INTELLIGENT MOBILITY IN SHAPING URBAN SUSTAINABILITY

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Abstract. *The policy for sustainable development for years has been a challenge for local authorities, enterprises operating within agglomerations or urban residents, in the area of ever-higher environmental standards. This is mainly due to the fact that the ongoing process of urbanization of the world, although it is a symbol of social evolution, raises numerous challenges related to intensive energy consumption, overloaded transport networks, water and air pollution, waste and a drop in the quality of life. The implementation of new technologies is currently perceived as a key factor in reducing greenhouse gas emissions, pollution or improving the efficiency of cities. These technologies must be smart, slim, integrated, cost-effective. They should play an important role not only in the field of environmental sustainability but also with regard to the well-being of citizens and financial stability. One of the key areas shaping smart cities, where contemporary technologies should be implemented, is transport. The effective transport operates in well-developed areas. This is one of the aspects of the functioning of urban areas, which is also an element and condition for economic growth.*

Keywords: *intelligent mobility; sustainable development; smart city; management of intelligent assets.*

Introduction

One of the most important socio-economic processes in the modern world is progressive globalization. According to the UN forecasts, it is estimated that by 2050, 66% of the world's population will live in cities. The growing concentration of the population and the innumerable relations between various entities determine a high degree of difficulty in the functioning of urban areas. Therefore, the specificity of contemporary urban centers refers not only to their physical structure but also to virtual networks, connections, and relationships (UN, 2014).

With the progressing urbanization, globalization, technological progress and the growth of ecological awareness and the development of a knowledge-based economy, the search for concepts and models of effective functioning of cities has begun. One of their main assumptions is the achievement of environmentally and socially and economically rational relations between the functioning entities. One of such ideas is smart growth, which task is to minimize the costs and inconveniences resulting from the growth of cities. For some time, technologically advanced cities striving to save resources have been distinguished. Shaping a smart city is a long-term process and requires a well

thought-through way of functioning of its areas, among which are (Sikora-Fernandez, 2013, p. 85):
1.Economy (smart economy).
2.Transport and communication (smart mobility).
3.Environment (smart environment).
4.People (smart people),
5.Management/governance (smart governance).
6.Quality of life (smart living).

City centers recognized as smart cities must, therefore, have appropriate features, the importance of which depends on the direction of development in a given spatial area. Creating smart cities in the above spheres results directly from the postulates proposed by contemporary urban communities that deal with unfavorable phenomena on a daily basis. These are mainly road traffic, noise, security or weakening of social ties.

What is more, nowadays collaboration between self-government bodies and institutions as well as public utilities with internal and external entities, aimed to trigger required changes in attitudes and behaviors and decisions of various target groups, is a reflection of execution of marketing activities (operations, ventures, campaigns). Exchange of values between pairs of units or territorial groups means acquiring specific resources, winning the favor of people and/or approval of offered environmental assets (social, investment, tourist, economic etc.) in return for relatively equivalent assets delivered in a returnable way including material, financial, information and emotional assets. All these activities in self-government units lead to an intelligent way of thinking and create smart societies (Wereda at al., 2016, p.138).

One of the key areas shaping smart cities, where modern technologies should be implemented is transport. It is one of those aspects of the functioning of urban areas, which is also an element and condition for economic growth. Effective transport operates in well-developed areas, equipped with the necessary elements. The economy stimulated by transport generates ever greater needs resulting from the growing production capacities and greater consumption of the society. An efficient transport system often determines the attractiveness of countries, regions, and cities. However, its organization in urban space, where there is a high population density, is an extremely difficult task (Kummitha & Crutzen, 2017, p.48).

Transport problems of contemporary cities

In recent years the development of digital technology is fast becoming a pervasive feature across a wide variety of products. Equipped with the ability to sense, store and communicate information about themselves and their surroundings, these ‘intelligent assets’ are posed to unlock tremendous opportunities for businesses, public organizations, and individuals, especially for a standard way of living in a sustainable environment (Wereda & Kornec, 2016, pp.133-134).

The necessity of thorough transformations of city structures and public spaces is to a large extent the consequence of many destructive processes that began to appear with the increase in the number of cars. This is, inter alia, the disintegration of cities, i.e. the process of spatial disintegration, suburbanization - the city's development phase consisting in the depopulation of the center, the cost of suburban development, its result

is the development of the entire city transport network and infrastructure development in suburban areas, playing the role of urban dormitories. Along with the deteriorating quality of life resulting from the chaotic development of transport, there is a reorientation of local authorities' actions for sustainable and intelligent solutions not only in transport but the entire urban logistics (Malasek, 2016, p.878). This is one of the main challenges because, as estimated by the Ministry of Environmental Protection, 30% of the total pool of pollutants emitted into the environment comes from transport, especially from road transport, but in cities, the share of transport pollution is much higher, it can be approx. 70 % even up to 90%. In the light of such alarming data, it is necessary to count losses caused by transport, especially those losses that are not suffered by the interested parties, but the whole society (Pajak, 2018).

One of the main problems and still not solved is individual communication. As a means of transport, it facilitates relatively free movement, enabling efficient organization of family and professional life. Being, especially in Poland, a particularly valuable good, a determinant of social position and abundance, many people cannot imagine life without a car (Parysek, 2016, p.12). Entities participating in transport processes, through attitudes, choices, consumption patterns, affect the operation of the transport system. It would seem that the quantitative and qualitative development of road infrastructure is one of the solutions to this problem. However, as many researchers have noted, the concentration of activities related to the improvement of the offer for individual transport leads to a decrease in the attractiveness of public transport. The effect of this is undesirable and excessive demand for further infrastructure investments related to the operation of both individual car transport and public transport (Litman, 2018). This action leads to a vicious circle (Figure 1) including higher infrastructure maintenance costs, environmental degradation, and poor quality of life.

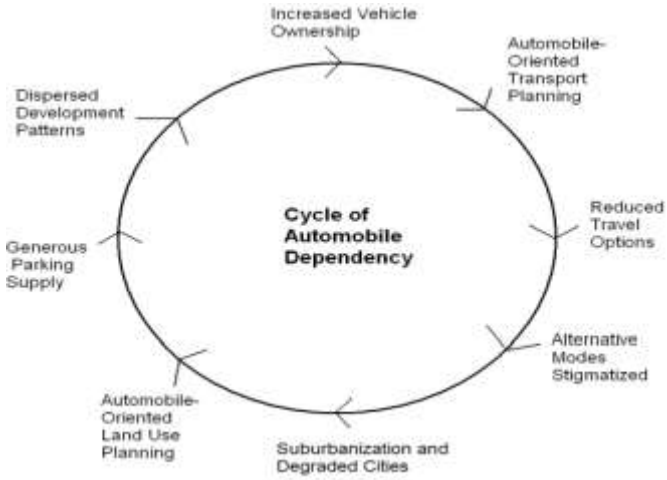

Figure 1. A vicious circle of increased dependence on a passenger car (Litman, 2018)

The car as an element of the spatial development of the city is at the same time the cause of the increase in the city's operating costs and problems faced by pedestrians and city authorities. The size of issues related to the nuisance resulting from the functioning of road transport in the urban space tends to take measures limiting its impact on the quality of life. These projects should be multi-span, focusing on simultaneous

implementation of many tasks to maximize the ability to achieve the assumed goal (Paundra et al., 2017, p.121).

In Poland, this problem is particularly visible. With the entry into the structures of the European Union, our country has become a beneficiary of many subsidies, within which transport infrastructure is being developed. Along with the development in Poland, there are also passenger cars. In 2015, the motorization rate in our country was much higher than in the entire European Union and amounted to 546 cars per 1000 people (in the EU 497 items per 1000 people). Among the largest cities in Poland (over 200,000 inhabitants), the largest indicator is observed in Warsaw, Katowice, Poznań, and Wrocław (Table 1) – data based on the Central Statistical Office in Poland.

Table 1. Motorization indicator in Polish cities with a size of over 200,000 residents in 2009-2016

CITY	YEARS								Growth dynamics
	2016	2015	2014	2013	2012	2011	2010	2009	2016-2009
Warsaw	681	645	620	598	580	565	548	535	21,4%
Krakow	585	557	534	521	503	486	467	463	20,8%
Lodz	525	502	483	466	448	434	408	389	25,9%
Wroclaw	632	300	575	558	540	525	498	487	22,9%
Poznan	660	625	601	578	554	538	514	515	21,9%
Gdansk	572	552	543	523	509	496	475	471	17,6%
Szczecin	508	487	466	449	434	421	400	398	21,6%
Bydgoszcz	549	529	510	500	486	473	462	462	15,8%
Lublin	506	483	463	447	425	410	387	379	25,0%
Katowice	668	632	599	571	540	516	491	484	27,5%
Bialystok	413	394	377	365	355	345	327	315	23,7%
Gdynia	567	542	521	503	484	471	449	441	22,2%
Czestochowa	519	496	489	467	453	442	420	406	21,7%
Radom	471	445	427	413	400	388	371	355	24,6%
Sosnowiec	526	509	495	483	468	453	435	412	21,6%
Torun	490	470	453	441	428	417	403	396	19,1%

The functioning of the car transport is the main reason for the increase in the costs of the operation of urban centers and the problems faced by pedestrians and authorities. The size of issues related to the nuisance resulting from the functioning of road transport in urban space is also conditioned by the quality of moving vehicles. Unfortunately, in Poland, more than half of the passenger cars are older than 15 years (Table 2) – data based on Central Statistical Office in Poland.

Table 2. Age structure of cars in Poland in 2014-2016

AGE OF CARS	YEARS		
	2016	2015	2014
1-3	6,1%	5,8%	5,8%
4-7	7,4%	8,1%	8,9%
8-11	13,3%	13,7%	13,7%
12-15	16,7%	17%	18,5%
16-20	22,9%	22,7%	21,8%

AGE OF CARS	YEARS		
	2016	2015	2014
21 and more	33,6%	32,7%	31,3%

Compared with the new generation cars, old vehicles are much louder, emit more amounts of fumes, and are less safe. The age of vehicles together with the growing motorization rate adversely affects the quality of life in cities. One of the fundamental inconveniences is continuous noise, which the main emitter is road transport, and in turn: air, industrial, neighboring, as well as the noise of mass events.

Data from 2017 from acoustic maps prepared as part of the third round of mapping show a significant exceeding of the permissible noise level in urban areas. The descriptive part of the map shows that in Krakow almost 10%, in Bialystok almost 12%, in Warsaw about 6%, and in Gdansk almost 2% of residents are exposed to excessive levels of road traffic noise (Acoustic Map of Warsaw, 2018; Acoustic Map of Krakow, 2018; Acoustic Map of Bialystok, 2018; Acoustic Map of Gdansk, 2018). However, these results do not reflect the fully analyzed problem. In 2015, research carried out at the request of the European Parliament indicated that dissatisfaction with noise levels is reported by more people than those exposed to above-standard noise (Figure 2).

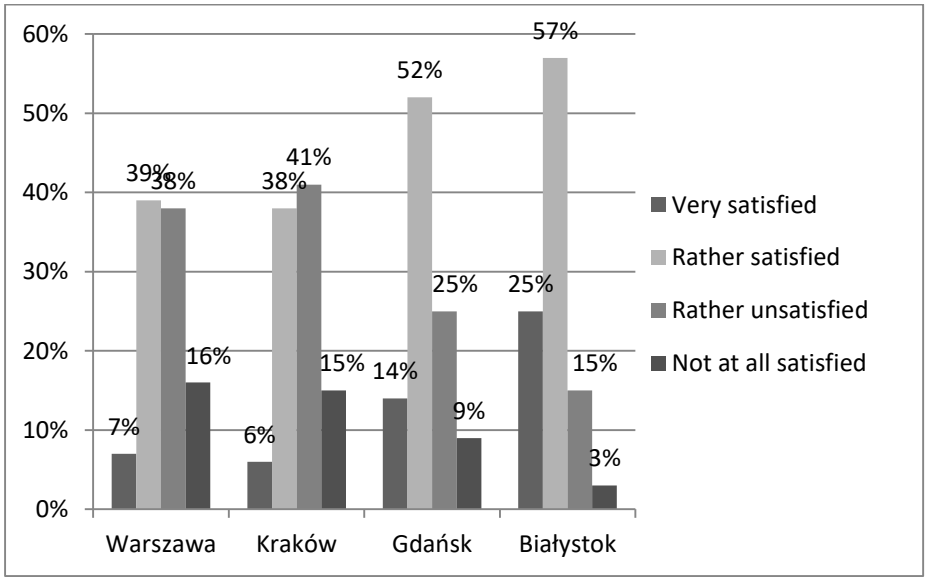

Figure. 2. Assessment of noise level in selected Polish cities in 2015 (Eurobarometer, 09.04.2018)

The highest percentage of people for whom noise level is a significant problem is in Krakow and Warsaw, where over 50% of residents are dissatisfied with the acoustic climate. In these cities, there is also the largest number of vehicles per 1000 inhabitants. In Bialystok and Gdansk, the level of dissatisfaction is much lower. Białystok is also the city in which the motorization index is the lowest for the group of cities over 200,000 residents.

Another important problem of private communication is air pollution. Cars, next to individually heated buildings, are the main emitter of substances for air shaping the level

of pollution. Among the cities studied, the most people dissatisfied with air quality are in Krakow and Warsaw (Figure 3).

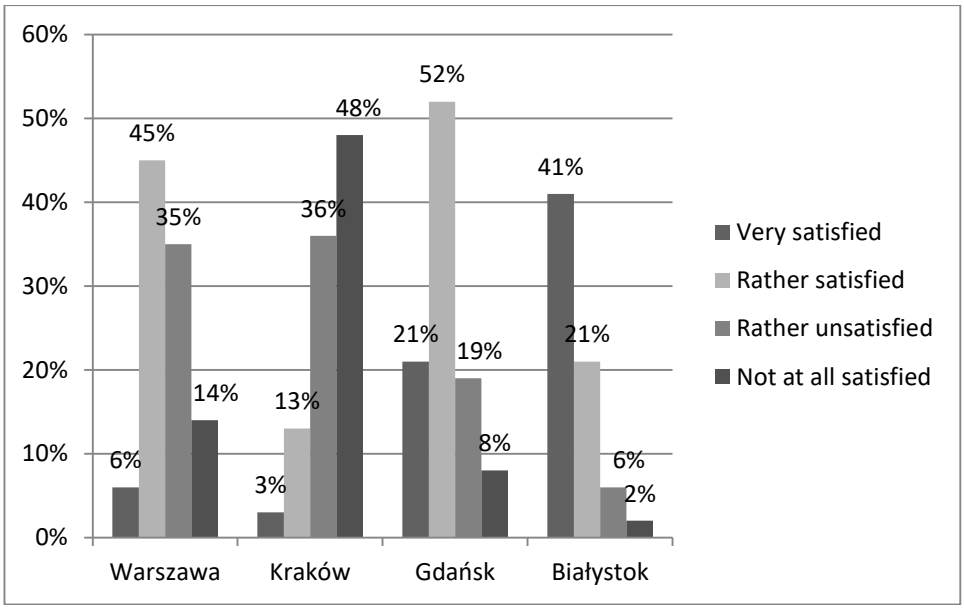

Figure 3. Air quality assessment in selected Polish cities 2015 (Eurobarometer, 09.04.2018)

It should be stressed that road transport in Warsaw is the dominant source of air pollution. The communal-living emitters are located on the outskirts, not like in Krakow - all over the city. The capital has a well-developed gas and heating network, to which the vast majority of infrastructure is connected. With this in mind, local air pollution in Warsaw is emitted in 60-80% by road communication (Urbanowicz, 2017).

The problems of noise and exhaust emissions are also conditioned by the volume of traffic, which is growing due to the increasing motorization rate. Traffic load of motor vehicles, of course, is not even for the whole network, it increases with the importance of roads in the functional system and in cities, causing traffic jams. Despite the fact that in recent years the congestion rate for Polish cities is constantly declining, they are still on the list of one of the most congested cities in Europe and in the world. According to the TomTom Traffic Index report from 2017, Lodz is in 5th place just behind Chongqing (China), and in front of such agglomerations as Istanbul, Los Angeles, and Moscow. Congestion on the streets of Lodz results in an increase of travel time by an average of 51%, and during the afternoon rush hours by up to 88% compared to a situation in which traffic jams are absent. In the world ranking in the first hundred, there are seven Polish cities: Lodz (5th), Lublin (34th), Krakow (48th), Warsaw (50th), Wroclaw (63th), Poznan (69th), Bydgoszcz (83rd place) (TomTom Traffic Index, 2018). Despite the fact that the level of congestion has been declining in recent years, it remains at a high level (Figure 4).

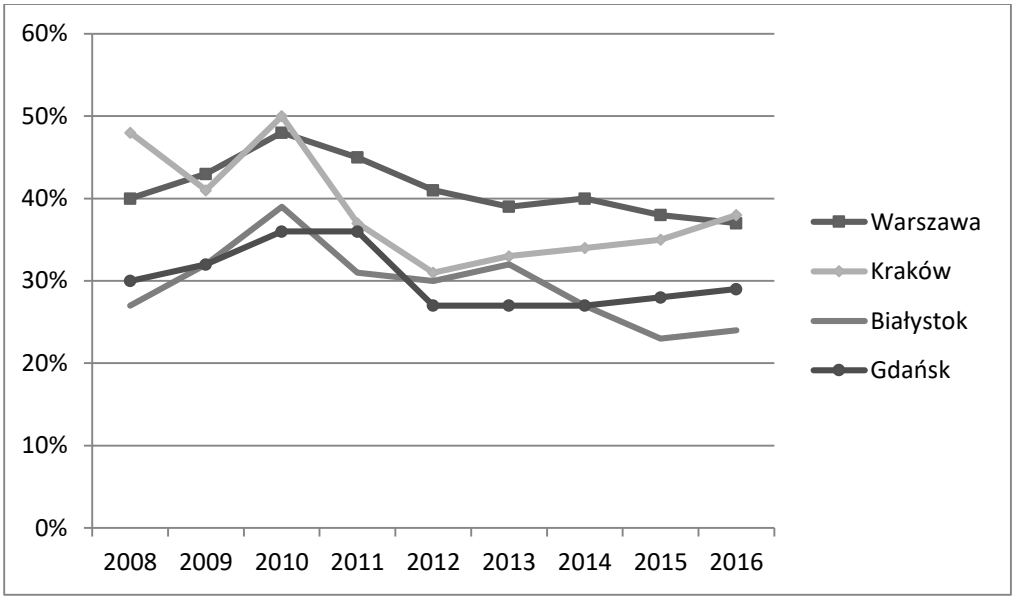

Figure 4. The level of congestion in selected Polish cities in years 2008-2016 (www.tomtom.comm, 09.04.2018)

The size of issues related to the nuisance resulting from the functioning of road transport in the urban space tends to take measures limiting its impact on the quality of life. These projects should be multi-span, focusing on the simultaneous implementation of many tasks to maximize the possibility of achieving the assumed goal.

Intelligent solutions in urban transport

Optimization of the transport system in urban space can bring improvement in the quality of life by minimizing external costs and impact on the natural environment as well as increasing road safety. The priorities of the EU transport policy in this respect relate primarily to (Jaroszyński & Chłąd, 2015, p.166):
•rationalization of the use of individual vehicles;
•increasing the attractiveness of public transport;
•introduction of modern traffic control and traffic control systems;
•exchange of good practices in the aspect of using existing city infrastructure.
To increase the effectiveness of the proposed solutions, comprehensive models of cities have been developed for many years in which transport and mobility of people is one of the most important links. One such concepts is a smart city.

The smart city concept in the EU documents originally concerned only development in the field of energy and climate objectives (European Initiative on Smart Cities, 2018). Currently, attention is also focused on the use of digital technologies to increase efficiency and improve living conditions, save resources and social activation. The complex nature of this concept causes a heterogeneous understanding of the term.

Selected definitions presented in the literature are defined in table 3. Selected definitions of "smart city" from the literature are presented in table 3.

Table 3 Selected definitions of "smart city"

Source	Definition
Hall et al. (2000)	An urban center of the future, made safe, secure environmentally green, and efficient because all structures–whether for power, water, transportation, etc. are designed, constructed, and maintained making use of advanced, integrated materials, sensors, electronics, and networks which are interfaced with computerized systems comprised of databases, tracking, and decision-making algorithms.
Thite (2011)	Creative or smart city experiments [...] aimed at nurturing a creative economy through investment in the quality of life which in turn attracts knowledge workers to live and work in smart cities. The nexus of competitive advantage has [...] shifted to those regions that can generate, retain, and attract the best talent.
Caragliu, Del Bo & Nijkamp (2011)	A city that is smart when investments in human and social capital and traditional transport and modern ICT infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory governance.
Nam & Pardo (2011)	A smart city infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions, deploy resources effectively, and share data to enable collaboration across entities and domains.
Lombardi et al. (2012)	The identified clusters are smart governance (related to participation); smart human capital (related to people); smart environment (related to national resources); smart living (related to the quality of life); and smart economy (related to competitiveness).
Bakici, Almirall & Wareham (2012)	Smart city as a high-tech intensive and advanced city that connects people, information and city elements using new technologies in order to create a sustainable, greener city, competitive and innovative commerce, and an increased life quality.
Townsend (2013)	[…] define smart cities as places where information technology is combined with infrastructure, architecture, everyday objects, and even our bodies to address social, economic, and environmental problems.
Scholl & Alawadhi (2015)	smart city (definition) is a programmatic term that summarizes the creation, integration, combination, development, and effective leverage of resources and assets towards innovation, attractiveness, competitiveness, sustainability, and livability of an urban space facilitated and accelerated by the ubiquitous use of advanced information and communication technologies with local governments playing key investigating roles in this process.
Lara et al. (2016)	A community that systematically promotes the overall well - being for all of its members, and flexible enough to proactively and sustainably become an increasingly better place to live, work and play.
Business Dictionary (2018)	A developed urban area that creates sustainable economic development and high quality of life by excelling in multiple key areas; economy, mobility, environment, people, living, and government. Excelling in these key areas can be done so through the strong human capital, social capital, and/or ICT infrastructure.

There are various approaches in the subject literature; various areas of application of modern methods of management and use of technology are exposed. On the one hand, smart city researchers focus on technical and environmental aspects of city management. They emphasize the use and importance of modern technologies in everyday urban life. In the same time cooperation with the business actors are valued (Pinzaru, Zbuchea, & Vitelar, 2018). As a result, innovative transport systems are created, logistics processes are optimized, green and efficient energy systems are created. The authors investigated this aspect of the functioning of cities based on the smart concept in modern technologies recognize the possibility of increasing the efficiency of services and improving the quality of life and reducing pressure on the environment. However, the elements defining the concept of the smart city only in a direct context with information and communication technologies are insufficient. Therefore, apart from the aspect of modern technologies, attention is paid to the role of human capital, education, and creativity in the development of smart cities. Participating management is very important in this respect (Ahvenniemi et al., 2017, p.236). As noted by Caragliu et al., a smart city is when investments in human capital, information, and communication technologies, transport, and infrastructure are carried out through wise and sustainable participative management of available natural resources (Caragliu, Del Bo & Nijkamp, 2011, p.66). Lombardi's social aspect of building smart cities also involves an adequate level of security and preservation of cultural identity. Lombardi describes these elements as "soft factors" for shaping smart cities (Lombardi et al., 2011, p.4). According to the Correia and Wünstel (2018) approach, a smart city is capable of combining physical capital with human capital and developing better services and infrastructure. It makes it possible to combine technologies, information and political ideas into an organized city and services improvement program.

One of the areas of building smart cities is transportation. Urban mobility plays a key role in this process. In particular, these undertakings should take into account the need to maintain appropriate proportions between the social, environmental and economic aspect, constituting the fundamental pillars of sustainable development, which are one of the conditions for shaping a smart city. It is, therefore, an essential element influencing the other areas of the smart city (Sciullo & Occelli, 2013, pp.293–309). The basic goals of smart mobility can be (Bencardino & Greco, 2014, p.47):

- pollution reduction;
- limitation of traffic;
- improvement of traffic safety;
- improving the average speed of vehicle movement;
- minimization of transport costs.

The condition of the transport system in Polish cities is diverse. It results from the differences in the size of cities, in the levels of motorization, in the quality of technical infrastructure, in the rules of organization of transport by public transport, or in the degree of preparation and implementation of transport development policies and programs. An important role in the functioning of the transport system in cities is played by collective communication (Ministerstwo Transportu, Budownictwa i Gospodarki Morskiej, 2013).

However, with the development of technologies and concepts of intelligent transport systems, they are increasingly implemented in Polish cities. As part of the intelligent transport system implemented in May 2015 covering the entire city of Bialystok, traffic lights control was implemented at 120 intersections, the priority of passage for public

transport buses, variable message boards informing about traffic obstructions, detours and accidents. Thanks to the above elements, both car drivers and passengers of public transport can now move more efficiently around the city. The system constantly analyzes the traffic and adjusts the functioning of traffic lights on a regular basis. The information from the system is publicly available on a special website, which enables current tracking of traffic in the city and facilitates travel planning. The system collects the above information, determines the traffic forecasts, and on their basis and historical data, it optimizes the management of traffic lights on an ongoing basis. It is a highly innovative solution, assuming a priority for public transport. As part of the construction of an intelligent transport system in Bialystok, at the intersections of over 120 CCTV monitoring cameras, the system operator can monitor the traffic situation on an ongoing basis and, if necessary, analyze events based on archived video images (Tomaszewska, 2015, p.326).

In Krakow, the system plays its role mainly in trams, buses, and trains. In fact, it looks like the means of urban transport reaching the intersection send a signal to the central computer, which in turn compares the time of the actual presence of the vehicle before the intersection with the time appearing on the timetable. If a given public transport means is delayed, the green light is extended or lights up faster to allow the vehicle to pass freely. In addition, there are passenger information systems, passenger services, monitoring systems, passenger counting systems, communication systems, etc. in the city. Passengers can use electronic boards at information stops, for example, they see how much time they will have to wait for the bus and what it is its delay. For ITS drivers it means the possibility of informing about currently jammed streets. Information is also sent to operators or security services. Thanks to this, for example, the operator knows about the breakdown of the vehicle before it reaches the stop.

Municipal vehicles are also equipped with central driver or driver modules, which include information for the driver about the level of energy consumption. At the same time, the appropriate application sends information to the operator, who can reward the driver of the vehicle for economical driving. In addition, ITS is constantly supported by the GPS system (Barwiński & Kotas, 2015, p.28).

The "ITS Poznan System" project implemented in the city of Poznan is located in the so-called "western area" of the city (Grunwald and partly Jeżyce districts). Its subject was the implementation of an integrated intelligent traffic management system in Poznan in the western area of the city. The intelligent transport system in Poznan currently covers 115 traffic lights and a public transport fleet of 540 tram and bus vehicles in total. In addition, system users have access to real data about traffic in the city obtained from measurement stations, thanks to which they can more effectively plan a journey through the city through collective transport. The profits resulting from the functioning of this system are primarily determined in the social and economic spheres. The biggest share in the benefits is to have savings due to reducing the costs of the travel time of users. Such profits are immeasurable and it is difficult to estimate their value in money, but the benefits and reimbursement of incurred investment outlays will certainly outweigh its costs (Gawełek, 2018).

The effect of the ITS system implementation is to shorten the timetable times of trams. On the tram from Junikowo loop through ul. Grunwaldzka to the Baltic Sea accelerated by 2 minutes - from 17 to 15 minutes. Also for 2 minutes the travel time from the

Górczyn loop to the West Railway Station has been shortened. In turn, from Rondo Rataje to ul. Półwiejska, at the rush hour, the tram passes by a minute faster, and after the peak - 2 minutes. In comparison to 2016, the punctuality of buses and trams also improved. In 2017, trams went on punctuality 88.79%, whereas in the year before this rate was 81.30%. A similar increase occurred in terms of bus punctuality - 78.23% in 2017 and from 71.60% in 2016. Public transport in Poznan is also more efficient due to changes in traffic organization. (Poznan: Tramwaje…, 2018).

At present, Warsaw has a fairly limited integrated traffic control system covering a small area of the city center. The city also gave up its resources in the past years with funds for its expansion. At the moment, the integrated traffic control system includes Aleje Jerozolimskie, Powiśle, and sections of Wisłostrada. The city prepared a project to extend the system by another 150 intersections, some of which - incidentally - do not meet the current legal requirements for the functioning of traffic lights. However, the idea of developing a traffic control system has not fallen and it is planned to develop it. The analysis is to take into account the latest trends and tendencies in this type of solutions in the world, as well as numerous investments already made in Warsaw. There are several partial or point investments implemented by ZDM, investments are also carried out by Warsaw Trams, which interfere with infrastructure very much, often building signaling from scratch.

Another example of the Polish agglomeration in which attempts are made to implement intelligent transport systems in the area of the Tri-City, where the Tristar system is developed. The benefits of its launch are primarily related to:
•improved capacity of communication arteries in the Tri-City,
•shortening travel times by individual and collective transport,
•reduction in the number of accidents (resulting, among others, from entries at a red traffic light),
•driver satisfaction (lower fuel consumption, time saved),
•satisfaction of residents (more efficient collective transport, the quick finding of a free parking space, reduction of air pollution).

According to data from Gdansk Municipal Investments and the Road and Green Board in Gdansk, buses, trolleybuses, and trams have accelerated by about 9%, but it is difficult to find confirmation of these results in an everyday travel. Even if we compare the upper limits of acceleration, it will turn out that the cars have gained twice as much as communication. The Tristar system allows recognizing public transport vehicles and even controlling compliance with the timetable. However, this did not cause a significant acceleration of buses, because even despite successful tests, priority is given only to delayed vehicles (Sielski, 2017).

An important issue in building intelligent mobility is the skillful shaping of residents' preferences and behavior. This applies not only to the transition from a personal car to public communication, but also solutions based on the principles of economy of sharing in urban transport, such as the use of vehicles (car-sharing) and space in cars (car-pooling). The proper availability of means of transport in these systems in time and space is essential in the dissemination of these issues (Qu, Yu & Yu, 2017, p.686). Recently, the car-sharing service is available in the largest Polish cities. The local and regional authorities of Warsaw and Wroclaw, having experience in the implementation of public bike rentals, analyzed the possibility of introducing urban car-sharing.

However, as it turns out, from the legal side it was a big challenge. At the same time, what turned out to be difficult for local government administration was relatively easy for a private entity. At the beginning of October 2016 in Krakow, traditional car rental - Express, launched a new brand - Traficar, offering the first regular car-sharing in Poland. Traficar originally offered 100 Opel Corsa vehicles available in Krakow (Połowianiuk, 2016). Currently, this service is offered by several entities in the largest cities of Poland, offering its clients more than 2,000 vehicles (Table 4).

Table 4. The size of the fleet of selected car-sharing services in Poland at the end of 2017

Lp.	Operator	Number of cars
1	Traficar	1100
2	4Mobility	330
3	Panek CS	300
4	Vozilla	200
5	Click2Go	100
6	Lubelski Samochód Miejski	25
7	Omni	10

Thanks to the high availability, network coverage, transparent and flexible prices, as well as the availability of cars of various classes, car-sharing fulfills many demands made so far only by private individual transport, thus making it an attractive alternative.

The use of contemporary technologies in the economic, social and environmental sphere can also effectively reduce transport needs using a passenger car. Communication and information technology can successfully replace everyday business trips, official matters (bank, administrative matters, etc.), stationary shopping or personal meetings. Bearing in mind the aspect of "indispensable mobility", local self-government should try to limit the need to use cars with such solutions as better communication, attractive public transport or modern land development (Malasek, 2016, p.878).

Conclusions

Cities, in which undesirable phenomena of high traffic, air pollution, high acoustic nuisance, degradation of the landscape and excessive, chaotic growth of agglomerations exist, are considered unfriendly not only for people but also for the functioning of business entities. Therefore, the management of the urban transport system in the area of people should be an integral part of the urban development policy. The task of local government authorities, in addition to creating economic conditions conducive to the innovation of enterprises, is also taking care of the city's development in the social and ecological sphere. At the same time, it should be emphasized that Poland is in such a moment of economic development that the quantitative and qualitative development of road infrastructure is necessary to create an efficient transport system. On the one hand, it allows for transit outside of urban centers, and on the other hand, it encourages the use of modern communication routes. That is why it is very important to develop intelligent public transport and a system of shared use of cars that efficiently meet the transport needs of residents of urban centers. It should be remembered that each city has its own specificity and the proposed solutions should also be adapted to the conditions prevailing in it. In the field of intelligent mobility, one should remember not only about the need to develop intelligent forms of transport, but also the needs of residents should be taken into account because huge investments in smart technologies

can be made, which will not bring tangible results. An intelligent city transport system is one that satisfies primarily local transportation needs in an economically, socially and ecologically effective way. Modern technologies can only be effective if their users can use them efficiently. Therefore, the priority in the aspect of building smart mobility should be system consultations with residents, in which technologies will play a supporting role.

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