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Challenges for Urban Sustainable Mobility – Gdynia Maritime University Case Study

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Abstract: The sustainable development of the cities represents one of the major challenges for the future of the planet in the 21st century, relatively to the contribution and adaptation to climate change, natural resources consumption, energetic transition, population mobility, welfare and security, pollution, the global economic growth. Tri-City, as many of contemporary agglomerations, faces lots of challenges connected with human negative impact on the environment, health and the city space. The mobility of people is one of them. The quality of transport in Gdansk, Gdynia and Sopot is getting worse because of the excessive use of cars, non-integrated public transport system, insufficient use of ecological transport, as well as uncontrolled urban sprawl. The objective of the paper is to present sustainable mobility planning challenges in the agglomerations at the example of seaport city Gdynia. To check the necessity of creating a new mobility pattern for important traffic generators, a research study has been carried out. The pilot survey research has been made among the staff and students of one of the biggest institutions in the city - Gdynia Maritime University. The research tool was based on an anonymous questionnaire containing a set of questions such as: the use of mode of transport, transit and parking problems, as well as the awareness of sustainable mobility. The survey results indicate that there is an unsustainable model of travelling among the academic community and transport's behavior should be changed in order to implement the sustainable mobility concept in practice.

Keywords: contemporary agglomerations' challenges**,** sustainable development, urban mobility, transport system.

JEL codes: N74, O18, R11, R41, R42

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1. Introduction

Development of civilizations has some negative impacts on the society nowadays. One of the biggest challenges is the increasing mobility of people and goods, caused by technical and economic developments during the last decades of the millennium (WUP-2014 2016). The transport sector has contributed to major external costs expansion during this period (Niches, 2016). As a result, modern agglomerations and cities face many challenges such as congestion,

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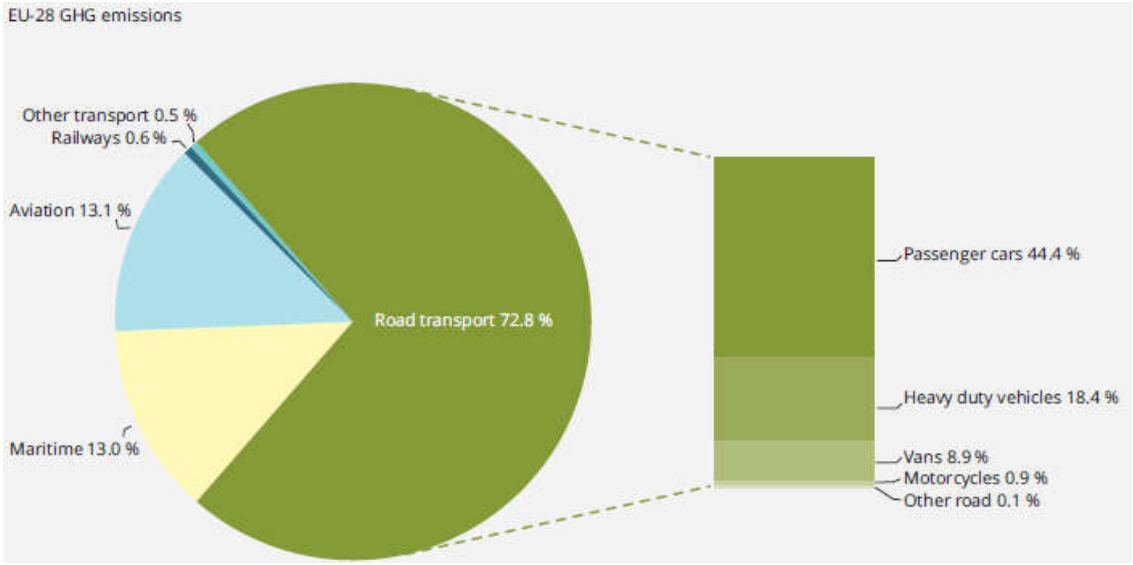
growth of number of cars or non-integrated and non-green public transport(Allen & Browne, 2016). Furthermore, there are some processes like urbanization, suburbanization or urban sprawl that are not connected to transport directly, but making the situation more dramatic. Tri-city (Gdansk, Gdynia, Sopot) face all of these problems. Despite the extensive public transport network and the promotion of alternative ways of traveling, for example, cycling, congestion is maintained at a high level. The number of trips made by car increases, however, the number of bicycle trips too. Not the best effectiveness and attractiveness of public transport is caused by insufficient number of connections and their scheduled integration, as well as the lack of full ticketing integration.

The objective of the paper is to present sustainable mobility planning challenges in the agglomerations at the example of seaport city Gdynia A research study has been carried out among the staff and students of one of the biggest institutions in the city - Gdynia Maritime University. The results of the study indicate many challenges with regard to sustainable mobility, however, leave a chance to meet them.

2. 21st century agglomerations mobility challenges

Nowadays, many contemporary agglomerations face lots of challenges connected with human negative impact on the environment, health and the city space (McLaren D and Agyeman, 2015). Transport, industry, agriculture, power plants, household and waste management all contribute to air pollution (White Paper, 2011). The mobile sources such as cars, buses, planes, trucks and trains account for 68,9% of CO_2 emissions in Europe (European Environment Agency, 2008:7). Although emission of variety of chemical elements have diminished since 1990, not all compounds' emissions have sufficiently decreased to meet air quality standards in many urban areas, for example nitrogen oxides (European Environment Agency, 2015:9). Moreover emissions of greenhouse gas (GHG) from transport is still high, meeting the 2050 EU transport policy target implies a reduction of two-thirds from current levels (European Environment Agency, 2016: 9). Road transport accounts for more than 72% of the transport GHG emissions (figure 1).

Figure 1. Share of EU-28 transport GHG emissions by mode in 2014

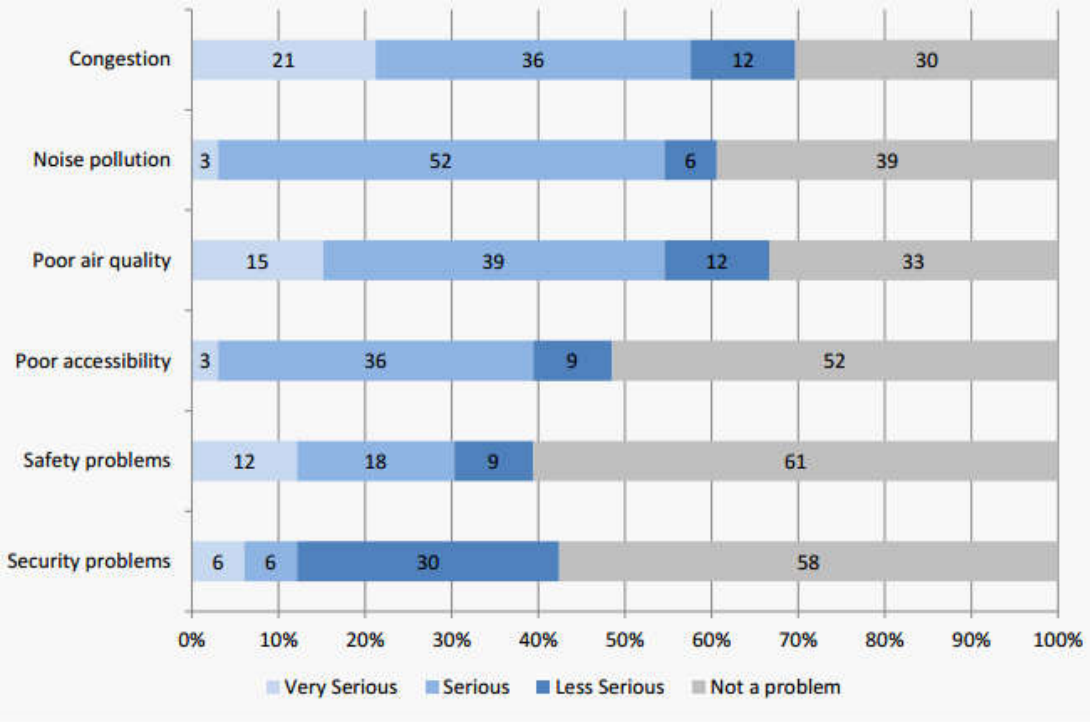


Source: European Environment Agency, 2016:17.

Transport in the EU is dominated by motorized modes, the private cars and trucks. European cities have multiple related transport problems specific to local context. Both noise pollution and poor air quality have become severe problems that concern over 50% of European cites, however the biggest challenge is congestion, often located in and around urban areas (figure 2). The European Union Strategy for Sustainable Development pointed transport congestion as one of the main threats of unsustainable trends (European Platform, 2016). The document encourages use of more environmentally-friendly modes of transport (Commission of the European Communities, 2001: 4-6). However, congestion in Europe has been increasing and costs nearly EUR 100 billion, or 1% of the EU's GDP, annually (European Commission, 2017). Many factors contribute to growing traffic, the most significant of them are:

- growth in the number of inhabitants living in cities and suburbs;
- urban sprawl and suburbanization process;
- growth in the number of cars, both private's cars and heavy duty vehicles;
- growth of demand for journeys and commodity's drops;
- extension and modernizations of transport infrastructure.

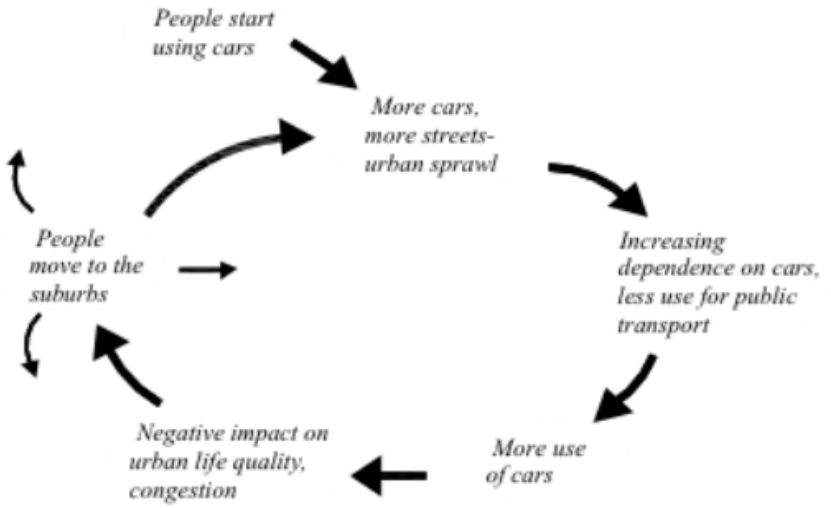
Figure 2. Transport problems in European cities



Source: European Platform of Mobility Management.

Because of urbanization process millions of people have migrated to the cities since the first decade of the 20th century. In the result new trends have appeared: urban sprawl and suburbanization. Both of them are related to each other. Urban sprawl describes the spreading of urban development into neighboring regions (undeveloped land near a city). Suburbanization is related to urbanization – population migrates from central urban areas into suburbs. The inhabitants living in neighboring regions often start to use cars to journeys because of convenience or lack of proper public transportation connections (figure 3). That process causes many problems like congestion, noise, pollution etc.

Figure 3. Use of automobile and sprawl



Source: Bekele, 2005:9.

The issue of high level of air and noise pollution in agglomerations has forced to create new regulations and norms regarding to the environment. European Union leads many projects (f.ex. Flow, Segment, Enter.hub) and initiatives (f.ex. Civitas, Civinet) to manage to overcome the problems and improve life quality (Rupprecht Consult, 2016). Governments and local authorities are responsible for implementing that projects and applying good practice. A new way of planning urban mobility refers to Sustainable Urban Mobility Plan (SUMP) – instrument for cities (Lopez-Ruiz, et al., 2013). Mobility planning is a complicated task because of complex and contradictory factors and needs in this process (City in Use, 2016). Political and financial issues pose additional difficulty (Banister, 2008).

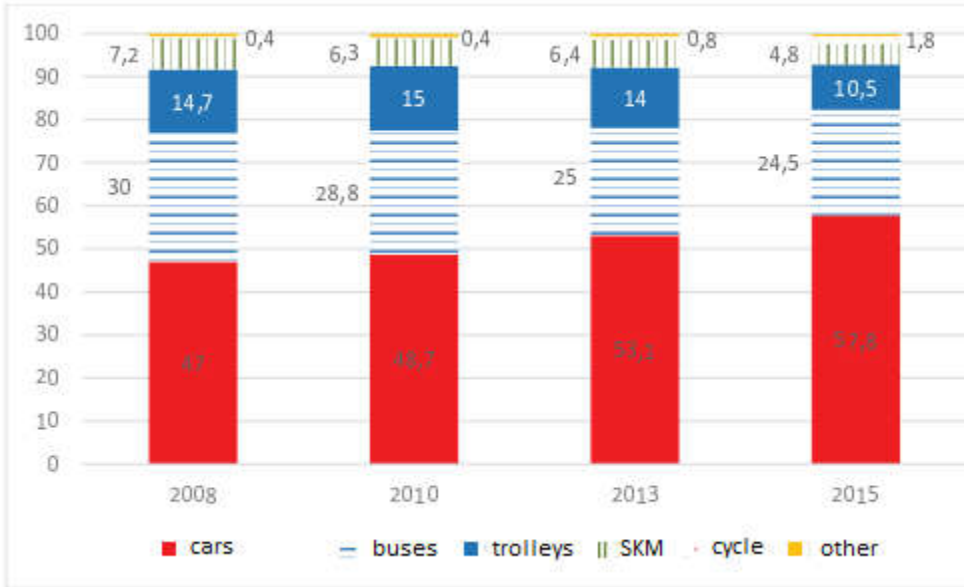
3. Tri-City characteristics and transport system

Tri-City consists of Gdańsk, Gdynia, Sopot. Although the cities have common features like seaside locations, they are completely different. Gdańsk was built in 7th century, so tradition and history of transport is very long. It is also the city with almost half million residents and about six million tourists annually. Gdynia was created in 1926 and has a quarter of millions population. Both develop industry and invest in their seaports. Sopot is a very popular resort city in Poland where live about 40th. of inhabitants.

Tri-City public transportation system consist of trains, buses, trams and trolleys. The cities are interconnected by a suburban train called SKM (Fast City Train), which runs along

thoroughfare from Gdańsk to Gdynia (across Sopot). The journey between the main station of Gdańsk and Gdynia last 34 minutes (distance about 23 kilometers). In addition PKM (Pomeranian Metropolitan Railway) connects centre of Gdańsk with Gdańsk Lech Wałęsa Airport and centre of Gdynia. Gdańsk and Gdynia have numerous amount of urban buses which service transport in Sopot too. The public transport system in Gdańsk includes 11 tramlines while Gdynia develops trolleys (16 lines). The biggest challenge is the lack of full ticket system integration between different cities and carriers. SKM and PKM offers one ticket for trip across agglomeration however there are different tickets for buses and trams – Gdynia has its own proposal and Gdańsk another. What is more, there is lack of integration in payment system. In reality, use of public transport has degreased for few years (figure 4). On the other hand, inhabitants would like to travel that mode of transport more often, however they expect public transport infrastructure extension and increase number of transport connections (Via Vistula, 2016:7).

Figure 4. The daily average of motorized trips (non-pedestrian) in Gdynia since 2008 to 2015 year

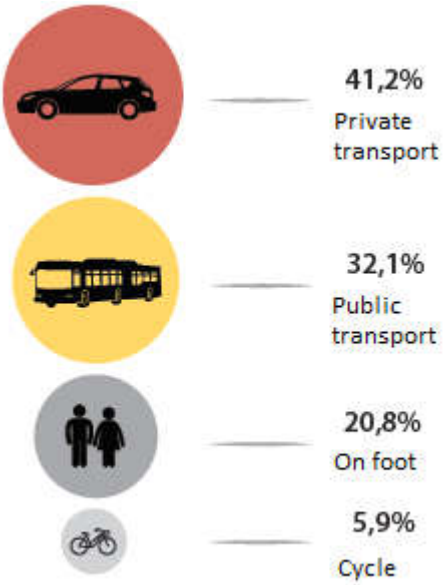


Source: Wołek, 2016:33.

The three cites promote and invest in cycling. Gdańsk has the biggest network of cycling roads in Poland which is 666,3 kilometers long. Since 2009 year bicycle motion has growth from 2% to 6% in modal split (figure 5). Both Gdańsk and Gdynia participate in European Cycling Challenge and lead campaigns to encourage children and workers to cycling f.ex. “I cycle to work” in Gdynia and “Bicycle’ May” in Gdańsk. The biggest challenge for Tri-City is to build

coherent public bike system. There is plan to implement Metropolitan Bike System in 16 boroughs in the spring in 2018 year. The system will provide 3500 bikes with GPS module, electronic lock and alarm (4th generation system) (Metropolitan Area Gdańsk Gdynia Sopot, 2016). Another challenge for Tri-City relates to low culture between bikers and drivers and restrictive law for cyclists in comparison to European's bicycle cities.

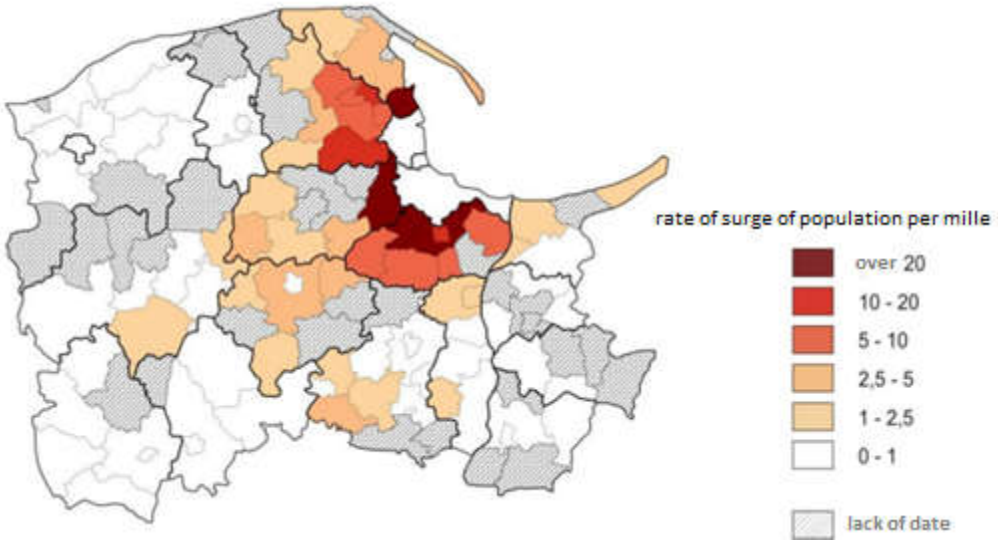
Figure 5. Modal split in Gdańsk in 2016



Source: Via Vistula, 2016:9.

Despite new road buildings, implementing ITS system (Tristar), improving public transport and bike transport, congestion is still increasing. There are more and more cars on roads, Sopot has the highest number of road motor vehicles per one thousand residents in Poland that totals 723 in 2015 year (703 in 2013 year) (Statistical Office in Gdańsk, 2016), Gdańsk reaches the number of 552 cars in 2015 (524 in 2013) (Statistical Office in Gdańsk, 2016) and Gdynia 542 in 2015 (503 in 2013) (Statistical Office in Gdańsk, 2016). That high rate contributes to unsustainable growth of urban mobility which is visible in modal split for Tri-city (figure 5). Low number of people commuting as passengers in cars is related to the lack of carpooling system for agglomeration or enterprises. Furthermore, Tri-city does not provide car-sharing system and there is not any private operator that provides such comprehensive and advance services. Also, the process of suburbanization and urban sprawl is still growing. Many residents of Tri-city work within the central urban area and choose to live in suburbs (figure 6). Consequently, travel time extends, air pollution and noise increases.

Figure 6. Surge of population to boroughs from Tri-City in 2010 year



Source: Factors and restrictions of development in Pomeranian Province cities, 2011: 61.

Analysis of the Tri-city transport system reveals many problems and challenges to be faced. Implementation of new regulations, cycling policy, new management strategies, such as the Sustainable Urban Mobility Plans (SUMP), are the key to improve the situation. In addition, the implementation of 'mobility plans' is more and more popular for big city traffic generators (companies and institutions) like enterprises, universities, offices, business and commercial centers, which cause a large number of trips during the day. The mobility plan is aimed at improving the mobility conditions through changing people's habits, promoting use of ecological means of transport, i.e. walking, cycling, car-sharing and carpooling system. Gdynia Maritime University is one of such important traffic generators.

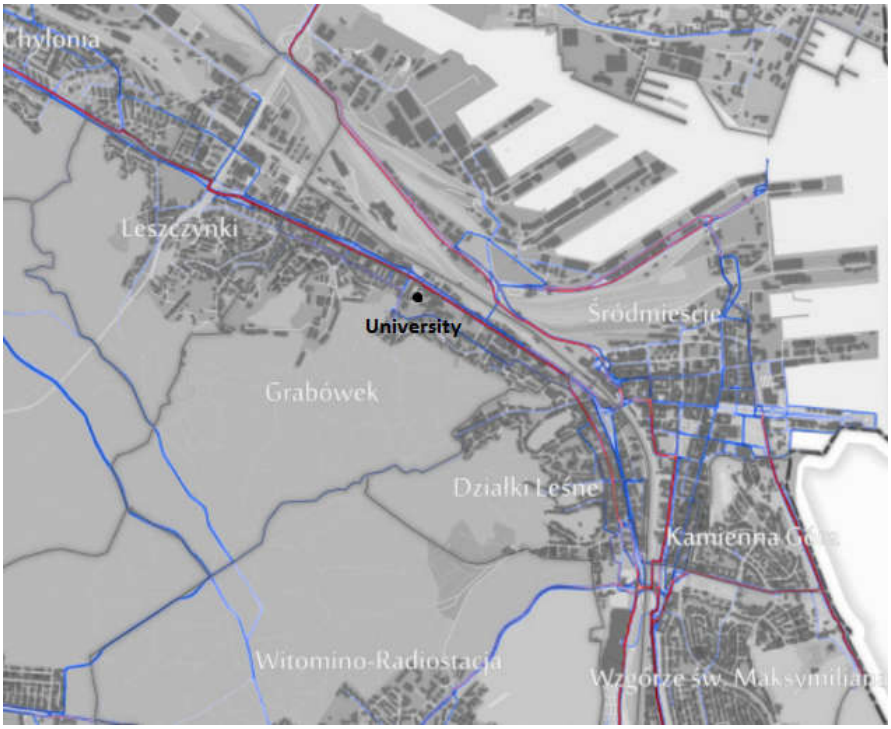
4. The pilot survey research for a big city traffic generator – Gdynia Maritime University

As it has been mentioned above, people travel in an unsustainable way, spend more time in congestion. Domination of car journeys and decrease of public transport passengers influences life quality because of the increase of noise and air pollution. Universities, as places of education and development, should provide a good example and encourage best practices. Authors decided to analyse Gdynia Maritime University, as one of big traffic generator in the city. They have carried out pilot research survey and the results are presented below.

Gdynia Maritime University is an institution with around 800 employees and over 5,000 students. The university is located in two places: Faculty of Navigation is located by the sea at

Kosciuszko Square, while the headquarters with other three faculties are located at Morska street nearby one of the largest roads in Gdynia. The survey was conducted among respondents traveling to the main building. There is no the city paid parking zone in this area and about 40 free places are available in front of its entrance. There is free car park for employees (about 200 places) on the university campus. 30 meters from the entrance to the university there is a bus/trolleybus stop, while the nearest agglomeration train stop is 750 meters away. Near the building entrance, there is also an outdoor bicycle park for several bikes. The cycling route network is incomplete, nonetheless, the university is located at the main cycling route. The blue color on the heat map below shows the cycle traffic intensity: up to 100 bicycle trips during the day, while the red color between 100 and 200 (figure 7).

Figure 7. Heat map of Gdynia



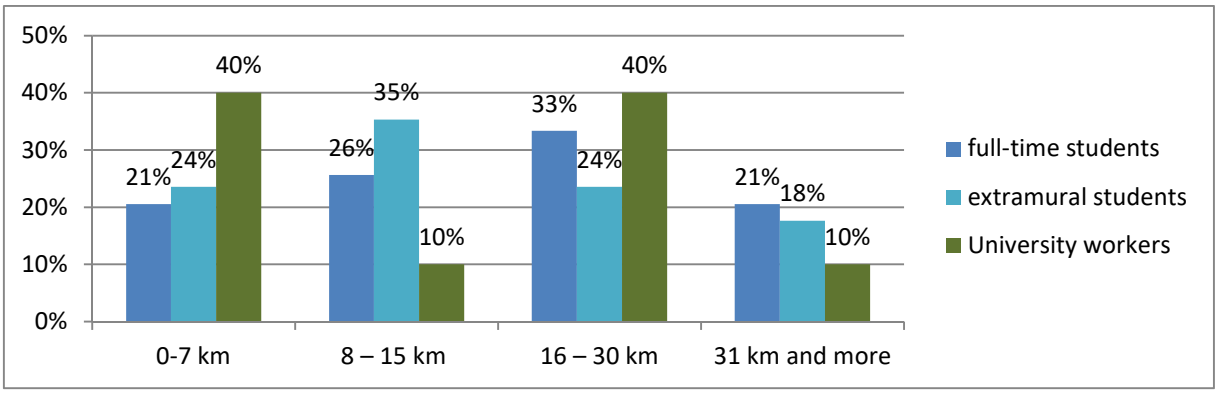
Source: European cycling challenge, 2017

For an effective mobility plan elaboration the first step is it to explore, analyze and understand people's transport behavior and preferences. A pilot survey research has been carried out among Gdynia Maritime University staff, full-time students and extramural students. The survey was based on anonymous questionnaire given to 66 people: 39 full-time students, 17 extramural students and 10 workers of University. The questionnaire contained 12 questions. The authors adopted the hypothesis that the model of commuting to the university is unsustainable. If these

assumptions were to be correct, a deeper research would be carried out on a larger group of people.

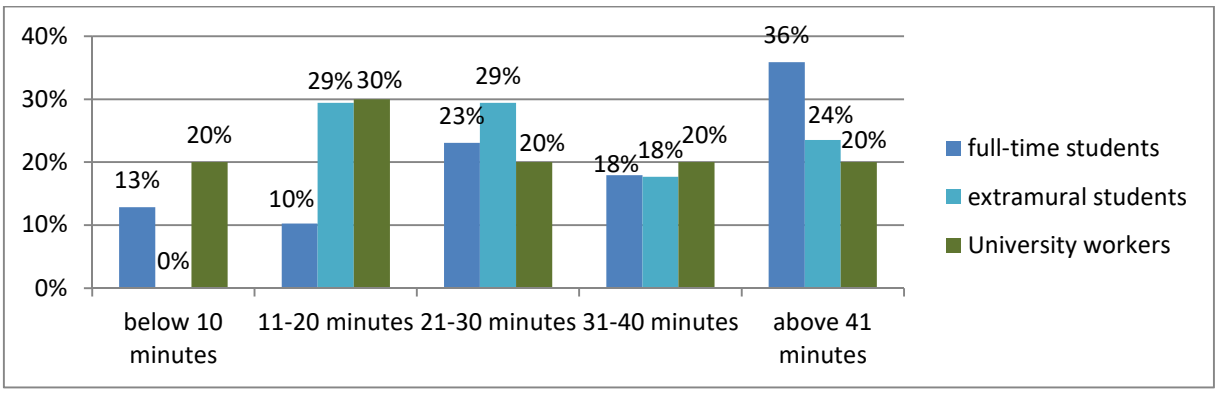
The first part of research concerned the distance between University and home, as well as the time that is needed to cover the distance. Most of respondents live neighbouring cities located 16 – 30 kilometers to the University (figure 8). They usually need above 31 minutes to reach the place (figure 9). Only few people, who live up to 7 kilometers from University, are able to commute in less than 10 minutes. Extramural students travel often faster than full-time students from similar destinations, because they avoid traffic jams that appear from Monday to Friday in Tri-City.

Figure 8. Respondents' distance to Gdynia Maritime University



Source: Gdynia Maritime University study, 2016.

Figure 9. Time needed to commute to Gdynia Maritime University

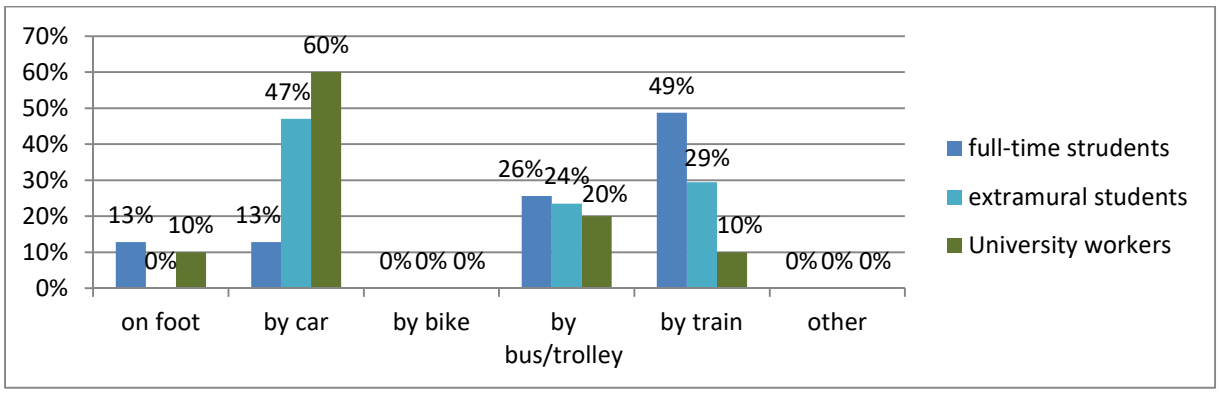


Source: Gdynia Maritime University study, 2016.

Another significant issue was to study how respondents reach the University and what kind of mode of transports they use. Most of them (25 people) travel by train (Fast City Train,

Pomeranian Metropolitan Railway and regional trains), however these were mainly full-time students (19 people) (figure 10). The second largest group are drivers: 19 people (60% of workers, 47% of extramural students, 13% of full-time students). Employees who live nearby the university admit they must use the car because they often carry a laptop, documents and student paper work. Carpooling is not popular form of mobility among full-time students and workers, nevertheless 18% of extramural students travel together. The reason is the distance they need to cover and money savings. Around one-fourth interviewees go to the University by bus/trolley. These means of transport are promoted by Gdynia, for example by creating bus lanes. Very few respondents, even if they live close to the University, choose walking and none of them rides a bicycle or other means of transport , e.g. a kick scooter or a motorbike, despite quite a good infrastructure nearby. The results of this part of the study indicate the unsustainable model of traveling among employees and students.

Figure 10. Respondents' modal split

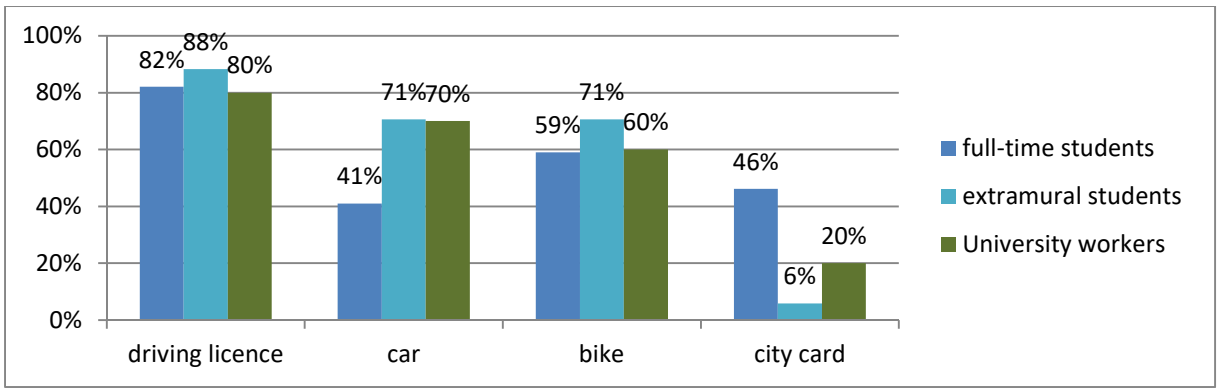


Source: Gdynia Maritime University study, 2016.

To check out interviewees potential to change their habits, a few more questions have been asked. The priority for choosing given means of transport is different for each group. Employees prefer convenience and disregard lowest cost of travel. They also pointed out the lack of possibility to travel in a different way. For extramural students the most important is the travel time, followed by convenience and an attractive price. Few of them occasionally traveled by bicycle to the university. While full-time students want to travel as quickly and cheaply as possible, they also pay attention to the convenient schedule of public transport. Nonetheless, over 80% of respondents are satisfied with the conditions of reaching Gdynia Maritime University.

Furthermore, referring to the question about changing their behavior, only few people pointed cycling (several employees and extramural students), even if more than half have a bicycle (figure 11). Most interviewees own driving license and would prefer to travel by car because of convenience. Very few respondents choose walking and it seems it is not going to change according to the research.

Figure 11. Respondents' possession of driving licences, cars, bikes, city cards



Source: Gdynia Maritime University study, 2016.

Summarizing the results of the study, it is possible to identify as many threats as opportunities in relation to sustainable transport. Comparing the modal split of university staff and students with the modal split of Gdańsk, the share of pedestrians and cyclists is significantly lower. On the other hand, it can be noticed that young people (full-time students) even if they have a car, do not necessarily use it in their daily trips - for this group the cost and time of arrival are the most important. Also, almost half of full-time students have a monthly city ticket (city card). Extramural students look for savings through carpooling, contributing to a smaller number of cars in the city. Zero participation in bicycle trips remains a big challenge for the university, the need to both promote this mode of transport and provide appropriate conditions for parking (a secure and roofed bicycle parking) is necessary.

5. Conclusion

The idea of sustainable development makes the basis for a new thinking about civilization and strikes fundamental aspects of to-date human activity. It assumes the rejection of the present model of development chiefly focused on pursuing infinite economic growth; therefore it

requires a transformation of consciousness in the direction of perceiving the relationship and harmony between economic, human and social values and their interdependence with nature.

Contemporary metropolis have to solve transport problems to keep sustainable development. Many of them is connected to different economy aspects and require cooperation between several sectors. Transport causes high environment pollution, particularly road transport. Despite sustainable mobility promoting, congestion is still increasing. In order to reduce a negative transport impact, agglomerations should control or plan mobility, especially for big traffic generators.

To try to cope with the 21st century challenges, Tri-City has to follow European policy and guidelines. New restrictions should be considered to decrease air pollution. Improving governance systems and looking for innovative solutions can provide better life quality. Inhabitants expect coherent and integrated public transport system founded on innovations. Existing intelligent transport system–Tristar– should develop its functions and range.

Gdynia is a city with a big developmental potential in terms of promoting sustainable mobility solutions such as cycling, although there is a long way to match European standards. It is worth conducting marketing studies as an element shaping city's transport policy, listen to users' opinions to be able to plan sustainable urban mobility efficiently, in a responsible way, based on research studies.

The survey results indicate that University staff and students transport behaviour is unsustainable. Many people do not travel public transport because journey lasts to long and they complain about non-integrated tariff system. On the other hand, the majority of respondents own bikes so it is possible to increase the cycling commuting rate if it will be promoted and a proper infrastructure will be provided in the near future. Furthermore, Metropolis Area plans to implement public bike system up to the spring in 2018.

Gdynia Maritime University has begun promoting sustainable mobility among staff and students and some good actions were undertook. In 2016, the university joined the national Civitas network “Civinet Polska”, that aim is to promote and implement integrated strategies for sustainable urban mobility. One of the activities was to organize a workshop for students of Tri-city universities to broaden their knowledge in the field of mobility plans for a big city traffic generators. In addition, in 2017 Gdynia Maritime University joined the European Network of Universities for Sustainable Mobility. It is aimed at the creation of a university network to facilitate the exchange and transfer of knowledge about sustainable mobility best practices among European universities. This network will serve as a tool towards the reduction

of CO2 emissions thanks to an improved mobility of the university community. The last initiative worth mentioning was the construction of electric vehicles at the university and a charging station. The station is located in the internal car park of the university and employees can use it.

The results of the pilot survey research confirmed the hypothesis regarding the unsustainable way of traveling and encouraged for further, deeper studies. Nearly 200 students and staff have been interviewed in a new survey research and results will be published soon. The study checks how often respondents use different modes of transport and how they evaluate the travel conditions for each of them.

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Wyzwania zrównoważonej mobilności miejskiej na przykładzie Akademii Morskiej w Gdyni

Streszczenie

Zrównoważony rozwój miast, podobnie jak zmiany klimatyczne, zużycie zasobów naturalnych, przemiany energetyczne, migracje ludności, dobrobyt i bezpieczeństwo społeczne, zanieczyszczenie środowiska, globalny wzrost gospodarczy, stanowi jedno z głównych wyzwań dla przyszłości naszej planety w 21 wieku. Trójmiasto, jak wiele innych współczesnych aglomeracji, mierzy się z wieloma wyzwaniami odnoszącymi się do negatywnego wpływu człowieka na środowisko, zdrowie i przestrzeń miejską. Mobilność ludzi jest jednym z nich. Jakość podróżowania w Gdańsku, Gdyni i Sopocie pogarsza się w wyniku nadmiernego użytkowania samochodów, braku integracji systemu transportu publicznego, nieefektywnego wykorzystania ekologicznych środków transportu, jak również niekontrolowanego rozrastania się miast. Celem niniejszego artykułu jest przedstawienie wyzwań związanych z planowaniem zrównoważonej mobilności w aglomeracjach na przykładzie Gdyni. Aby sprawdzić, czy konieczne jest stworzenie nowego wzorca przemieszczania się dla osób podróżujących do dużych generatorów ruchu, zostało wykonane badanie, przeprowadzone wśród studentów i pracowników jednej z największych instytucji w mieście – Akademii Morskiej w Gdyni. Narzędziem wykorzystanym podczas badania był anonimowy kwestionariusz ankietowy zawierający szereg pytań, takich jak: wykorzystanie środka transportu, problemy przewozowe i parkingowe, jak również świadomość respondentów odnośnie zrównoważonej mobilności. Wyniki badania wskazują na niezrównoważony model podróżowania wśród pracowników i studentów. Aby móc realizować koncepcję zrównoważonej mobilności w praktyce, zachowania transportowe respondentów powinny ulec zmianie.

Słowa kluczowe: wyzwania współczesnych aglomeracji, zrównoważony rozwój, mobilność miejska, system transportowy.

Kody JEL: N74, O18, R11, R41, R42

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