also in the future.

From my personal view, the results of project NEMo are new in this sense and can be well transferred to other regions.

Lüneburg, Germany

Prof. Dr. Helmut Faasch

Acknowledgments

We want to thank Prof. Dr.-Ing. Benjamin Wagner vom Berg for his ideas and contributions in this project. Also, our thanks go to Benjamin Dietrich as interim project assistant.

The success of project NEMo is largely based on the willingness of the residents and local population to contribute to the interviews, surveys and field studies conducted during the project. We, therefore, thank all participants for their voluntary and unselfish commitment to project NEMo. Furthermore, we thank the Wirtschaftsförderung Wesermarsch and the City of Oldenburg for their help in recruiting the participants.

We want to thank Gunnar Barghorn, Prof. Dr. Helmut Faasch, Prof. Dr. Helmut Lessing and Prof. Dr. Katharina Manderscheid for their work and contributions in the scientific advisory board of project NEMo. Moreover, we thank the multitude of associated partners from municipalities, boards, businesses and research facilities for their support of project NEMo.

Project NEMo was enabled through the funding by the VolkswagenStiftung and the Ministry for Science and Culture of Lower Saxony. We, therefore, thank them for the confidence in the vision and objective of project NEMo, which led to the project results at hand.

Project NEMo was strongly embedded into research and teaching activities at the universities involved. More than 50 graduate students elaborated their final theses focusing on the research aspects of project NEMo. In addition, research assistants of the different departments contributed to the successful realization of the project idea. We would like to take this opportunity to express our appreciation to (or to thank) all (former) students who were part of project NEMo.

This work is part of the project “NEMo—Sustainable Fulfilment of Mobility Needs in Rural Areas”. Further information are available on the following website: www.nemo-mobilitaet.de. The project is funded by the Ministry for Science

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Part I
Current State and Perspectives
of Sustainable Mobility

Research Approaches and Objectives of Project NEMo



Ali Akyol, Klaas Dählmann, Martina Jahns, Dilshod Kuryazov, Ali Amin Rezaei, Johannes Rolfs, Ute Samland, Alexander Sandau, Johannes Schering, and Cedrik Theesen

Abstract NEMo is an inter- and transdisciplinary research project with the objective to improve mobility in rural areas through the holistic development of a sustainable, ICT-based mobility platform for carpooling, ridesharing, and public transportation services. This contribution details the research approaches and objectives as well as the general methodology. Moreover, it introduces the four relevant research modules of the project, consisting of the examination of the local communities, organizational aspects, suitable business models, and technical solutions. The relevance of the individual research modules is presented both on a theoretical level with regard to sustainability research in general and on an applied level with regard to specifics of project NEMo.

Keywords Carpooling · Mobility platform · Ridesharing · Rural areas · Sustainable mobility · Transdisciplinary research

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1 Introduction

In the Federal Republic of Germany, more than 50 million people live outside urban areas, with corresponding mobility and service needs. This corresponds to more than 60% of the total national population (Federal Statistical Office of Germany 2013). Due to the increasing concentration of medical and health care facilities and shopping centers, the demand for mobility in rural areas will further increase (Raabe et al. 2001). Last but not least, the accessibility of schools, health centers, leisure facilities, and jobs and training places will play a central role for companies when choosing a location (Zängler 2000; Institut für Mobilitätsforschung 2004, 2006). Therefore, mobility offers are an important location factor for the creation of corporate value and the basis for participation in social life (Beckmann et al. 2006; Rammler 2001). Nevertheless, in times of demographic change, it is becoming increasingly difficult to maintain a basic supply of mobility services without questioning social participation, regional value creation, and, of course, environmental protection goals. Mobility problems in rural areas will thus challenge society, politics, administration, and the economy in the future. It can be expected that mobility solutions that integrate traffic-optimizing coordination and organizational activities will be demanded increasingly by both public and corporate actors.

The objective of the project NEMO¹ is the sustainable and purposeful fulfillment of supply and mobility needs, considering the specific social structures in rural areas. These structures are the key to developing a mobility model based on social self-organization (community building). In this context, information and communication technology (ICT) in the form of socio-technical information systems play a crucial supporting role and can serve as a basis for a sustainable rural mobility supply.

Sustainability in its economic, social, and ecological dimensions should be taken into account. Especially the consideration of the last two dimensions requires a strategy of sufficiency II (Paech 2005). In this strategy, mobility should not be reduced overall, but rather in terms of its negative effects. Existing concepts such as function/purpose orientation, which focus on the shared mobility function instead of owning a vehicle, appear to be generally suitable for the implementation of such a strategy. This is particularly true for mobility in rural areas, as these are characterized by a high proportion of motorized private transport in the form of private cars and insufficient provision by local public transport (Heinze 2007).

The extreme condition of public transport in rural areas is mainly the result of a backlogged adaptation to the change of the spatial system environment. In rural areas the traditional public transport offer has shrunk considerably. Of the remaining demand for public transport, 70–90% of all transports in sparsely populated areas is now school transport. Despite its restrictions, school transport has thus become the generally accessible mobility basis and the minimum service offer for carless parts of the population. There are already places of residence without school transport,

¹<https://nemo-mobilitaet.de>.

which are served only once a week or by stub trips as a call bus. For this reason, private mass motorization can be interpreted as a user-financed problem solution (Heinze 2007).

Solutions to limit the increasing mass motorization can be created by flexible forms such as shared call taxis (AnrufSammelTaxi), call buses, or carpooling. Some of these also act as feeders and distributors, which become more attractive due to their time flexibility (bus stop “front door”) and have been proven to induce new traffic (also for later bus lines). The flexibility of carpooling can be achieved by transferring sharing and pooling concepts that are established in metropolitan areas and combining them with existing public transport services in rural areas. The particular challenge here is that private individuals are transformed into local mobility providers who offer their own vehicle capacities to other people. For instance, public transport stops could be served by private individuals. Furthermore, infrastructural, social and economic needs, and specifics of rural areas must be considered.

1.1 Research Methodology

For a long time, awareness of the mobility problems in rural areas had been relatively neglected in the focus of scientific research projects. Despite a large number of publications on the topic of mobility, rural regions are often excluded and cannot benefit from the research results, as they mainly address urban areas and adjacent areas. This leads to an increasing weakening of the rural areas and perpetuates the problematic situation. It is therefore necessary to focus research activities more on rural areas and their special conditions. Despite the knowledge about the problems and the advanced sensitization of the general public over the last years, measures to change the status quo have so far been insufficiently implemented and the solution of the rural problems associated with this question has been postponed. The following collective research question emerges from this:

Building on the social structures of rural areas, how can mobility needs be fulfilled under aspects of sustainability and purpose orientation?

In order to answer the collective research question, sub-areas were identified, which lead to desired transformation effects. Figure 1 shows the four sub-areas (hereafter referred as modules) community, organization, business models, and ICT, which are arranged according to the used research methodology of the Belief-Action-Outcome model.

The Belief-Action-Outcome model (Coleman 1986; Melville 2010), which was developed specifically for research in the context of sustainability, is used as the basic structure of the research project. This comprises the following three research steps.

Beliefs First, the central expectations of stakeholders in rural areas must be identified. This involves collecting requirements for the provision of new innovative