



INSTRUMENTS SHAPING SUSTAINABLE MOBILITY OF URBAN RESIDENTS

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ABSTRACT

Urban development increases the demand for efficient, fast and safe ecological transport. Extensive development of urban transport system, in particular transport infrastructure, changed the point of view about transport needs. Research on the effectiveness of transport systems has accompanied the study of mobility for years. The development of modern technology, the need to increase transport efficiency and environmental awareness determined the development of principles and instruments of sustainable mobility. This paper discusses these instruments, their characteristics and application examples.

ARTICLE INFO

Available online 3 October 2016

Keywords:
sustainable mobility,
transport policy,
mobility instruments.

JEL: R42.

Doi: 10.19197/tbr.v15i3.40

INTRODUCTION

Growing transport problems in cities, congestion, an increase in the number of accidents and emissions of pollutants became the basis for establishing various documents to determine a new approach to the problems of development of transport policy in urban areas. Even 30 years ago, the dominant way of solving transport problems of towns and cities was to realize further infrastructure investments that can absorb the increasing traffic in transport. This was accompanied by the belief that economic growth must be associated with an increase in transport needs and demand, because transport as a branch of the national economy can be substituted only to a small extent (e.g. by the communication and connection processes).

A new approach to transport policy is the result of research proving that capital-intensive investments in transport are not able to solve the growing problems associat-

ed with the operation of transport systems. The new notion is conducive to the deepening budget deficit of the most developed countries, which encourages the search for solutions involving minor measures and focused on reducing the needs and changing travel behavior. The European Commission supports action plans for the implementation of sustainable urban mobility in the EU Member States. This is consistent with the objectives of the 2011 White Paper, i.e. to increase coordination between transport companies, transport organizers and decision makers of transport policy (Lopez-Ruiz, Panayotis, Demirel & Kompi 2013).

Road transport freight and passenger services face many problems: congestion, greenhouse gas emissions and local air pollution, noise, accidents and depletion of fuel. Taking into account the related economic, social and environmental situation, the current system of mobility can be seen in many aspects. Sometimes, the very notion of “sustainable”, and often different criteria and characteristics are attributed to the system. Talking of sustainable mobility should help to understand the social and economic situation without harming the environment and its resources (Nykvist & Whitmarsh 2008).

The technological progress also creates favorable conditions for the implementation of innovative solutions in the management of transport processes (the computerization of logistics processes, intelligent traffic management, low-floor and low-emission vehicles), forming the basis for intensification of development of transport solutions in place of capital- and area-intensive solutions. Also, the change awareness of the psychological, sociological, environmental and health effects of the increasing traffic meant that a possible solution to transport problems in the humanities was recognized, considering the impact of various factors (not just engineering – related to the construction of infrastructure and vehicles or economic factors) on the decision-making process for the selection of means of transport. As a result, under the concept of mobility management (mobility culture), the strategies and techniques for reducing the demand for traveling by car were developed under the influence of the needs and the commuting behavior of residents.

The result of many studies is a set of 12 indicators that constitutes the most important dimensions of sustainable mobility. These include: accessibility, financial outlay required of users, travel time, reliability, safety, security, greenhouse gas emissions, impact on the environment and on public well-being, resource use, equity implications, impact on public revenues and expenditures, prospective rate of return to private business (Mobility 2030. Full Report 2004).

The relationships between mobility instruments and individual travel behavior as well as their transitions towards sustainable mobility are analyzed by specialists, scientists and practitioners (Geerlings, Shiftan & Stead 2016). The aim of the research undertaken by the authors in this study is the identification of instruments of Mobility Management, demonstrating their diversity and scope of their use, and to determine differences in their functional efficiency based on the analysis of the instruments used in the practice of Polish and European cities.



MOBILITY MANAGEMENT IN SHAPING SUSTAINABLE MOBILITY

Mobility management is a generic term for strategies that allow for more efficient use of the transport system's resources. This action is more effective than the traditionally understood development of transport by building new roads, car parks, airports and other infrastructure facilities. Mobility management is the movement of people and goods, not just vehicles. Therefore, it should ensure priority for public transport, pedestrians and non-motorized travel, especially in congested urban centers (Litman 2003).

Mobility management is defined as activities related to the planning, organizing, coordinating and controlling the movement of people and goods with the use of available human, financial, material and information resources in order to influence attitudes, demand and travel behavior, leading to the use of alternative, in relation to cars, means of transport (Nosal & Starowicz 2010, p. 26).

The goals of mobility management include (Nosal & Starowicz 2010, p. 27):

- meeting the communication needs through a more efficient and integrated use of existing transport and urban infrastructure;
- reducing congestion by reducing the number and length of travels realized by car and reducing the demand for these trips;
- reducing the noise, air pollution and greenhouse gas emissions through the use of energy efficient vehicles and alternative fuels;
- improving the availability of means of transport by modern technical and technological solutions in vehicles and infrastructure;
- integrating different means of transport and improving the connections;
- increasing the economic efficiency of the transport system.

Thus, mobility management is shaping sustainable mobility. The public authorities seeking to facilitate sustainable mobility have a wide spectrum of measures from mobility management (Attaining Energy-Efficient Mobility in an Ageing Society, 2016).

The following instruments of mobility management may be distinguished:

- formal-legal and organizational;
- planning;
- investment;
- financial;
- others.

FORMAL AND LEGAL INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

Legal documents may have the form of acts and resolutions, rules or recommendations. The rules and recommendations for the development of sustainable mobility are the subject of national and EU documents.

The definition of a new culture of urban mobility was introduced in the Green Paper Transport Authority (adopted by EU countries in 2007) entitled "Towards a new culture for urban mobility".

Another document on the mobility was the 2009 Statement of the European Commission entitled "The Action Plan on Urban Mobility". Also, the 2011 White Paper enti-



tled “The Plan to Create a Homogenous European Transport Area – Towards a competitive and resource efficient transport system” was related to mobility. To date, the culmination of the work on mobility within the EU structures is the European Commission’s package of actions on the urban mobility supporting the actions in the field of sustainable urban transport developed in 2013.

A new culture of mobility is to seek to develop transport behaviors of urban residents which are compatible with the sustainable development policy, and thus ensure the reduction of CO₂ emissions from cars and public transport vehicles. The Green Paper on urban transport states that “action should be taken to make attractive and safer alternative, in relation to travelling by private cars, ways of moving, such as walking, cycling, public transport or riding motorbikes and scooters” (Zielona Księga, 2007).

The national documents also include a reference to the issue of sustainable mobility. The government’s report “Poland 2030” pointed to the need for adequate to transport potential and lower, compared with road transport, nuisance to the environment, using railway in serving urban areas, which is particularly important in relation to the prediction of their further development within about 30–40 km from the city center (Boni, 2009).

The National Development Strategy 2020 underlines the desirability of enhancing the quality of public transport, including taking the actions identified as the simplest, such as regulating traffic lights, no parking on the roads in the city center and simultaneous creating parking spaces in economically justified places, including in front of service points. The construction of ring roads in big cities is also planned in order to reduce the role of cars in the city.

The Transport Development Strategy until 2020 (with perspective until 2030) of 2013 highlights the need to strive to increase the role of public transport in urban transport, especially rail transport services in the regions and within the areas of agglomeration (Strategia Rozwoju Kraju 2020, 2012). The Transport Development Strategy also recommends the development of new forms of the society’s mobility, including traveling together and sharing vehicles (carpooling and carsharing) as well as using bicycles and walking on foot. The Strategy also pointed to abandoning travel plans as decisions of cities’ residents desirable from the point of view of transport policy (Strategia Rozwoju Transportu 2020, 2013).

The National Regional Development Strategy points to reducing the problem of congestion by increasing the number and share of passengers using public transport in major cities and their functional areas as the most important target for urban transport. In this regard, the need to support actions in the field of public transport including infrastructure, rolling stock and organizational solutions was also stressed. The development of public transport, including joint timetables and integrated tariff systems, was seen as important. The importance of increasing freight by rail transport in urban areas was also emphasized. Desirable transport behavior in cities was to promote walks and cycling trips (Strategia Rozwoju Regionalnego 2010–2020, 2010).

In the latest strategic document, the National Urban Policy 2023 adopted in 2015, “the achievement of sustainable mobility in the functional area of the city, understood as conducting the trip in such numbers and such length as is apparent from meeting the needs of the users with rational use of particular subsystems of urban transport. Rational use of subsystems means making such choices for travelers that do not result in

the overall balance excessive loss of time and excessive costs – incurred by the participants of travel, transport organizers and the entire community (expressed in the latter by the environmental and social externalities)” (Krajowa Polityka Miejska 2023, 2015) is considered as a target of local authorities in the field of transport and mobility. The implementation measures of this objective should be consistent and multi-faceted.

Strategic documents adopted by local government also indicate the role of a new mobility culture by (Uchwała, 1998):

- reducing and controlling traffic needs, among others by spatial policy (localization), taking into account the transport effects of placing particular functions of land use in a particular place;
- introducing a priority for public transport (widely understood);
- limiting the use of cars in the city center and unifying parking rules;
- creating an integrated urban transport system, including urban rail, and in particular unifying tariff-ticketing system in public transport;
- limiting the nuisance of transport by eliminating transit traffic through already developed areas where conflicts regarding area and transport are particularly visible;
- developing forms and means of transport alternative to car travel, especially in areas with limited capacity of the environment or limited transport accessibility;
- developing the cycling subsystem.

ORGANIZATIONAL INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

As long as formal and legal instruments shaping sustainable mobility are used by authorities at all levels, organizational instruments are the most frequently used at the local level.

In Polish cities, one can see examples of activities that encourage travel planning by residents in order to implement the so-called complex travels (Chowdhury, 2011) as one of the solutions to a new mobility culture. The idea is that the residents seeking to make optimum use of their time plan their day to avoid unnecessary movements, for example, immediately after work they may be handling their personal matters or recreational needs, taking their children to school as part of their journey to work or doing shopping on the way back home. Consequently, the total number of their travels is reduced. An interesting solution used in Gdańsk in the EU project Civitas Mimosa Plus (The “Walking Bus”, 2015) and in Gdynia in the Segment (Segment, 2016) project in 2012 decreasing the number of trips was “a walking bus”. The routes to and from school were established in the way that the largest possible number of children could join gradually in order to continue the journey together. Each time children were accompanied by at least one guardian (one parent or a person designated by the school or municipal authorities). Not only the number of trips was limited, but also the safety of the children was ensured, and the journey to school was more attractive to children due to the contact with other young people. The initiative to limit the number of trips very often comes from parents who bring their children to after-school activities. They communicate with the parents of other children in order to take several children at once, so in practice they use carsharing or carpooling.

In many cities the campaigns promoting replacing car trips with walking on foot or cycling as well as educational programs, debates on transport, which involved different environments, were implemented. An example of this activity was the Youth program carried out by the International Union of Public Transport in Gdynia and addressed to young people (YOUTH, 2009).

Mobility management is also associated with social activity of older people. The example of such activity is the realization of the AENEAS program in Kraków (the English acronym of the project entitled “Achieving Energy-Efficient Mobility in an Ageing Society”) (ANEAS, 2016). The elderly are recommended to travel, not by car, but using public transport in off-peak hours.

PLANNING INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

Rational choice in transport planning means acting in the best possible way considering the aims and constraints. Standard transport policies are not always eco-rational as these policies are very different in terms of costs and urban sustainable mobility. A rational approach is not always the right alternative, but is most probably nearer to the best solution also because it is more acceptable and follows some minimal requirements of rationality (e.g. quantitative method's evaluations) (Carteni 2014).

Rules and recommendations regarding sustainable mobility are also included in the planning documents. These include studies on spatial development of the country, regions, municipalities and agglomerations, strategies of transport development, plans for sustainable transport (called transport plans). An example of a planning document containing principles of sustainable mobility is the Transport Development Strategy in the Metropolitan Area of Gdańsk-Gdynia-Sopot, which states: “In order to mitigate the force of negative impact of the functioning and development of the transport system on the environment the appropriate actions to reduce the described trends should be taken, aiming to:

- reduce the demand for travels or their length;
- rational use of means of transport in the transport and over-metropolitan travels, metropolitan and municipal ones, with the fixed demand for travels.”

Reducing the demand for travel is the basis for mobility management. The main actions used here are planning activities and mobility management. Planning tools allow reducing transport needs (including decreasing the number of trips and the length of the journey), by stimulating the development of a proper use of development planning. For this purpose, it is desirable to integrate the planning and spatial development with the planning process and development of the transport system. Mobility management in the field of reducing the demand is primarily the preparation and implementation of mobility plans and promoting a new mobility culture” (Strategia transportu i mobilności Obszaru Metropolitalnego Gdańsk-Gdynia-Sopot do roku 2030, 2015).

A good example in this regard is Aberdeen (*Reducing the Demand for Travel*). Aberdeenshire Council has introduced a flexible working time system as a way to reorganize and achieve financial savings. In addition to this effect, four objectives were adopted to: increase productivity; more efficiently manage the assets, achieve better customer ser-



vice and improve the employer's image. They offer four different profiles (flexible, mobile, home and regular) and eight different workflows as part of its WorkSmart program. The rationalization program began at the end of 2011. It assumed to reduce the office portfolio from 98 to 53 offices. The Council is also in the process of planning a trip that will identify mobile and flexible working initiatives and will be given to the Local Transport.

INVESTMENT INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

In Poland, the actions shaping the new mobility culture are achieved through investments in infrastructure and rolling stock, through implemented ITS solutions in traffic management and organizational ones integrating urban transport in urban areas. Moreover, aiming to use public transport to a greater extent than at present and also the innovative ways of travelling, the conditions for the coexistence of these solutions are created. Such possibilities are offered by hubs integrated with Park and Ride (P+R) and Bike and Ride (B+R) parking lots, where one can change the individual transport to public transport. The development of the P+R system demands the costs (covered by municipal authorities) of establishing such car parks and their maintenance as well as taking actions to promote the P+R system. In many cities there are signs indicating free parking spaces in the P+R system (for example, in Sopot).

The set of investment instruments used in Polish cities is vast and combined with organizational instruments. For example, in the Metropolitan Area of Gdańsk–Gdynia–Sopot it includes (Strategia transportu i mobilności Obszaru Metropolitalnego Gdańsk–Gdynia–Sopot do roku 2030, 2015):

- construction, reconstruction and modernization of transport infrastructure in such a way as to encourage residents to use means of transport alternative to a car; in this regard one can distinguish:
- construction of interchanges, together with the relevant devices facilitating and encouraging to use public transport (the P+R, B+R car parks, systems of information about services, joint stops, etc.);
- construction of bicycle paths, the P+R car parks, facilities supporting cycling;
- construction of dedicated lanes for public transport;
- the purchase of modern rolling stock for public transport, increasing the attractiveness of traveling by this type of transport;
- modern ticketing systems for public transport;
- intelligent traffic management systems;
- integration of public and individual transport;
- introducing incentives for the joint travel by car (carsharing, carpooling);
- restrictions on the freedom of use of cars in towns and cities.



FINANCIAL INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

The sources of financing sustainable mobility may include (Nosal & Starowicz 2010, p. 26):

- own funds (budget) of the local government;
- the European Union programs, subsidies and grants;
- own funds of research institutions;
- charges imposed by public authorities on citizens, businesses, offices, institutions and other entities operating in the area covered by the sustainable mobility policy;
- own resources of the public transport operators (depreciation, profits);
- own funds of economic entities and other entities operating in the area covered by the sustainable mobility policy and cooperating with the local government with regard to the implementation of specific projects (companies, car rentals, offices and tourist organizations, administrators of real estate, courier companies, bike rentals, schools, universities, hospitals, offices, trade institutions, etc.);
- sponsorship;
- loans, leasing;
- commercial activities (fees for services – for example, bike rental and advertising).

In practice, more than one source of funding is used to prepare, implement and monitor the results of sustainable mobility. Most often the proportions between using own sources and external sources are determined by:

- the scope of the project;
- the duration of the project;
- financial assumptions contained in EU programs and grants;
- financial capacity of the local government's budget;
- the number of entities involved in the project.

The EU funds supporting the implementation of sustainable mobility usually come from the Interreg IVC, Civitas and research-funding programs, for example, Horizon 2020. The aim of many projects is their international extent. This means that the condition for the realization of the project is its simultaneous implementation in several cities in different countries. On the one hand, it allows to acquire many sources of own financing and, on the other hand, to create international standards for sustainable mobility and comparing the results, taking into account the specificities of particular urban areas and agglomerations.

OTHER INSTRUMENTS SHAPING SUSTAINABLE MOBILITY

Other instruments include:

- information and advice;
- educational activities;
- promotional activities;
- coordination.



Among other instruments shaping sustainable mobility the promotion of sustainable mobility, in particular public transport, is commonly used in Polish cities.

Promoting certain activities shaping sustainable mobility does not require special involvement of transport operators, but rather other areas. For example, the use of public transport is promoted by the organizers of this transport, while carpooling and carsharing – the organizers of these forms of travel, in particular employers. Promoting cycling movements in the city is characteristic for the municipal government, local government and non-governmental organizations, including pro-health ones. Employers also engage by creating in the workplace appropriate conditions for storing bicycles, providing space for changing clothing by employees and places for taking a shower.

An example of the involvement of municipal authorities in the promotion of environmentally friendly transport behavior is the realization of a project called SEGMENT in Gdynia. The program focused on “turning points in life” that lead people to challenge their previous transport habits. Considering new employment such a “turning point”, the project encouraged to analyze the possibility of commuting by bicycle. These activities were directed to people who started a new job within the last year. At the same time, the social conditions that encourage traveling to work by bicycle were created, namely bicycle parkings, changing rooms and shower rooms for cyclists were provided. This project was implemented also in 5 other European cities (Utrecht, Sofia, Almada, Athens and Aberdeen) (*Projekt SEGMENT*).

CONCLUSIONS

The aim of the research work has been fully implemented. It has been shown that the instruments of mobility management are characterized by diversity and varying degrees of influence on the development of sustainable mobility in cities. It verified the thesis about the need for their comprehensive use to achieve the objectives of the new culture of mobility.

The new culture of mobility requires the use of instruments with high efficiency. When choosing a set of tools to shape sustainable mobility one may use the previously verified instruments from the formal and legal, organizational, investment and financial planning spheres. The choice should involve the widest possible range of activities in order to make an effective impact on various segments of travelers and their travel behavior. It should be taken into consideration that the specificity of the transport needs and performing by the car not only a function of the means of transport, but also the attribute of social position, means that effective impact on the transport behavior of inhabitants must also involve restrictions on freedom of using cars in urban areas.

Currently, the used instruments of mobility management in Polish cities should be viewed positively and they should be developed.

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