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The Settings Approach and the Significance of City Settings in the Promotion of Sport for All and Physical Activity

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Introduction

The development of cars and technology in the past 60 years has affected cities and everyday life, the natural environment, the social relationships, and health. This brought to a reaction regarding transports in the 1990s (C. Horn, 2014).[1]

"Sitting is the new smoking". This widespread statement, used also by ISCA (International Sport and Culture Association) and Cebr (Centre for Economic and Business Research) in their report on the economic cost of physical inactivity (June 2015), follows the negative outcomes of increasingly sedentary lifestyles and the lack of knowledge of those risks. Physical inactivity has become a crucial public health challenge. It is estimated to be the 4th leading cause of death worldwide, only overcome by high blood pressure and glucose and tobacco use. It represents 6% of the global mortality.[2]

As the WHO (World Health Organization) Regional Office for Europe states, a healthy city is an active city. Promoting physical activity is a public concern as it is important for both the environment, current and future generations. Being active regularly is being proved to have an elevated positive impact of physical and mental health.[3] A clear distinction needs to be made between physical activity and sport. The latter is a choice, while the former is a must for everybody. This follows that improving the urban environment and promoting active mobility throughout the day and year would benefit all citizens.[4]

[1] C. Horn (2014). Towards Active Mobility. Europe. Urbanplanet
[2] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe. p7,17
[3] P. Edwards and A. D. Tsouros (2008). A Healthy City is an Active City: a physical activity planning guide. Europe. World Health Organization, p1
[4] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe. p77

The WHO estimated that about 25% of European adults and 80% of European adolescents are insufficiently active.[5] The recommended level of physical activity is a cumulative of 30 minutes per day, and 60 minutes for children. This can be reached in various forms, such as walking and cycling, sport and playing outdoor, gardening and climbing stairs, etc.[6]

Role of Cities and Municipalities

The number of projects focusing on developing active cities have been grown worldwide given to alarming data concerning mainly the urban population. Focusing on cities and municipalities is prominent as urbanization is growing. Nowadays, about 50% of the world population lives in urban areas and it has been estimated that this data will reach 68.4% by 2050, which in number means plus 2.5 billion people living in cities. The European percentage is greater than the world average as it hits now around 74% and it is expected to reach 83.7% by 2050 (UN, 2018).[7] Moreover, municipalities are the major providers of structures and infrastructures that can be used, and are used, to promote, deliver, and practice physical activity. They provide open public spaces, local parks, bike paths, etc. However, there is a lack of acknowledgement and recognition in their role within the promotion and sustainability of physical activity within the communities' lives. More crucial is, consequently, the role of municipalities in promoting and facilitating cross-sectoral cooperation.[8] The cooperation between health, education, and sport sectors should be increased

[5] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe. p7
[6] World Health Organization French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p11
[7] UN (2018). 68% of the World Population Projected to Live in Urban Areas by 2050, Says UN. New York, USA. United Nations: Department of Economic and Social Affairs
[8] TAFISA (2014). Triple AC: The 5 Key Success Areas. Europe

and encouraged as education and training systems have a crucial role in promoting active living.[9]

It is estimated that almost 30% of Europeans, that is around 210 million of people, are physically inactive. However, 66% of local European decision-makers are unaware of the current situation on the level of physical activity within the citizens.[10] Active cities can be developed focusing on where people spend most of their time, such as in schools and workplaces, leisure and commuting time. This paper will focus on Active Transport and Mobility. As the WHO explains, there are various factors that influence active mobility, positively and/or negatively. Some drivers include land use and urban planning, such as the design of a developed environment and road planning. An active lifestyle is also highly influenced by security and accessibility. Local authorities play an important role in assessing those factors and promoting sustainable transport, which can also increase the attractiveness of the city for both tourists and citizens. If people have the possibility to reach places by foot or bike, their daily life becomes consequently more active. Active mobility is therefore proportionally linked to the opportunities to reach key places, such as work business and educational buildings, public and open spaces, such as parks.[11]

There are different types of promoting strategies in place in the various municipalities. Strategies such as open spaces and skate parks, designed walking tracks, cycle parking spots and paths, can be found Europe-wide. The only scheme that has a low distribution is the "Walking bus" scheme, which is the idea of walking to school within organized groups lead by a volunteer. However,

[9] Commission of the European Communities (July 11th, 2017). White Paper on Sport, Brussels, p4
[10] ICSSPE and PACTE Project members (2019). Physical Activity Policies at Municipal Level in Europe, Analysis of the Passport Survey. Erasmus+ co-funded project. Europe, p8
[11] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p15

the presence of communication or mass media strategy to raise awareness and promoting the benefits of physical activity lack in a big portion of the European municipalities (PACTE, 2019).[12] Municipalities, in general, believe that increasing citizens' levels of physical activity is important, however, most of them do not know where to start or do not have the resources to develop and implement their strategy within this sector. Some would focus on elite sports, but that includes only a part of the population. In principle, it is important to provide adequate facilities and infrastructures to allow people to perform sport, but this strategy would mainly tackle already physically active people. To increase the overall level of physical activity within a municipality or city, it is important to focus also on inactive people.

Objective

Given the increase of physical inactivity in urban areas, cities have the main role in the provision of infrastructure and facilities, and in developing programs to promote sport and physical activity. Unfortunately, most of the times, cities, have a very restrictive understanding of sport and they only focus on how it is organized or on the competitive part. They don't know where to start or how to increase participation within their community. What are the municipalities' needs and expectations? What challenges do they identify and where do they need help? Municipalities, first of all, need to understand the problem of physical inactivity, its costs and the benefits of increasing the level of physical activity among the population. To tackle physical inactivity and promote active living within their territory, municipalities and decision-makers have to

[12] ICSSPE and PACTE Project members (2019). Physical Activity Policies at Municipal Level in Europe, Analysis of the Passport Survey. Erasmus+ co-funded project. Europe, p26-27

understand the needs of their citizens and the challenges that are needed to be faced to fulfill those needs.

There is a widespread believe that private transport is more convenient than active transport, mainly in terms of time. However, giving traffic congestion, the cost, and the long-term benefits, active transports turns out to be a better option.

We want to study different scenarios to improve active transport, through public transport, walking and cycling as alternative mode of transport to the private one, to see which would be the better alternative under different circumstances. To do so, interviews with some cities that want or have already became active cities was useful to highlight different factors affecting one's choice of the preferred mode of transport. Some partners and pilot cities from different active cities programs, such as Triple AC, Global Active Cities, and PACTE, were interviewed on the transport and setting of their cities. Data was then collected through a survey on people habits and what would be helpful in increasing the level of physical activity through their day while commuting. The different scenarios are analyzed through the use of techniques for managerial decisions, such as SMART and goal seeking analysis. The former refers to the Simple Multi Attribute Rating Technique, while the latter is used to determine the break-even point, that is the probability to be indifferent between two projects.

Survey

To study the habits and the factors that would make people more physically active by choosing active mode of transport when commuting, a survey was developed. Choices could be divided in terms of time, quality and cost of the

mode of transport. The survey was shared online worldwide, and 209 responses were collected in a time frame of 4 weeks during n the month of November 2019. Responses were collected from all ages, both genders, and from 12 countries, mainly Europeans. 70% of the data was collected in Italy.

First, to the participants it was asked which type of transport they use the most between public, private, walking and cycling and where this transport concentrate the most, choosing between urban, extra-urban, regional, interregional transportation. Related to this, there are different drivers that affect the choice of mode of transport used and chosen. Those drivers are related to time (convenience, time factor, distance to reach final destination, freedom and flexibility), quality (accessibility, quality factor, security, possibility to reach key places, comfort), cost, weather, and friends' and family's choice of transport. Second, it was asked the time that was spend on the different mode of transport on an average day. Last, there was a focus on different drivers that would improve active transport within the city, divided between public transport, walking and cycling based on four criteria (accessibility, affordability, availability and acceptability).

Ch. 1 – The problem of Physical Inactivity

Physical inactivity is growing worldwide in both formal and informal activities, from leisure to work time, from commuting to the domestic environment. The problem and consequences related to this phenomenon are greater that what people think and perceive. The level of physical inactivity, in fact, continues to decline worldwide. Another alarming fact is that these inactivity habits are passed through generations, from parents to children and so on. It then creates an intergenerational cycle that makes the phenomenon bigger. Worldwide it is been estimated that in a period of just 20/30 years, the level of physical activity drops down by more than 10%, for instance in UK, reaching even a pick of 28% in Brazil. While in developed countries the physical activity declines on a constant rate, the situation is worst in rapidly developing countries. For instance, China experienced a drop of 45% between 1991 and 2009. As mentioned before physically inactive children have higher possibilities of becoming physically inactive adults and parents, which possibly leads to a next generation of physically inactive citizens. Inactivity at early age has both short and long-term consequences. In the short-term, it leads to higher chances of obesity, increased potential missed school days and lower test scores. In the long-term, it can lead to health problems, and thus higher health costs, and lower salaries. In other words, as the authors of "Designed to Move" state, "physical activity is an investment in human competitiveness and in maximizing human potential". Promoting and enhancing physical activity has positive effects on physical, emotional, individual, social, intellectual, and financial capital.[13] By definition, physical activity is "any body movement that results in

[13] Nike In. (2012). Designed to Move. Nike Inc., 2, p2-10

energy expenditure" (C. Casperson et al., 1985). In other words, it doesn't only include sport but also other everyday activities such as walking, cycling, climbing stairs, playing and cleaning the house. To tackle the inactivity problem, an international consensus among many international and national agencies, such as the World Health Organization (WHO) was established in the mid-1990s and, among other, states that:[14]

"Daily activity should be accepted as the cornerstone of a healthy lifestyle. Physical activity should be reintegrated into the routine of everyday living. An obvious first step would be the use of stairs instead of lifts and walking and cycling for short journey."[15]

Physical activity can therefore be part of everyone daily life, regardless of their age, gender, and social status. However, it requires appropriate environmental and urban conditions. Citizens need to feel walking and cycling as safe, enjoyable and convenient.[16]

Awareness and Idea of Physical Inactivity Problem

One of the first challenges that cities face when promoting active lifestyle within their territory is linked to the awareness and knowledge of the problem of physical inactivity across the population. Most of the cities and decision-makers under-estimated the costs this has on the economy on the city and the country and the benefits that increasing the level of physical activity would have on the

[14] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p6

[15] WHO/FIMS Committee on Physical activity for Health (1995). Exercise for Health. Bulletin of the World Health Organization, 73(2): 135-136

[16] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p8

social and economic environment. Awareness and knowledge problems are faced also on the other hand, some cities have the facilities and programs but there is no widespread information among the citizens about it.

The responsibility on physical activity practices and policies varies among the 28 European countries. Focusing on the city setting, in most situations, the municipality or the city itself is responsible for the development and implementation of promoting practices. Those practices take or should take place within education, primary and clinical health care, workplaces, senior adult services, sport and leisure, tourism and city setting related factors. Those refers to transport, environment, urban design and planning. On an educational level, all ages should be tackled, from kindergarten to primary and high schools to colleges and universities. However, 66% of local European decision-makers are unaware of the current situation on the level of physical activity within citizens.[17] Not only the level of physical inactivity is most of times unknown, but also the costs of it and the benefits of reducing it are unknown or under-evaluated. A first need, step, would then be to make more and more people, both among decision-makers and the population itself, aware of the benefits that citizens and the city itself could gain from increasing physical activity within everyday life.

Another challenge encountered is the idea and perception people have about physical activity. Physical activity is most of the times linked to sport and fatigue. However, active living simply means including physical activity into our daily routines.[18] As mentioned above, improving physical activity within citizens' everyday life could be done also by focusing on activities that people already by

[17] ICSSPE and PACTE Project members (2019). Physical Activity Policies at Municipal Level in Europe, Analysis of the Passport Survey. Erasmus+ co-funded project. Europe, p8, 22

[18] P. Edwards and A. D. Tsouros (2008). A Healthy City is an Active City: a physical activity planning guide. Europe. World Health Organization, p2

limiting the movements they do. Taking stairs instead of elevators, parking on the other side of the parking lot when going to a store or to work instead of in front of the entrance door, favoring stand up meeting and walking to a coworker at work instead of sitting all day long and relay on technology would already increase the level of physical activity within the population and would bring costs, health and social benefits. One of the situations in which people spend most of their time during the day is commuting. This represents a good opportunity for promoting active living. People should be encouraged to walk, cycle or using public transports to school, work, for leisure and sport activities. Improving the possibilities to choose walking and cycling as mode of transport during trips between home and work would lead to a greater possibility of regular physical activity among workers. It therefore provides the potential for an elevated increase of physically active people within the commuting population.[19]

Improving infrastructures and services should then be integrated with increasing awareness of what active living means and its short and long-term benefits. However, communication or mass media strategies to raise awareness and promoting the benefits of physical activity lack in most cities and municipalities Europe-wide.[20] Cities and citizens have their habits and changing them is always a challenge faced Europewide as well as worldwide. First, some people are reluctant to change. Second, changes in urban settings, most of the time, requires time and create discomforts at the beginning, while working on the roads and facilities and at the beginning of new implementations. Most of the

[19] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p10

[20] ICSSPE and PACTE Project members (2019). Physical Activity Policies at Municipal Level in Europe, Analysis of the Passport Survey. Erasmus+ co-funded project. Europe, p27

people focus on the short-term consequences of change, without looking at the long-term benefits. Municipalities and decision-makers should take small steps to allow people to see the benefits of changes and have the time to adapt to them, instead of trying to make radical changes within their territory.

Health Costs of Physical Inactivity

As work becomes more sedentary, daily tasks more mechanic, and the use of cars for moving from one place to another increases, the lack of physical activity among all ages within the population also increases. This phenomenon is believed to be the cause of millions of deaths. The WHO has estimated this data within the 53 European member States. Physical inactivity is also linked to the changes in people's mobility habits. This is a consequence of how distance is perceived. Private transports, which allow to reach places easily, tend to be used more compared with cycling and walking habits. The workplaces, schools, supermarkets and sport centers are now further away than in the past, and the amount of journeys taken, either to go to work/school or for leisure activities, has greatly increased.[21] The increasing levels of physical inactivity among the population are a national and international issue, however, the key to tackle it is more local rather than global in order to reach long-term sustainable goals.

As mentioned above, physical activity is somehow linked to mortality risk. The relationship between different mortality risk factors is complex. The estimate of the amount of global mortality linked to physical inactivity might be subject to uncertainty as, for example, it can evolve in overweight and obesity or in high blood pressure. It might than be difficult to isolate the exact contribution

[21] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p8

physical inactivity has. However, recent studies, as explained in the report from ISCA and Cebr (June 2015), “The Economic Cost of Physical Inactivity in Europe”, show how the impact of physically inactive lifestyles on global mortality can be compared to other top leading risk factors.

Figure 1. Main leading risk factors for global mortality from the 1st to the 10th factor. Physical inactivity is estimated to be the 4th leading cause of death worldwide // source: WHO, Cebr analysis (2004)

Physical inactivity, according to WHO, is one of the four top leading cause of death, together with smoking, hypertension and high blood sugar. In 2004, it accounted for 3.2 million of death, which could be reduced by enhancing more active lifestyles among the population. It has become a higher risk factor than overweight and obesity, high cholesterol, unsafe sex, alcohol use, childhood

underweight, and indoor smoke from solid fuels (see Figure 1).[22] Physical activity is also linked to the other leading risk factors, as increasing it can decrease or prevent them.

Moreover, the economic costs linked to physical inactivity, both direct and indirect costs, have negative effects on the national and local economies.[23] The WHO has estimated that the cost of physical inactivity among EU28 was €80.4 billion in 2012, which corresponds to 6.2% of European health expenses of that year. It is €5 billion more than the amount of world expenditures on cancer drugs. Moreover, it is estimated that these costs could increase to 56% and reach €126 billion by 2030. Physical inactivity in Europe leads to a cost that is 1.4 times bigger than the one brought up by air pollution and greenhouse gases from industry all across Europe and three times bigger than that from smoking attributable diseases. Proportionally to healthcare expenses, costs of physical inactivity, in 2012, were higher in Italy (8.9%), followed by Poland and UK. This inactivity costs could be easily avoided if citizens would be more physically active for just 20 minutes per day. This goal could be reached with easy and inexpensive activities, such as walking and cycling. Moreover, the amount of time to be physically active doesn't have to be achieved all in the same time, but the recommended limit refers to the average time within the day among all Europeans. The benefits of interventions toward a fifth of currently inactive Europeans, with the goal of reaching the recommended levels of regular activity would be of €16.1 billion.

Physical inactivity has both direct and indirect costs on the society. The direct costs linked to physical inactivity refers to the health expenses on four major

[22] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe, p17-25

[23] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p7

non-communicable diseases, which are coronary heart disease, type II diabetes, colorectal and breast cancer. The total direct costs to the EU-28 was estimated to be €9.2 billion, of which about 82% is accountable to only six countries: United Kingdom, Germany, Italy, France, Spain, and Poland. The indirect costs have been estimated on human capital value, considering loss of potential years of healthy life related to morbidity and premature mortality due to physical inactivity. Those costs have been estimated to be €71.1 billion for the EU-28, of which about 72% is accountable to the six major European countries mentioned above.

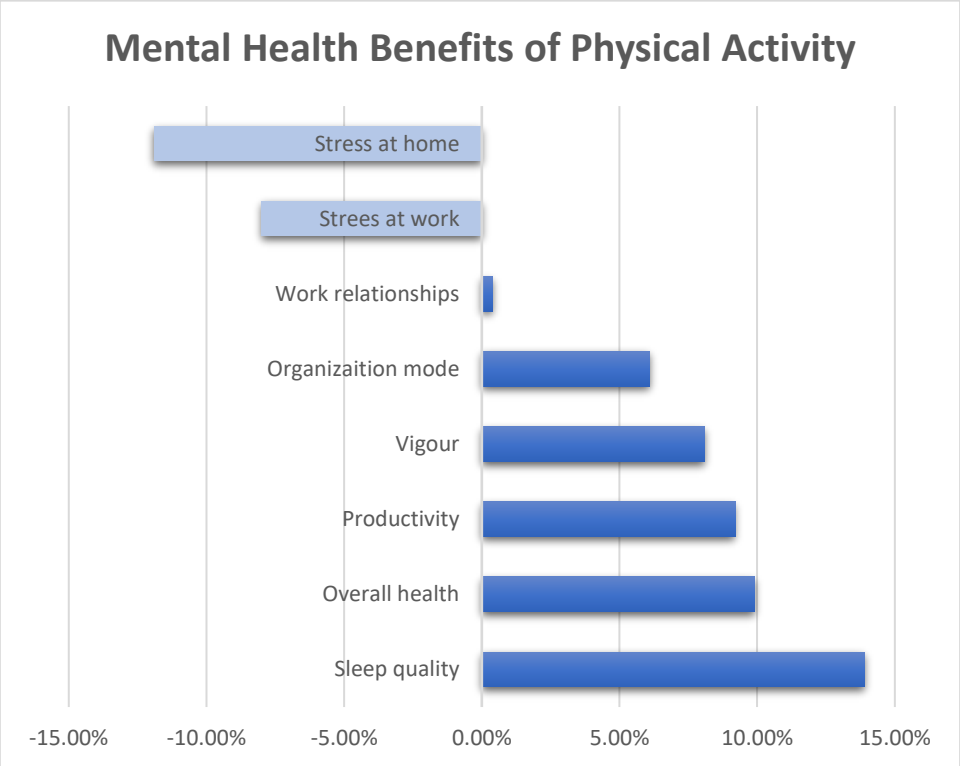

Figure 2. Average impact of physical activity from self-reports from participants in Global Corporate Challenge, 2012 // source: ISCA, Cebr, 2015

The report from the Global Corporate Challenge, a workplace competition initiative in which participants within teams had to reach the highest number of

steps within 16 weeks, shows how increasing physical activity has positive economic implications by decreasing indirect costs. Considerable improvements have been recorded in sleeping quality, productivity, energy, organization mode, and reducing stress at home and at work (see Figure 2). These leads to healthier and happier workers, which will in turn result in more productivity and efficiency, less sick days, and higher contribution to the company itself and the economy as a whole.

Encouraging physical activity and, consequently, lowering the level of physical inactivity would produce huge economic benefits. Only with a little decrease of 5%, economic savings Europe-wide have been calculated to be around €4 billion. In a scenario with a reduction of physical inactivity among the European population of 20%, costs savings have been assessed to reach an amount of almost €16 billion (see Figure 3). To be noted is that about 75% of the total potential savings would benefit the six countries cited above (see Figure 4). This is proportioned to those countries' share of EU GDP and health expenditure.[24]

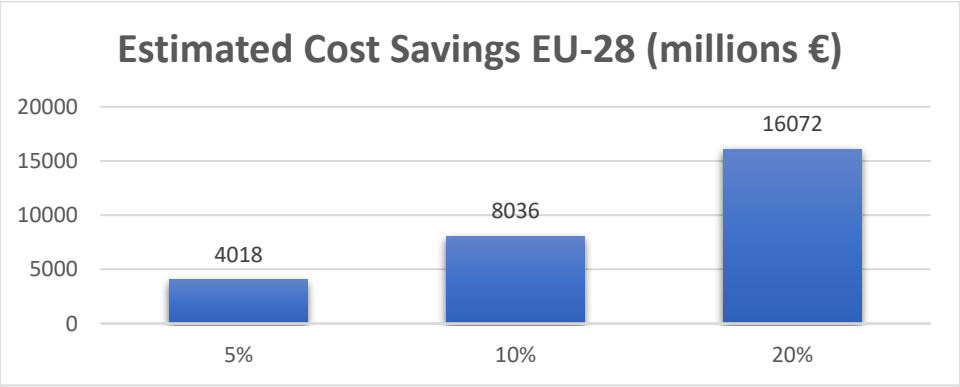

Figure 3. Estimated cost savings in € millions with a 5%, 10% and 20% reduction of physical inactivity Europe-wide // source: ISCA, Cebr report (2015)

[24] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe, p17-25

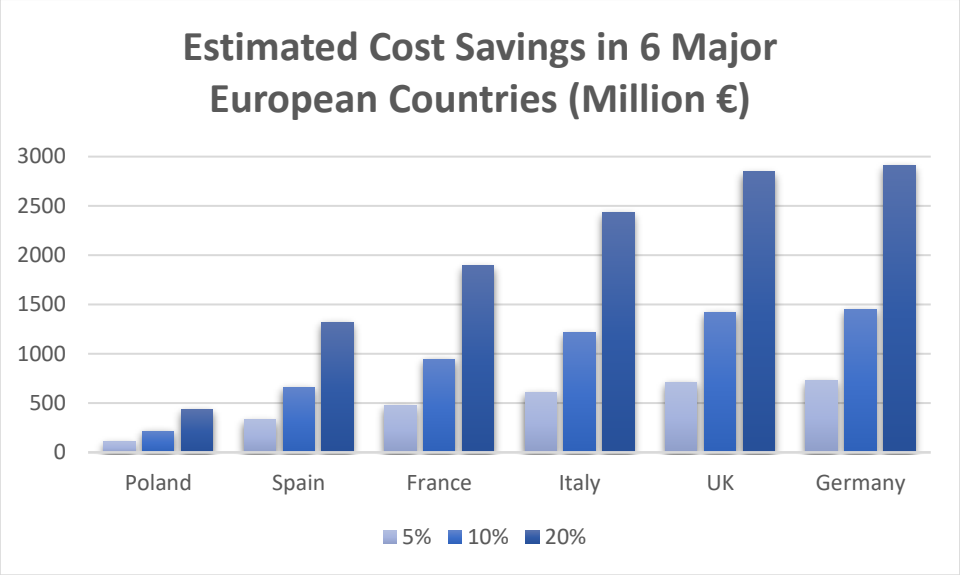

Figure 4. Estimated cost savings in € millions with a 5%, 10% and 20% reduction of physical inactivity in six major European countries: Poland, Spain, France, Italy, UK, Germany // source: ISCA, Cebr report (2015)

Motivators and Barriers

There are several reasons that motivate citizens in being active or influence them in being physically inactive. Main reasons of being active are improving health, fitness and physical performance, relaxing and have fun. On the other hand, lack of time, motivation or interest are among the main reasons for not practicing (see Figures 5-6).

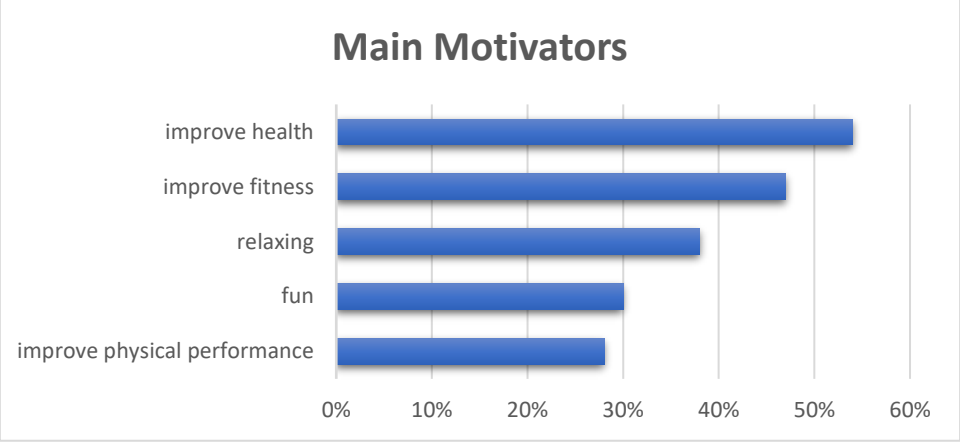

Figure 5. Main motivators to engage in physical activity Europe-wide // source: Eurobarometer, 2019

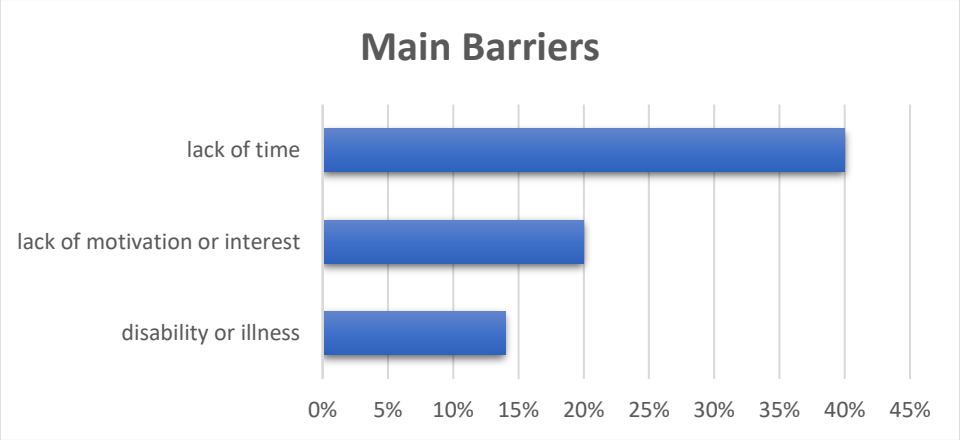

Figure 6. Main barriers to engage in physical activity Europe-wide // source: Eurobarometer, 2019

The level of these influences varies across Europe. In 2017, the majority of European countries engage in physical activity, both formally and informally, mainly to improve one's own health, while fitness motivation is the most common reason in Ireland, France, Finland, and Greece. In Romania, both health and relax are among the most common motivations, while Netherlands is more influenced by being activity to have fun. In general, physical activity takes more place in informal setting rather than formal ones such as sport clubs and centers. Motivational factors vary with time. Since 2013, improving health has decreased in proportion Europe-wide, while remaining the most common reason for being active. Improving fitness, relax and having fun have increased among citizens as reasons to be active, with large increases in France regarding relax and in Netherlands regarding having fun. Relax and having fun both have greater impact in Netherlands, while Greece has experienced a less focus on relax and Cyprus in having fun.[25] Additionally, the WHO explains other obstacles that prevent people from increased their level of active mobility. People sometimes connect active mobility with sport and therefore they feel that they are not fit

[25] Special Eurobarometer 472 (December 2017). Report, Sport and physical activity, European Commission, p4-8, 39-45, 51-64

enough for this time of mobility, or that it requires too much effort and fatigue. On the other hand, some believe they are active enough and those choose private transport to move from one place to another. The WHO also highlights the topic of lack of time. It is commonly believed that cycling or walking requires more time than motorized transport. However, in high dense urban areas, for trip within three kilometers, cycling reveals to be the fastest mode of transport.[26]

[26] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p13

Ch.2 – Transport Habits: Private and Active Transport

As it is shown in the Eurobarometer report on sport and physical activity, 2017, 60% of Europeans never or rarely exercise (see Figure 7). This data didn't change much in a 4-year time frame. However, there has been a 4% that stopped exercising, in comparison to doing it rarely in 2013. Giving a more specific look, levels dropped substantially in Croatia, Latvia, Austria and Estonia, while they increased in Malta, Bulgaria and Cyprus.[27]

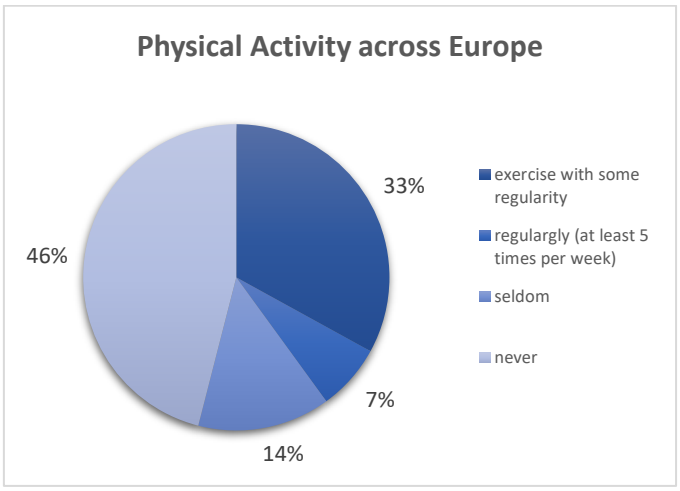

Figure 7. Amount of physical activity from regular to never across Europe in 2017 // source: Eurobarometer, 2019

Even that studies on the relationship between economic and activity factors are still ongoing, WHO analysis shows that higher income European countries tend to have higher percentage of insufficiently physically active citizens. Moreover, the graph below highlighting the percentage of insufficiently physically active male and female population in Europe, clearly shows that females tend to be more physically inactive compared to the male population (see Figure 8). In

[27] Special Eurobarometer 472 (December 2017). Report, Sport and physical activity, European Commission, p4

Europe, 22% of the male population and 30% of the female population are not sufficiently active. In addition, urbanization has also negatively linked to the level of physical inactivity. For instance, UK has a 19% share of rural population and higher level of insufficient physical activity compared to Poland that accounts for 39% of rural population.[28] However, it should be noted that wealthier countries tend to have more population walking compared to less wealthy. This phenomenon is probably linked to higher investments in mobility and pedestrian facilities.[29]

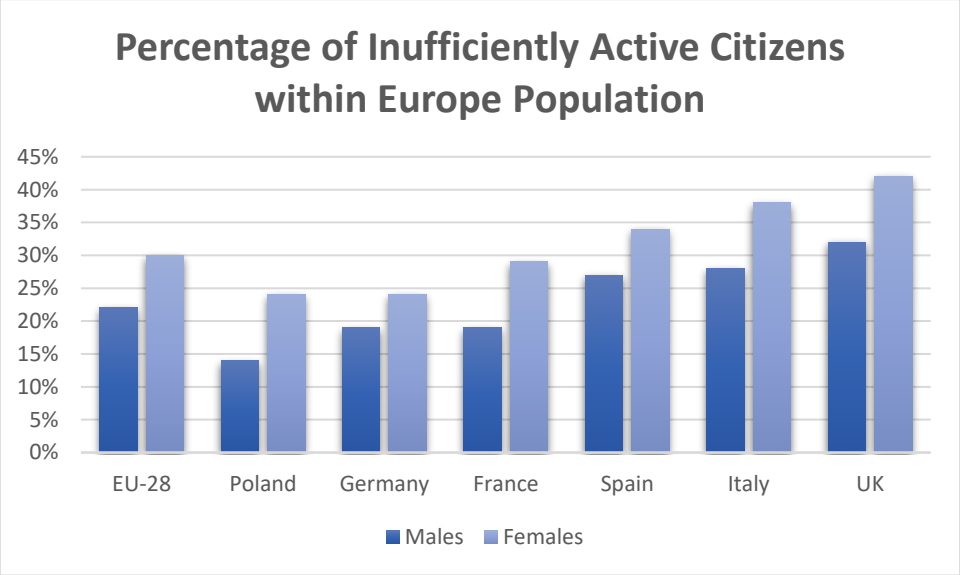

Figure 8. Male and female population not sufficiently physically active in Europe compared to six major European countries // source: ISCA, Cebr, 2015

Main locations in which physical activity is carried out are outdoors, at home and on the way to work, school and other everyday activities. Commuting is one of the main common situations in which physical activity takes place, either by

[28] ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe, p13

[29] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p15

walking or cycling or throughout the use of public transports (see Figure 9). In EU-28 physical activity on the way between home and school, work or shops accounts for 23%, with a lower rate of 11% in United Kingdom and a higher rate or 42% in Greece. On average, regarding the main location on which physical activity takes place, there are not big differences based on gender, age, education, and subjective urbanization.[30]

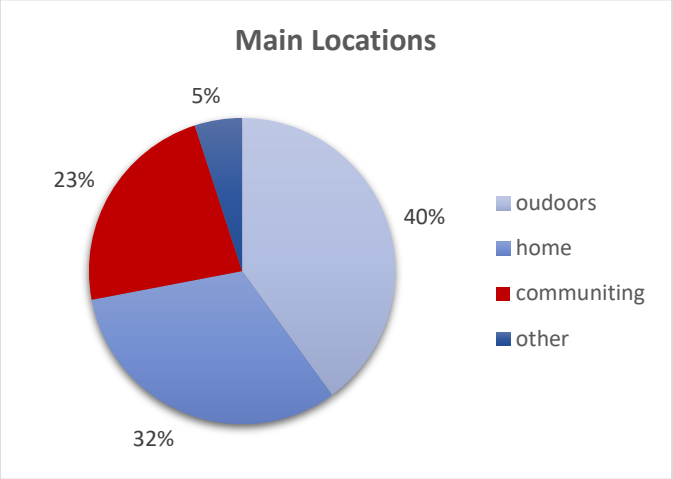

Figure 9. Main location in which physical activity takes place in Europe. Commuting accounts for 23% compared to home, outdoors and other locations // source: Eurobarometer, 2019

The development of cars in the past 60 years has changed greatly the idea and way of transportation. It affected cities and landscapes and everyday life. Distances that could be reached highly increased leading to an increase of the number of cars within the streets and the need of constructing new highways. On an emotional point of view, it turned the pleasure of driving to just a way of moving from one place to another. Moreover, this mobility transformation and

[30] Special Eurobarometer 472 (December 2017). Report, Sport and physical activity, European Commission, p4-8, 39-45, 51-64

increase negatively impact the natural environment, the social relationships, and, as explained above, health.[31]

To promote physical activity through commuting, urban planners need to think not just about citizens need of going from A to B but also to the surrounding and in making the city more attractive for the citizens. Open space, instead of being viewed as a scarce resource, should be viewed as an opportunity for investment and intervention and a resource to serve more needs at the same time using a holistic approach. As WHO Europe explains, "a good street for walking is also a good street for stopping, standing and sitting", which would encourage people to use more the street and be more physically active. Sitting along the streets itself does not provide physical activity. But it encourages it indirectly as it makes enhances social interaction making the streets safer and more pleasant to walk and cycle. The walking environment also plays a crucial, in the meaning of ground floor space and surrounding building. It impacts the perceived distance to walk.[32]

Travel modes change as people grow up and their economic status changes. Moreover, children are highly affected by their parents' habits. Younger people have a limited budget and therefore they try to save on transports, but at the same time they wish for more independence. This leads them to borrow bikes and cars or travelling by group in order to decrease the expenses they face. As they grow older and find a job, they stabilize professionally and domestically. At this point, they will develop their ultimate mobility habits. A later change will be reached with retirement. This happens because of travel boundaries and difficulties encountered by older people within their journeys. Factors affecting

[31] C. Horn (2014). Towards Active Mobility. Europe. Urbanplanet

[32] World Health Organization Regional Office of Europe (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe. WHO Europe, p54

this change are, for instance, the lack of benches, crossing over busy roads, and lack of visibility at crossings.[33] Among the main barriers that prevent people from walking and cycling is the perceived danger of roads. This leads parents to restrict the independent mobility of their children and elderly to self-restrict theirs. Cycling and pedestrian injuries and accidents accounts for approximately 20% of the serious accidents in Europe. This figure is higher compared to motorized transport user accidents.[34] In the survey that was carried out, it was asked which ones where the most used transport modes among private and public transport, walking and cycling on the way to work/school and for leisure time. 41% of the participants mainly engage in active transport, such as walking, cycling, or public transport, while 12% use mainly private transport. Europeans tend to use public transport, walk or cycle more than the United States population. In general, however, half of the participants, use a combination between private and public transport together with choosing walking and cycling as mode of transport. This data is similar differentiating between male and female participants. Females are slightly more likely to choose active transport compared to the males.

There are different factors that affect one's decision on which type of transport to choose among various modes. Those factors are based on time, quality, cost and external influences. Time related factors are those that influence people's choice the most. Convenience, distance to reach the final destination, freedom and flexibility, together with the possibility to reach key places are among the main factors that influence people on the type of transport they use within the

[33] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p12

[34] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p13

city. On the other hand, accessibility and friends' and family's choice of transport have low importance in affecting this choice (see Figures 10-12).

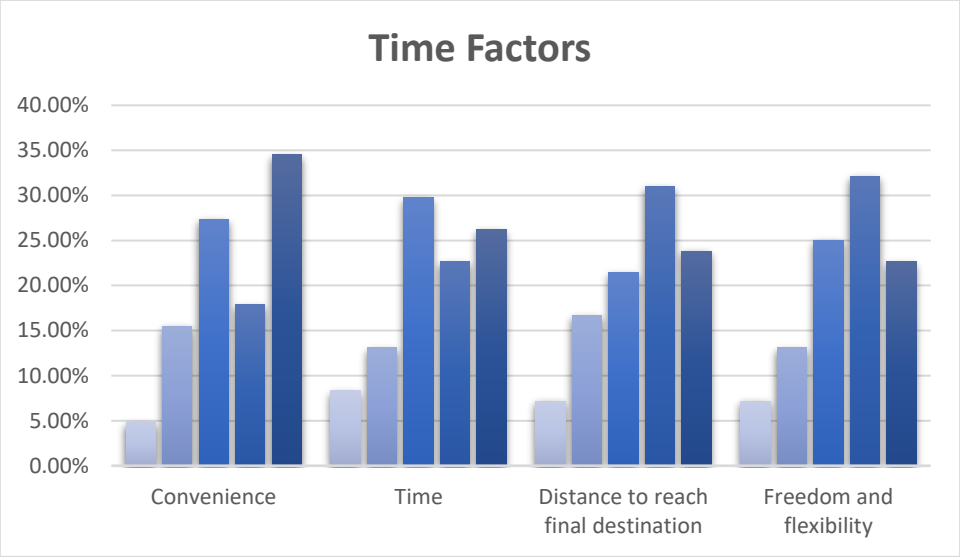

Figure 10. Time factors affecting choices on mode of transport, from low (left) to high (right) importance // results from survey, 2019

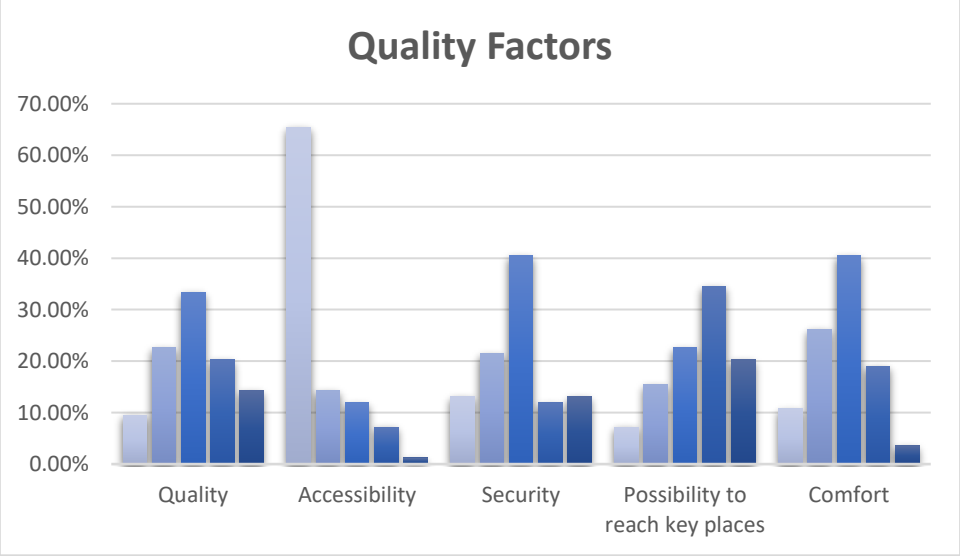

Figure 11. Quality factors affecting choices on mode of transport, from low (left) to high (right) importance // results from survey, 2019

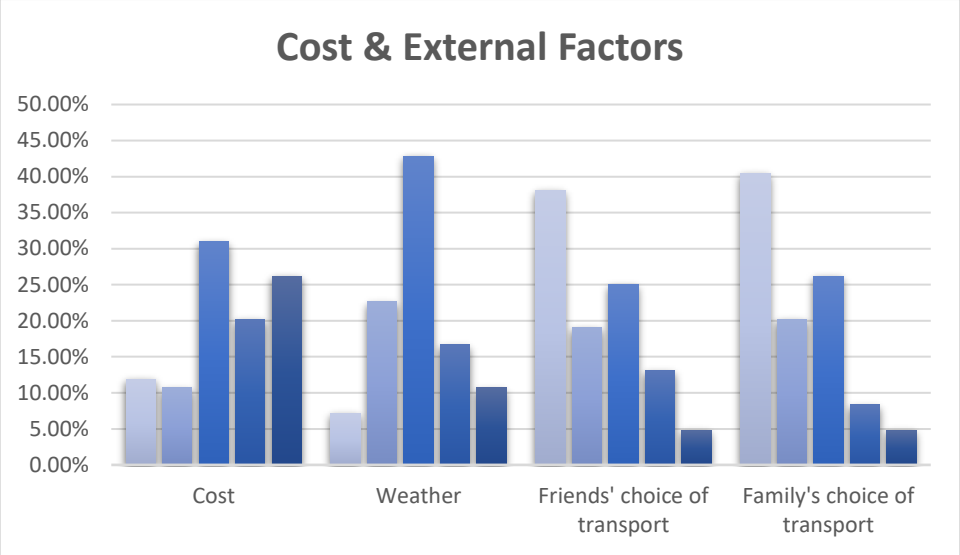

Figure 12. Cost and external factors affecting choices on mode of transport, from low (left) to high (right) importance // results from survey, 2019

The WHO defines Active Mobility as "modes of travel such as walking or cycling, as an alternative to motorized travel". It can also be referred as "sustainable transport" for two reasons. It generates no air pollution emissions and it indirectly promote physical activity, also when combined with public transport.[35] Active mobility can have a positive impact on social and environmental matters. It increases the possibility of using public spaces and be physically active. It also reduces stress compared to private and public transport.[36] Time and comfort have higher importance in choosing private transport compared to walking, cycling and/or public transport, while distance to reach destinations has a slightly greater importance in the case of choosing active transport (see Figure 13). There are also some differences regarding gender. Males tend to focus on convenience, quality, comfort and possibility to reach key places more compared to the female population.

[35] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p9

[36] C. Horn (2014). Towards Active Mobility. Europe. Urbanplanet

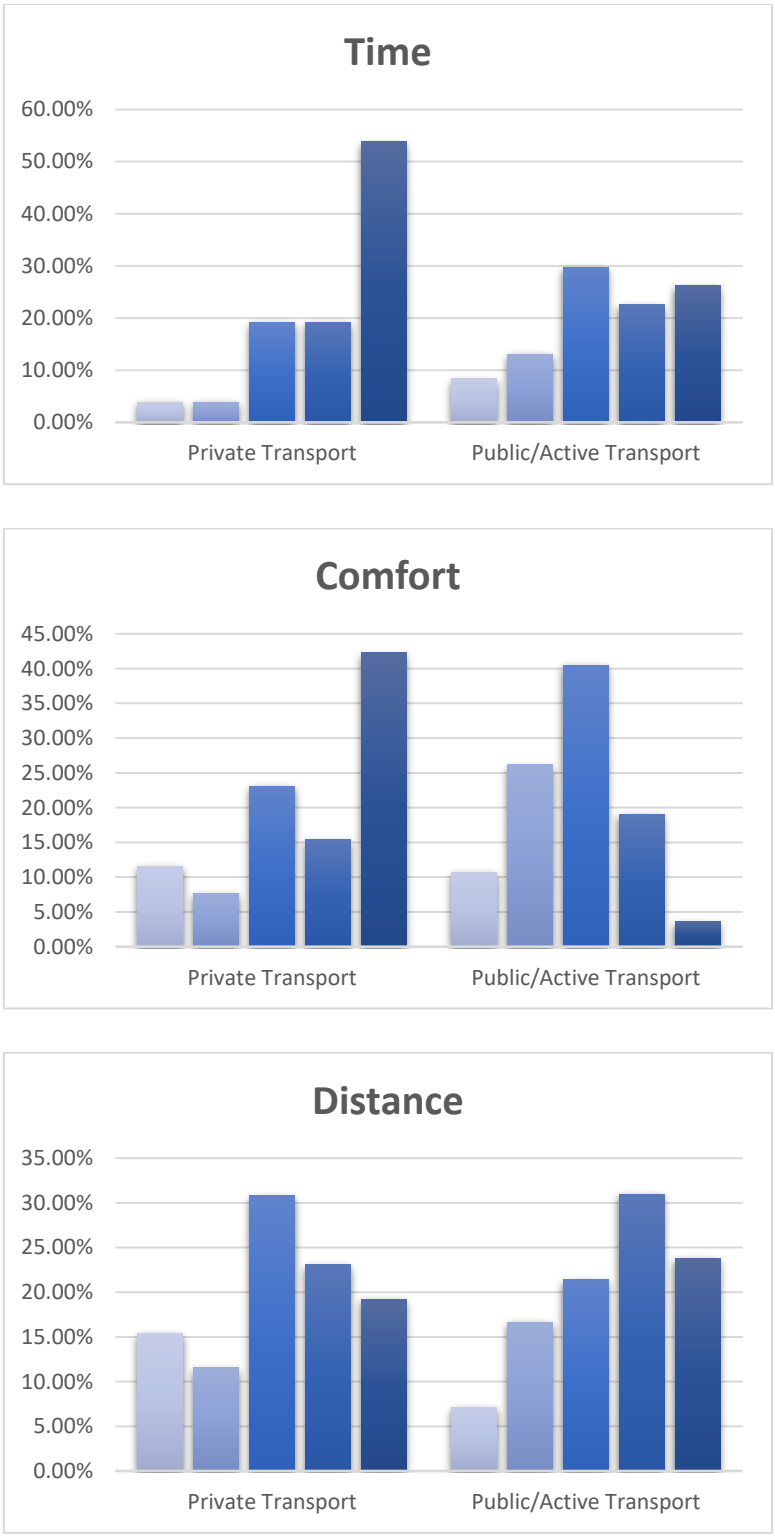

Figure 13. Importance of time, comfort and distance to reach final destination factors comparison between private and active transport, from low (left) to high (right) importance // results from survey, 2019

A commonly misinterpreted factor is linked to the effective cost of the use of the car. The WHO explains that French usually estimate the annual costs of using their car to be around €2200. Through the use of ADEME (French Environment and Energy Management Agency) calculator, the WHO has estimated that the actual cost of using the car for commuting is between €6000 and €10000 per year.[37]

As T. Litman explains in his report "Evaluating non-motorized transportation benefits and costs" (2011), non-motorized transport is generally under-evaluated even though most motorized travels require walking, for instance, from parking spots to final destinations, and people spend a lot of time in pedestrian environment, such as airports and shopping centers. Pedestrian environments, which cover a big part of the public space, are also the place where people meet and socialize.[38] Biking and walking are usually not taken into consideration within transportation researches because they have a low percentage of kilometers compared to motorized transports. However, if we look at the share of total trips this data changes. Biking and walking are key modes of transport because of several reasons. They provide door to door connections, are cheap and good for the environment and for the health and are essential within intermodal transport. However, they are perceived as low speed transports, even that they may be comparable to motorized ones in case of high traffic. They are also remarked with low level of comfort, mainly linked to weather conditions and physical effort.[39] Non-motorized transport, including

[37] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p14

[38] T. Litman (May 16th, 2011). Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, p4

[39] P. Rietveld (January 2001). Biking and Walking: The Position of Non-Motorized Transport Modes in Transport Systems. Tinbergen Institute Discussion Paper. Amsterdam, p2

transits between private and/or public transports, cover 16-17% of total trips and travel times in urban areas (see Figure 14).[40]

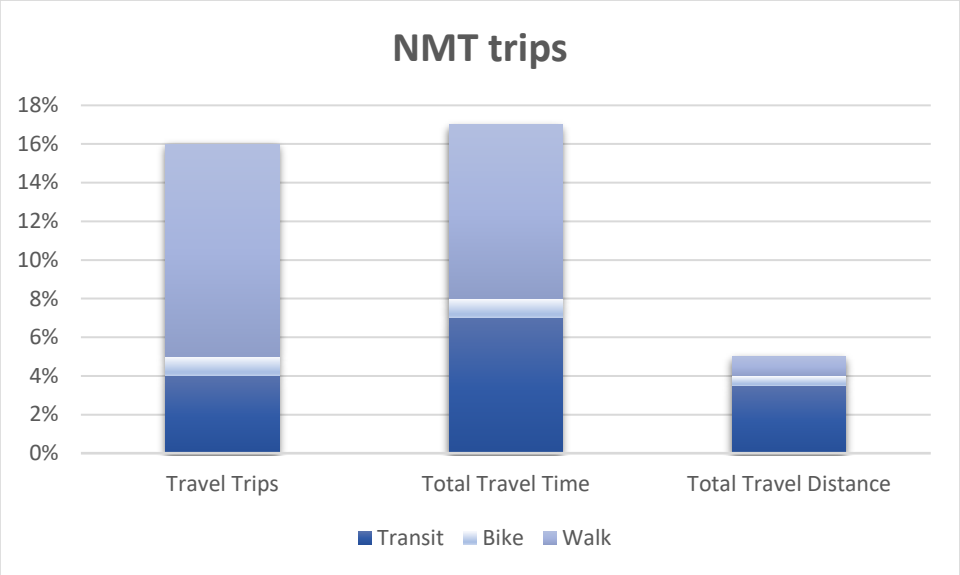

Figure 14. Non-motorized trips and travel time divided by transit, cycling and walking (Europe) // source: Todd Litman, 2011

Non-motorized transports, such as walking and cycling, are also referred to active or human powered transports. As T. Litman describes in his report "Evaluating Non-Motorized Transportation Benefits and Costs" (2011), walking is a universal human activity, and together with cycling is the most practical, easy and economical way to improve one's own fitness and health and support related industries, such as retail, recreation and tourism ones. Enhancing non-motorized transport conditions can benefit the society as a whole. It is an affordable type of transport and it allows access to motorized one.[41]

[40] T. Litman (May 16th, 2011). Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, p10

[41] T. Litman (May 16th, 2011). Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, p4

In Europe, most of the trips are, in fact, short. Walking is the most common mode of transport for trips with a length of less than 1.6km. However, most of them are made by cars. In terms of distance covered, more than 30% cover less than 3km, and 50% less than 5km. The real time of those trips depend on the traffic congestion and population density of the city they have been carried out. Compared to a more active mode of transport, if those trips would have been made by bicycle, they would need 15-20 minutes, while by walking 30-50 minutes. In other words, just switching the mode of transport, citizens would easily reach the recommended level of physical activity per day.[42]

If we look at our history, walking was predominant in all countries. A substantial change was influences by railways' and highways' development. In the 19th century, also the bicycles became more popular. Since 1950, in most industrialized countries, the car became the main mode of transport. Bicycles than went back to their original role as recreational and sport activity. On the other hand, in developing countries, including China and India, bicycles are still essential in the everyday life. An interesting fact in given by the annual sales of bikes and cars: ownership of bicycles greatly increased compared to the cars' one (see Figure 15).[43]

[42] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p6-8

[43] P. Rietveld (January 2001). Biking and Walking: The Position of Non-Motorized Transport Modes in Transport Systems. Tinbergen Institute Discussion Paper. Amsterdam, p2-3

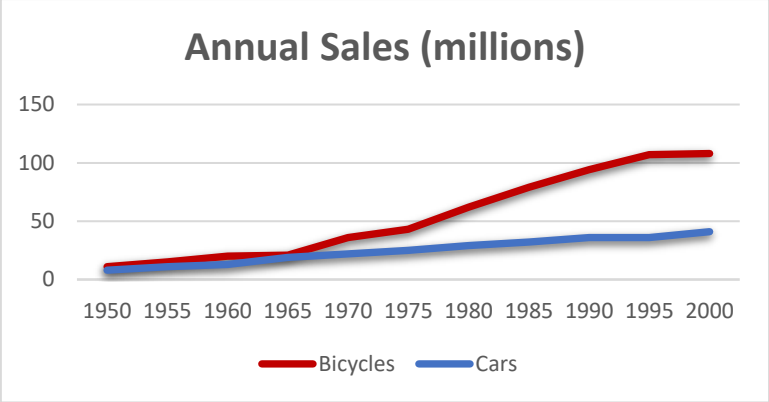

Figure 15. Worldwide annual sales comparison between cars and bikes (millions) // source: P. Rietveld, 2001

The potential of using bikes as mode of transport is therefore high. However, what prevent people from choosing to walk or cycle or using public transport, or a mix of those mode of transport is the fear of cars. If we take as an example commuting from home to school, most parents do not let their children walk or cycle to school because they are afraid of cars. Of course, this changes among cities also depending on the size of the city. In any case, the challenge that came out from a survey taken in Guimarães, Portugal, with the goal of developing a new strategy of urban planning, is the link between increasing number of cars and the low number of children waking and cycling to school. In this survey, teachers and parents have been called to give their impression. What came out is that parents wish and are willing to let their children walk or cycle to school but they are afraid because of the high number of cars around the school and on the way to the school. Consequently, they choose themselves the cars as mode of transport to reach schools. In other words, the challenge that raised is a loop in which the fear of cars leads to not walking and cycling, which in turns lead to an increase number of cars and therefore an elevated fear of roads.

Ch.3 – Active Cities and Active Transport

Impact of Improving Transport

There are some strategies that can be implemented globally or nationally as they would benefit the population in general, while others need to focus on local facilities and urban planning as cities' setting changes worldwide and have different historical and cultural settings.

Transport systems and socioeconomic changes are highly related in regions worldwide have been affected in different ways by the 19th century industrial revolution and the 20th-21st century globalization and economic integration. Transports on all levels, international, regional, and local, have become fundamental components of the economic activities. The positive relation between transportation, society and economy are linked to mobility, accessibility, employment, and investment. However, if capacity and reliability drop down, it leads to missed opportunities and a lower life quality. Moreover, transport systems also lead to united consequences, such as congestion, accidents and mobility gaps. Congestions can be viewed as an indicator of a growing economy in which capacity and infrastructures cannot meet the increasing mobility demand (J.P. Rodrigue, 2017).[44] Physical activity can have a great economic impact on the development of the society. It can contribute to its growth and job creation. It can also positively affect local and regional development as well as urban and rural one (EU, 2007).[45] As P. Walker explains in his article in the Guardian (2019), his research shows that active residents

[44] P. Rietveld (January 2001). Biking and Walking: The Position of Non-Motorized Transport Modes in Transport Systems. Tinbergen Institute Discussion Paper. Amsterdam, p3-4

[45] European Commission. Special Eurobarometer 472 Report (December 2017). Sport and physical activity. European Commission, p4-8

bring benefits to their cities, such as increased economic productivity, property values and school performance. He concluded that projects related to walking and cycling have an average return of 13£ (15.14€) in economic benefits for every £1 (€1.16) invested. This estimate is linked to direct and indirect benefits, such as increasing trade for local shops, decreasing traffic congestion and days off from workers.[46]

When planning the city settings, urban planners, politicians and decision-makers have to ace various challenges. There is an increasing demand of personal mobility and economic growth that needs to be balanced with the need to respect the surrounding and world environment and contributing for a better quality of life. Among all continents, Europe is the most urbanized one. 80% of the population lives in urban areas. Another interesting fact is that half of all journeys have a length of less than five kilometers and a third less than three kilometers. Favoring sustainable transport would positively affect social inclusion and accessibility, urban traffic and congestions. The positive outcomes would be direct to the whole population, including the 30% that does not have access to a car and those that can benefit from it. Using existing roads and their current capacity more efficiently is among the main European challenges. A solution could be provided by allocating the space used for private transport to different types of travel. There is a widespread growing recognition of the need of giving priority to sustainable transport.[47] Another point to take into consideration when trying to improve active and sustainable transport is the difference among each individual, in other words, habits and responsiveness to change should be taken into account. A city has to deal with both people that

[46] P. Walker (February 16th, 2019). Cities with Physically Active Residents More Productive as well as Healthier. The Guardian

[47] European Commission (2004). Directorate-General for the Environment, Reclaiming City Streets for People: Chaos of Quality of Life?. European Commission, p9-13

are ready, open and accepting change and with those that are reluctant of change. Approaches should then be differentiated as in the case of people already active compared to those that mainly use motorized transport.[48]

Conventional transportation planning practices give priority to motorized travel rather than to walking. They tend to under-evaluate walkability and under-estimate its benefits. Those benefits are related to economy, health and daily life as walking is more affordable and resources efficient compared to motorized travels. On an economic point of view, walking and walkability can increase cost savings, improve efficient land use and economic development, and support equity objectives. On a healthy point of view, it improves fitness and public health. Last, it affects our daily life on basic mobility and community livability. The practice of giving low value to walkability leads to some consequences. First, it shifts resources to roads and parking facilities and maintenance. Second, land is principally used to increase the among of motorized vehicles it can contain. Thirds, it affects pedestrian safety. Other reasons regarding this under-evaluation are measurement difficulties, low status and cost. If we think about it, while automobile transit industries grow worldwide, there is not an organized walking industry. This is also a result of the fact that walking is "taken for granted": for example, if a road lacks sidewalk, it is still possible to walk along it. however, those people living in areas not built for walking tend to go around lees on foot and drive more than those living and working in "walkable" areas. Moreover, people in the latter situation spend 50% more than those without access to multi-modal transportation systems. external costs. External costs added to the use and maintenance of cars regards traffic congestions, crash risk and environment damages. Another impact regards social life: streets are the

[48] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p14

place where people meet and interact. Improving them for walking, cycling and public transports has shown to have a positive impact on the economic performance of a community commercial sector. It increases local and nearby business retail sales and it reduces commercial vacancies. Last, walkability is also linked to equity distribution. It provides better opportunities for physically and economic disadvantaged people and it leads to a better distribution of public resources among non-drivers and basic mobility.[49]

Improving Transport: Practical Cases

There have been various ideas to increase active mobility. Early trends where creating separate lanes based on the type of mobility: private and public transport, bicycles and pedestrians. This led to an increase in the amount of bike lanes. However, this increases urban complexity, and difficulties to cross traffic lanes.[50] Urban planning linked to promoting active transport, mainly through the development of public areas, streets, and accessibility can lead to not only to air and water pollution reductions, but also to decreases in noise disturbances and energy consumption. All those are negative effects of individual motorized transport usage. Local authorities have a great impact regarding making their cities more attractive and developing intermodal transport. Starting from small steps, there are various options that can make a city more attractive for both its citizens and potential tourists, from maps and signs highlighting the time or distance to reach key places either by foot or by bike, to wider and more accessible and less slippery pavements or pedestrian zone near schools or in the city centers, to safer cycles paths or more opportunities for parking bikes. To

[49] T. Litman (May 16th, 2011). Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, p4-10

[50] C. Horn (2014). Towards Active Mobility. Europe. Urbanplanet

reach a good intermodal transport service, local authorities need to focus on increased and, possibly, maximizing, the range of alternatives available in terms of transport compared to private transport and make it easier to switch from one type of transport to another.

In order to benefit the whole population of a city, it is important also to consider the final target and more in particular the different targets that exists within a population. From a geographical side, distinction between the part of the citizens that live closer to the center and those that live in suburban areas needs to be made. Suburban areas are usually highly crowded and include the poorer population of the city. From an infrastructure point of view, road safety is low and distance from the city and jobs is high. From a social point of view, the risk of violence, both real and perceived, and the working hours are high. All those factors lead to increases in difficulties in choosing intermodal transport. Other distinctions to be made are gender, age, and level of mobility.[51] Children and elderly provide a good evaluation driver regarding the conditions of the urban environment, including the perceived and actual level of safety, on whether this is suitable of not for commuting by walking or cycling or using public transport. As mentioned earlier, establishing a healthy and active lifestyle in children will encourage them to have a more active lifestyle as adults. The journey to school is a great opportunity to establish this type of habits. However, most parents give priority to the use of the cars also linked to the increase motorized traffic in the surrounding of the school and on the way between home and school. This creates a negative cycle. The fear of cars and the perceived unsafety leads to the use of cars, which in turns leads to an increase in the motorized traffic. This, in turn, leads to an increase of the dangerousness of roads and therefore less

[51] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p30-32

adults would choose walking and cycling as mode of transport for the children. This would in the end increase once again the traffic and restart the vicious cycle.[52] Another important class refers to the reduced mobility population, which includes the elderly, pregnant women and wheelchair users. For instance, public benches would encourage and facilitate active travel for those with reduced mobility, considering that it has been estimated that 30% of them cannot walk for more than 50 meters without taking a break.[53]

Traffic-calmed Areas: Gradual Strategies

One way to improve active mobility within cities is to implement traffic-calmed areas, which include pedestrian areas, 20km/h and 30km/h zones. Traffic-calmed areas leads to increased diversity in the streets, drivers' attention, different perception of the street. Reducing the speed limits leads to the perception that the roads or squares are no longer mainly designed for motorized traffic, it therefore allows for a wider range of diversity of traffic modes, increasing pedestrians and bike-users. As a consequence, drivers provide a greater attention as pedestrians have now right of way. The first city in France that implemented this concept is Metz. It started the project in January 2009 with yearly consultation of the population regarding new zones of the cities being included in the project, and by the end of 2012 it implemented 100 kilometers of 30km/h zones.[54] Meanwhile in Denmark, a project of pedestrianization started in the capital in 1962. Nowdays, Copenhagen reached 96000 m^2 of car-free space in the city center. A third of it includes streets, while

[52] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p10-11

[53] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p30-32

[54] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p34-35

the other two thirds are city squares. 80% of the trips within the center are made by foot and 14% by bicycle. Shopping and activities are now four times greater than in 1968. The key success of this transformation is an incremental approach. There was a gradual transformation before drastic changes were made. This gave time to the citizens to progressively adapt and change their mode of travel, from private cars to public transports, walking and cycling.[55] Another interesting case is Kajaani, Finland. Due to the elevated traffic congestion and urban decline of the city in the early 1990s, a project to regenerate the city center was implemented. Before the pedestrianization of the main square, about 13000 vehicles per day used to cross the square. Initially traffic flow in the project area and nearby increased, but it finally ended in decreased traffic congestions and more trips made by foot to reach the city center. Opinions from citizens are overall positive in terms of comfortable, safeness, and prettiness of the center. Moreover, they positively think that the project should be expanded and that the pedestrianized area should be increased. Another gradual strategy was developed in England, in the city of Wolverhampton as a reaction to high traffic congestion, bad environmental conditions, and a declining economy. One option was building more roads, but from a local authority commissioned study it came up that it wouldn't solve the transportation problem. On the other hand, a more effective strategy was enhancing public transport and the urban environment. First, the main central roads were gradually restricted from private cars with the aim of reaching restricted access to only public transport, which was improved, pedestrians and cyclist. As experienced in Kajaani, an initial greater congestion was faced, but at the end of the project, the city center was finally car-free. Also, in this case, the majority of the traffic that was removed

[55] European Commission, Directorate-General for the Environment (2004). Reclaiming City Streets for People: Chaos of Quality of Life?. European Commission, p16-17

from the main core roads wasn't transferred elsewhere. Public opinion was initially negative until benefits and positive impact became apparent. The city center became cleaner, safer, more attractive, with better access and enhanced shopping and commercial environment.[56]

Pedestrian Signs: Awareness of Real Time Needed

The city of Genoble focused on introducing pedestrian signs based on the average time of journeys to reach places by foot, such as main points in the city, cultural sites, green spaces and squares. It focuses on three points: increasing the pedestrian flow in the city centers, sensitize urban areas towards public transport facilities and towards a green mode of transport. The main challenge that all cities and authorities face is time. Pedestrian signs are a useful tool to increase awareness of the real time that it takes to reach a destination by walking. In the implementation process of this option to increase and promote physical activity within a city, strategic points have a key role. Breaks should be avoided in order to provide full information in reaching the destination, considering spots in which pedestrians need to choose a direction and have to choose between a motorized type of transport or keep walking. Moreover, pedestrian signs need to be different and not confusing compared to those already existing for other road users.[57]

Walking Bus: Decrease Traffic in School Surroundings

After the first implementation of walking busses to make commuting to schools safer and more active in Hertfordshire, United Kingdom, which decreased car traffic in the school surroundings by more than 30%, hundreds of walking busses

[56] European Commission, Directorate-General for the Environment (2004). Reclaiming City Streets for People: Chaos of Quality of Life?. European Commission, p22-27

[57] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p40-41

are now implemented all around United Kingdom. [58] Following the experience of Nordic and English-speaker countries, by 2012, around 350 villages and cities in France have implemented walking bus schemes. Among those, there is the agglomeration of the city of Lyon. It started with implementing 2 walking bus routes in 2002 and in ten years it reached 96 routes covering 73 schools and almost 900 kids per day. Walking busses lead to social, educational, health and environmental benefits. On the social point of view, it leads to increased safety around the schools and reducing traffic. On an educational point of view, it teaches children how to correctly and responsibly behave on roads. It leads to healthier environment as it reduces air and noise pollution and it makes individuals participate in environmental protection. Main reasons for the success of this type of scheme is the city support and integration into education and active mobility plans, and the elevated involvement of the community.[59]

Shopping: Impact of Active Transport

Regarding perceptions, another challenge is convincing stores' owner about the benefits of pedestrian areas against high traffic. There is a widespread believe that limiting the cars within city centers would have high negative effects on the shopping economy. A study focusing on shopping and modes of travel on a pedestrian street of Dublin shows that on average, against widespread believes among retailers, cyclists spend nearly as much as car drivers. Moreover, those reaching the area by bus spend only 15% less than drives, while those that choose to walk spend around 22% less than car drivers.[60] In fact, when driving

[58] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p11

[59] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p38-39

[60] Pere Pärtel-Peeter. The Effect of Pedestrianisation and Bicycles on Local Business: Case studies for the Tallin High Street project. Future Place Leadership, p11

people directly go to their final destination, while when commuting by bike or foot, citizens have the time and the possibility to look at all the stores on their way. Another study published by the Research Institute of Trade (FfH) took into consideration eleven German towns of different population sizes. The study focused on the turnovers in pedestrian areas and outside of those in relation to structural changes of retailing. In general, turnovers in the pedestrian areas increased compared to outside areas. Those results can be compared to a study from Kolck (1979) covering six small towns in the north of Germany, with a population size of 17000-30000. 32.4% of those reported an increase in their turnover of 5-10%, 15.8% of them of 10-20%, and 6.8% of over 20%. In general, most of the retailers, in both big and small cities faced a turnover increase.[61]

Employment and Transport

Nottingham's Ucycle project aimed at promoting cycling among students and university staff. This project focused on improving infrastructures and using social media for marketing related activities on one side and reducing the reliance on car by limiting parking spots or providing incentive cycling and walking, such as through the distribution of route maps to find new ways to avoid traffic, on the other side. As a result of the project started in 2010, from a survey carried out in 2013, 44% of the staff and students chose walking and cycling as mode of transport compared to motorized transport and the travel by car to reach and leave the university campus decreased by 10%.[62]

[61] C. Hass-Klau. (1993). Impact of Pedestrianization and Traffic Calming on Retailing: a review of the evidence from Germany and the UK. Brighton, UK. Environmental and Transport Planning. Transport Policy 1993 1 (1), p22-25

[62] S. Joseph, R. Bourn. Improving Local Transport Helps the Economy – experience from the Local Sustainable Transport Fund. London, UK. Campaign for Better Transport, p17

Ch. 4 - Improving Active Transport

Benefits and Costs

Physical activity has benefits that last a lifetime. As mentioned early, it also leads to a. intergenerational cycle, but in this case to a positive one. In fact, physically active children will likely become physically active adults, which are then associated with a next generation of physically active children. Moreover, it has been estimated that children of active moms are twice as likely to be active compared to those of physically inactive moms. In their early childhood, a physically active child has 1 possibility over 10 to be obese and reaches 40% higher scores compared to inactive coetaneous. During the adolescence phase, being physically active can lead to fewer possibility of smoking or drugs use habits, become pregnant or engage in risky sexual behavior. Moreover, it is estimated that, compared to inactive adolescents, they have a 15% more likelihood to go to college. In the adulthood phase, they earn 7-8% more during their life, save between $2000 and 3000 per year in health costs, and are likely to live 5 more years compared to inactive adults.[63] As the population ages, which is a growing part of the world population, it is more and more important to provide adequate support and access to public transport facilities in order to keep the elderly active. This would not just benefit the well-being of the individuals but the society as a whole. It would also provide economic benefits due to improved quality of life linked to social engagement, mental and physical health.[64]

[63] Nike In. (2012). Designed to Move. Nike Inc., p14

[64] B. P. Shrestha, A. Milonig, N. B. Hounsell, M. McDonald (2017). Review of Public Transport Needs of Older People in European Context. Journal of Population Ageing (10), p346

Improving non-motorized transport conditions and reducing automobile travel has various benefits and costs both on an individual and community levels. Direct user benefits include increase in convenience, comfort, enjoyment, local property values, and consumer savings related to transport expenses. Society's benefits are linked to option value, more livable communities and community cohesion in a means of increasing interaction among people. It also includes road related benefits, such as reduces traffic congestions and crashes, road and parking facilities costs savings, and increased accessibility, which is the ability to reach places and it is linked to mobility, available modes of transport, network connectivity, and land use. Lastly, improvements in active transport also leads to environmental benefits. It preserves energy and habitat and reduces air and noise pollution. On the other hand, user costs are linked to equipment, for example shoes and bikes, and to travel time increases. On a society level, development and facilities costs and traffic speed reduction can be faced.

T. Litman (2018) estimated the potential consumer cost savings from reducing automobile travel (see Figure 16). Consumer savings are related to vehicle operating costs, such as fuel and oil, and ownership, mileage and parking related costs. To be considered are also costs related to tolls and insurance.[65] Vehicle ownership and usage costs are among those factors that are often overlooked when considering the benefits of non-motorized modes of transport. The only category that is usually considered is the costs of fuel, oil and tire wear, in other words, the operating costs. Parking costs and vehicle ownership are usually underestimated. When planning urban transports and solutions, generally, congestion and traffic impacts from reduced motorized transport, impacts on

[65] T. Litman (July 24th, 2018). Economic Value of Walkability. Victoria Transport Policy Institute, p2-4, 9

physical activity and public health, and preferences of travelers in choosing among alternative modes of travel are not taken into consideration.[66]

Category	Description	Typical Values
Vehicle Operating Costs	fuel, oil and tire wear	10-15 cent per vehicle-mile - higher in congestion
Long-term Mileage Related Costs	mileage-related depreciation, mileage lease fees, user costs from crashes and tickets	10 cent per vehicle/mile
Special Costs	tolls, parking fees, parking cash out, insurance	varies
Vehicle Ownership	reduction in fixed vehicle costs	$3000 per vehicle/year
Residential Parking	reduction in residential costs due to reduced vehicle ownership	$100-1200 per vehicle/year

Figure 16. estimate of consumer savings from automobile travel reduction // Source: T. Litman, 2018

Active mobility leads to more people in the streets which in turn leads to an increase in the interaction between citizens and to a stronger social cohesion within a neighborhood. The WHO France Healthy Cities Network highlights in his report on "Active Mobility Every Day" a study in San Francisco. It has been showed that social interaction between citizens increases as traffic decreases. Moreover, in the case of moderate compared to intense car traffic, social interaction double within neighborhoods.[67]

Transport issues affect local economies also on the employment side. Congestion and traffic can lead to a poor environment in which people do not

[66] T. Litman (May 16th, 2011). Evaluating Non-Motorized Transport Benefits and Costs. Victoria Transport Policy Institute, p6

[67] WHO French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p17

want to live or work. Moreover, poor transportation system can lead to labor shortage. In fact, it can become a barrier for the labor market, both in getting employed or even just to get to an interview. Parking issues, lack of travel choice or too high costs of transport also affect employers Improving active transport would allow the access to a wider labor market also to non-car users. Travel costs often take up most of a big part of an employee's wage and limit unemployed search area for a new job.[68]

Needs & Challenges

There are some challenges that are shared by cities and communities worldwide. However, there are some that characterize European cities. this happens as a result of the differences in population size and density compared with countries in the rest of the world. These differences need to be taken into account when developing ideas and opportunities to increase physical activity within cities. another interesting data is that the percentage of people walking is relatively high in Europe, mainly in southern regions. This is significant to remember when planning to promote physical activity: some cities might be more suitable to walk than cycle. Megacities, that means cities with a population of over ten million inhabitants, worldwide is almost three times more compared to 25 years ago. However, there are only a few European cases that can be considered as such. These megacities are London. Moscow, Paris and Istanbul. 65% of the European urban population lives in smaller cities with fewer than five million inhabitants. This turns out to be an advantage when promoting physical activity within active transport as European cities tend to be relatively compact.

[68] S. Joseph, R. Bourn. Improving Local Transport Helps the Economy – experience from the Local Sustainable Transport Fund. London, UK. Campaign for Better Transport, p4-11

On the other hand, inter-modality is required in larger cities to join cycling, walking, and public transport to make active mobility more attractive and convenient. Population density is an important prerequisite to sustain public transport and urban functions. It is important for the development of shops and community centers. Moreover, a population density of 3000 per km^2 is considered a minimum standard for a public transport system. If both these factors are planned in the correct way, they can enhance the willingness of people to walk or cycle from one place to another. Moreover, European cities have histories that can go back centuries, if not millennia in some regions. This represents a challenge for urbanization since it has to deal with the preservation of communities' historical and cultural heritage. It can create conflicts in the use, allocation and development of some public spaces.[69]

In Europe, the potential to increase physical activity within citizens everyday life through walking and cycling is significant. However, as in all parts of the world, some issues need to be faced. There is the need to improve infrastructures to enhance safety, both perceived and real, to reallocate road space, and to focus on the environment and culture. Safety responds firstly to the most vulnerable road users' needs, which can be meet also with reduction of speed limit. The focus on road space includes reallocating space from motorized transport to pedestrian and cycling use, and from private to public transport. This could be achieved starting from the consideration of walking and cycling as "real" mode of transport. Another critical factor is the density of the city and facilities'

[69] World Health Organization Regional Office of Europe (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe. WHO Europe, p18-21

accessibility and appropriateness. Land-use density needs to be high in order to allow short distances between facilities.[70]

Modes of transports have different functions from one another in terms of access, distribution and transit. Those needs to be taken into account when planning urban design and development. As they may conflict with one another, roads' hierarchy and functional classification is needed to deal with priorities and space in the roads and free spaces. All modes of transport should gain benefits from urban planning development and not only the motorized vehicles.[71] Nowdays, streets make up about 25-35% of the city and account for 80% of open spaces. Streets and public space in general are overlooked resources that have been reduced to transports use and parking space, while their potential could be enormous.[72]

As people's life expectancy is increasing, elderly became more active compared to the previous generations. However, because of physiological changes and inability to drive cars by themselves, they make fewer and shorter trips compared to other adults, which all together leads to a change in mode of transport's behavior. There is a widespread need to make public transport easily accessible and more attractive to elderly in order to give them the opportunity to be more active. Public transport plays a crucial role within the sense of freedom and independence of older people, as it allows them to provide for goods, services, employment and other activities without the need of others. Main factors linked to transport facilities and accessibility of places to keep a

[70] World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p14-15

[71] KM Gwilliam (2002). Cities on the move: A World Bank urban transport strategy review. Washington D.C., US. The World Bank, p129-130

[72] LV Kielgast et all (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity. Copenhagen, Denmark. World Health Organization Regional Office for Europe, p29-31

good healthy and active lifestyle are availability, effectiveness, affordability, and adaptability. Regardless of age, gender and sex, there are also some life changing events that need to be taken into account regarding the change in one's mobility behavior, needs and purposes. Retirement, illness of the death of the partner or a close relative as divorce or marriage, birth of a child or grandchild may affect one's choice of mode of transport. When considering barriers, needs and challenges linked to active transport, decision-makers need to think at the whole package. Sometimes, even if only of feature is not accessible, regardless of all the others, it would lead the users to choose for a more effective and accessible mode of transport. It has been estimated that, regardless the improvement Europe-wide, 10-20% of the citizens are still facing barriers within transportation modes. For instance, regarding public transport, all issues in and out transport need to be considered. In-transport challenges include, for instance, accessibility and condition of transport, priority seating, stepless entrance, wheelchair space, real-time audible information. Out-transport challenges regard accessibility and condition of stop facilities, including road crossing and distance from users' homes and destinations, availability of information, and easy wayfinding. Affordability also plays a crucial role, as youth and elderly have usually less income compared to adults. This, on a first thought, would lead them to own less cars than adults and rely more on active transport. However, the cost of travel and the availabilities of transport's tickets could then become significant barriers for people. This can become a greater negative impact in the cases in which basic and necessary destinations cannot be reached by walking. Another challenge that to be taken into consideration is people's experience with public transport. For those that have used private transport for most of their life, it is more difficult to change, adapt

and rely on public transport because, due to their lack of experience, they perceived it as inconvenient and complicated.

Criteria	Challenge
Affordability	Provisions of concessionary fares Ease of use Transferable and flexible tickets Simple fare structure
Accessibility	Low floor busses Handrail Priority seating Wheelchair space Information related to bus stop Audible announcement Bus stop: ▪ Visible location ▪ Clear and protection from rain and sun ▪ Provision of seating facilities ▪ Well maintained footpath and sidewalk ▪ Level or low gradient footpath ▪ Good crossing facilities ▪ Lower traffic speed
Availability	Service connecting residence to place of interest
Acceptability	Safety Provision of help point Travel information and awareness At bus stop - easily understandable and readable ▪ Timetable and ▪ Information Driver - Good attitude towards older people - Driving behavior - Helpful and informative

Figure 17. Needs and challenges of public transport for older people // source: Journal of Population Aging, 2017

There is therefore a need to provide clear information and to raise awareness on the available services and the areas covered. In the table below are summarized general challenges that need to be faced when planning to cover the elderly population needs regarding public transport (see Figure 17).[73] Affordability, accessibility, availability, and acceptability of public transport are not needs and challenges only related to the elderly population but to the population as a whole. Improving them would benefit all citizens regardless of age, sex and level of mobility.

Moreover, there is the challenge to meet the needs of the whole population which comprises different groups of people divided by age, sex, level of mobility, life habits, meaning where they live, where they go for school, work and leisure.

Providing affordable, effective, available, accessible and safe alternative of mode of transport for children, elderly and those with reduced mobility would benefit the whole population. In order to meet the needs of the whole population, all aspects of walking, cycling, and public transport facilities need to be taken into account. Sometimes, just one feature which turns out to be not accessible, not affordable or not effective and efficient can lead to the choice of using private transport, where possible, or to decide to don't take the journey, and therefore would reduce physical activity levels. Nowdays a lot of information can be found through technological devices, which are available to most part of the population. However, elderly may face problems when they are reluctant to the technological change and usually there are not adequate information regarding accessibility of transport infrastructures. Therefore,

[73] B. P. Shrestha, A. Milonig, N. B. Hounsell, M. McDonald (2017). Review of Public Transport Needs of Older People in European Context. Journal of Population Ageing (10), p344-351

delivering clear and comprehensive information is among the main challenges that need to be addressed.

When choosing to commute by foot, cycle and public transport, wheelchair accessibility looks like to be a small factor in determining this choice. However, it needs to be taken into consideration that people in wheelchairs are only a relatively small part of the population and therefore some of their needs cannot be applied to the whole population. However, making facilities and infrastructure accessible would benefit the entire population, mainly regarding all other categories with reduced mobility, such as elderly, and parents or grandparents commuting with small children.

Different people have different needs when considering public transport, walking or cycling as an alternative to private mode of transport. Those are related can be distinguished in time, quality and cost related needs. More than half of the participants in the survey said that if the frequency of public transport would be higher, they would use it more often. In general, people relay on convenience when choosing which type of mode of transport to use when commuting between home and work or school or any other final destination. 34% of the participants in the survey stated that improving the convenience of public transport would make them use it more often. A greater portion showed the need to increase the possibility to reach key places, such as work, school, city centers, markets, sport halls, sport and leisure centers, through the use of public transport. Another time related factor refers to reliability and scheduled time of transports. Being more on time and higher speed, meaning the actual time required to reach a place, would also increase the willingness of people to use it. Cost is also an important factor, the variety of ticket options affects the

use of public transport, but more widespread is the need of lower cost in using this mode of transport (see Figure 18).

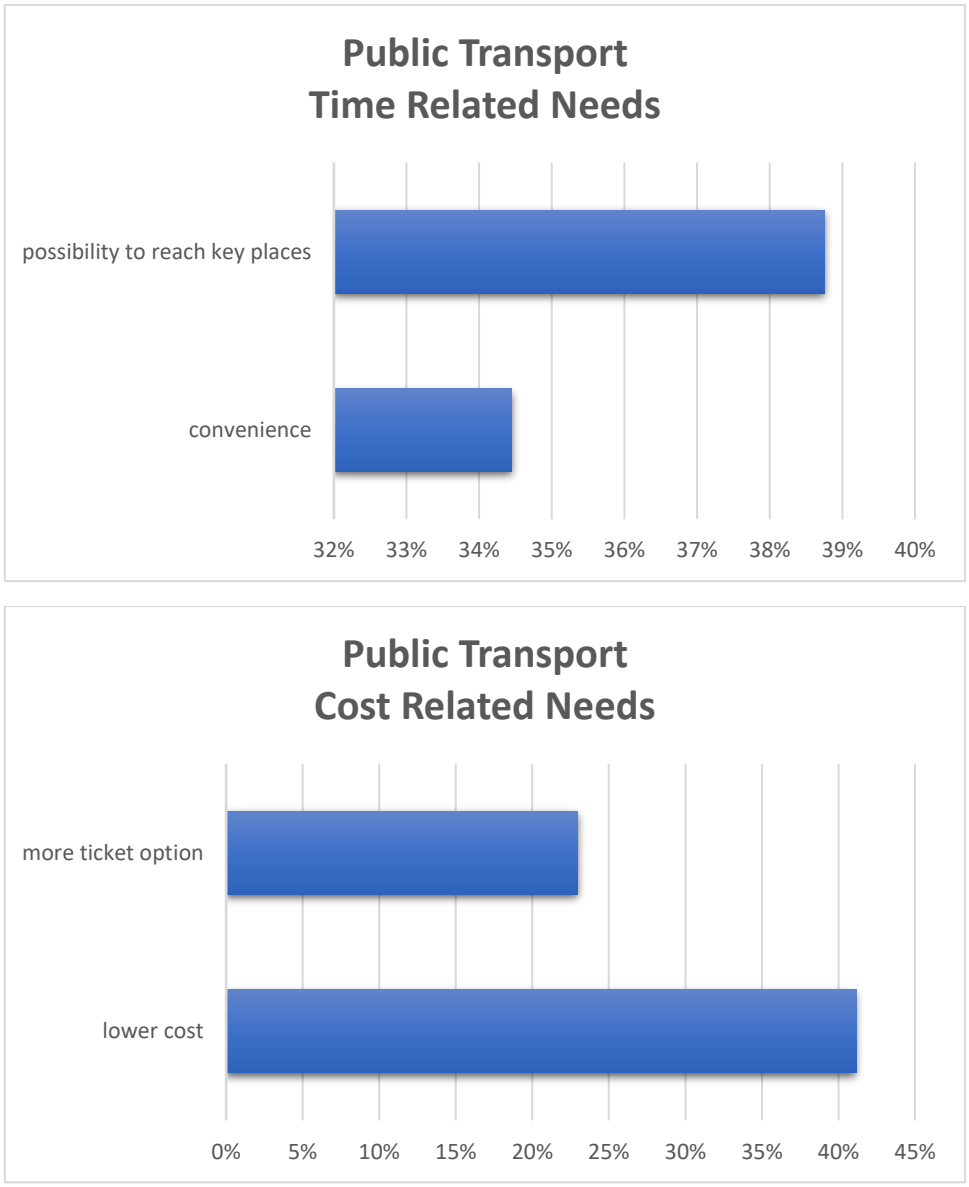

Figure 18. time and cost related needs concerning public transport use

There are various aspects related to the quality of public transport facilities and vehicles that need to be taken into account. Wheelchair accessibility, illumination, and the level of security during the day seem to have low importance in improving public transport. Higher importance has the comfort

(15%), the security during the night (22%), quality (30%), and, as mentioned before, the level of frequency which is an important factor for 61% of the participants in the survey. Other needs are linked to collecting information and co-operation and interconnection among different companies (see Figure 19).

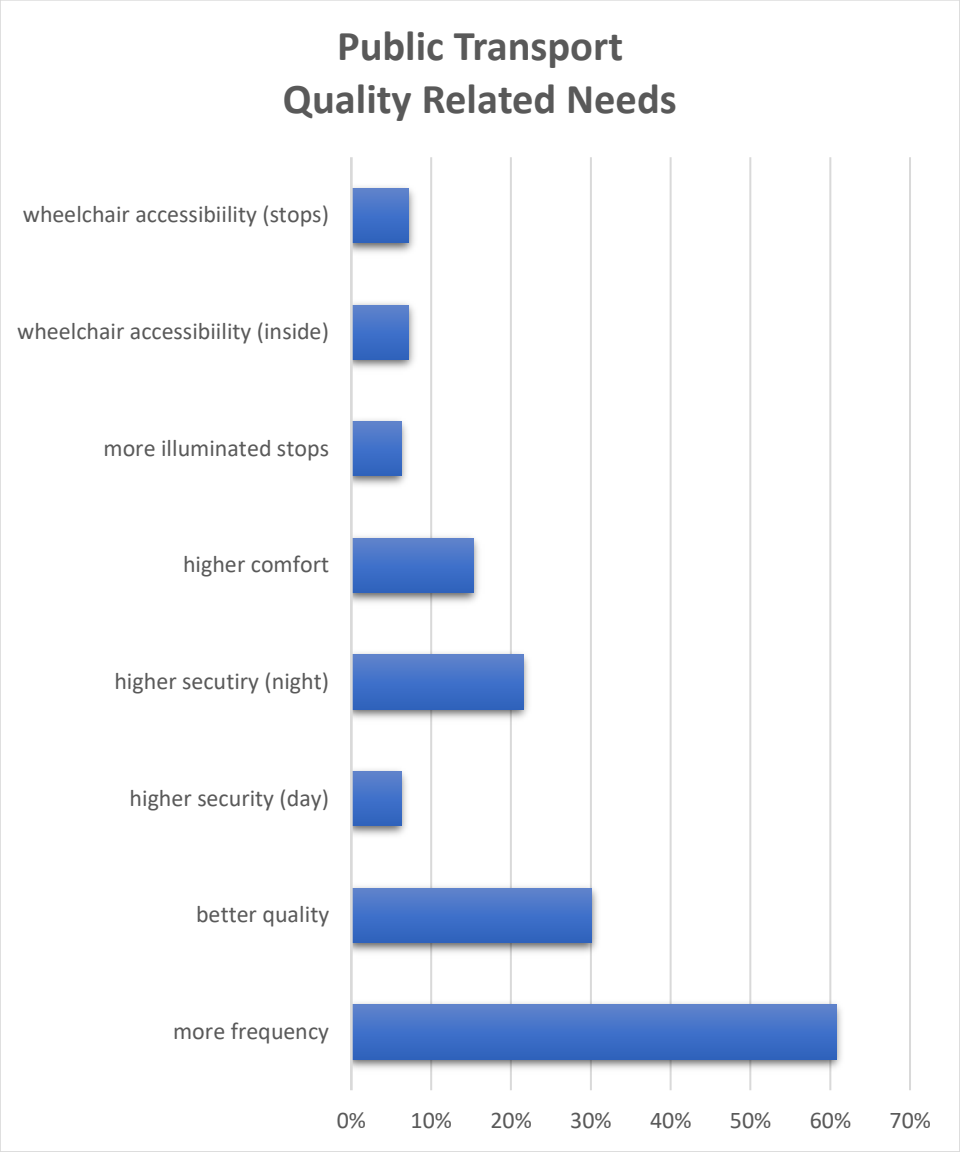

Figure 19. quality related needs concerning public transport use

Decision-makers, when planning the urban structure and the related changes, mainly focus on private transport. They sometimes increase the percentage of

road allocated to cars. However, this would not decrease traffic. Providing more lanes and opportunity for public transport would decrease the congestion. Different modes of transport require different parking and moving space. The most demanding type of transport in terms of space, both moving around and parking, is the private car. On Figure 16, we can see an example of how the limited urban space is wasted. A visual comparison of the space that public and private transport occupy was made. A single bus could hold up to 75 people compared to about 60 cars that would be needed to carry all those people around (see Figure 20).[74]

Figure 20. The waste of limited urban space: a comparison of the space occupied by 75 people using private transport against public transport. They could use about sixty cars or only one bus // source: EU, 2004

To increase the use of public transports, the needs of the whole population need to be taken into account, from those citizens that live in or near the city center to those that live in the surrounding areas of the city. People need bus stops near their starting and final destination as well as quick time to travel from one point to another. A solution to improve the quality of the service focuses on

[74] European Commission (2004). Directorate-General for the Environment, Reclaiming City Streets for People: Chaos of Quality of Life?. European Commission, p15

reducing the number of bus stops in order to make the bus connections faster to attract more people. The perception people have on private against public transport sometimes differs as some factors are not considered. The general perception links car usage to convenience and high-energy consumption, and on the other hand, public transport to environmentally friendly and high costs of investment and management. A dominant factor on the effectiveness of public transport is urban structure, such as size and density of the population and the historical land use and transport development. As population density increases, private transport leads to higher congestion, while as population density decreases, there is a low demand of public transport and therefore a relate high-energy consumption. Demand itself has a high impact on travel cost and time. When most people use cars, time cost of public transport is high because of low frequency. As people shift to the choice of using public transport for commuting, the related time cost drops.[75]

As mentioned before, there are various mechanisms of impact of transport enabling and reducing economic development. The performance of transports is measured by time and expenses, schedule reliability, access to intermodal facilities and connections, day and seasonal variations, and impact on demand and traffic growth. frequencies of departures and distance from bus and train stops highly affects one's willing of choosing public transport as preferred mode of transport. The Directorate-General for Regional and Urban Policy of the European Commission published a study on the access to public transport in large and medium sized European cities. Accessibility and frequency depend on the number of stops provided, the density of the street network and of the population around each stop. From the below graphs (Figure 21), we can see

[75] Masanobu Kii, Shinya Hanaoka (2003). Compatison of Sustainability between Private and Public Transport Considering Urban Structure. IATSS Research Vol.27 No.2, pp. 6-15

that, on average, public transport access levels are greater in larger cities compared to medium ones. In medium cities high access is quite rare, mainly because there are not metro stations, and railways stations are present in minor part in the urban centers, therefore public transport highly relies on buses.[76]

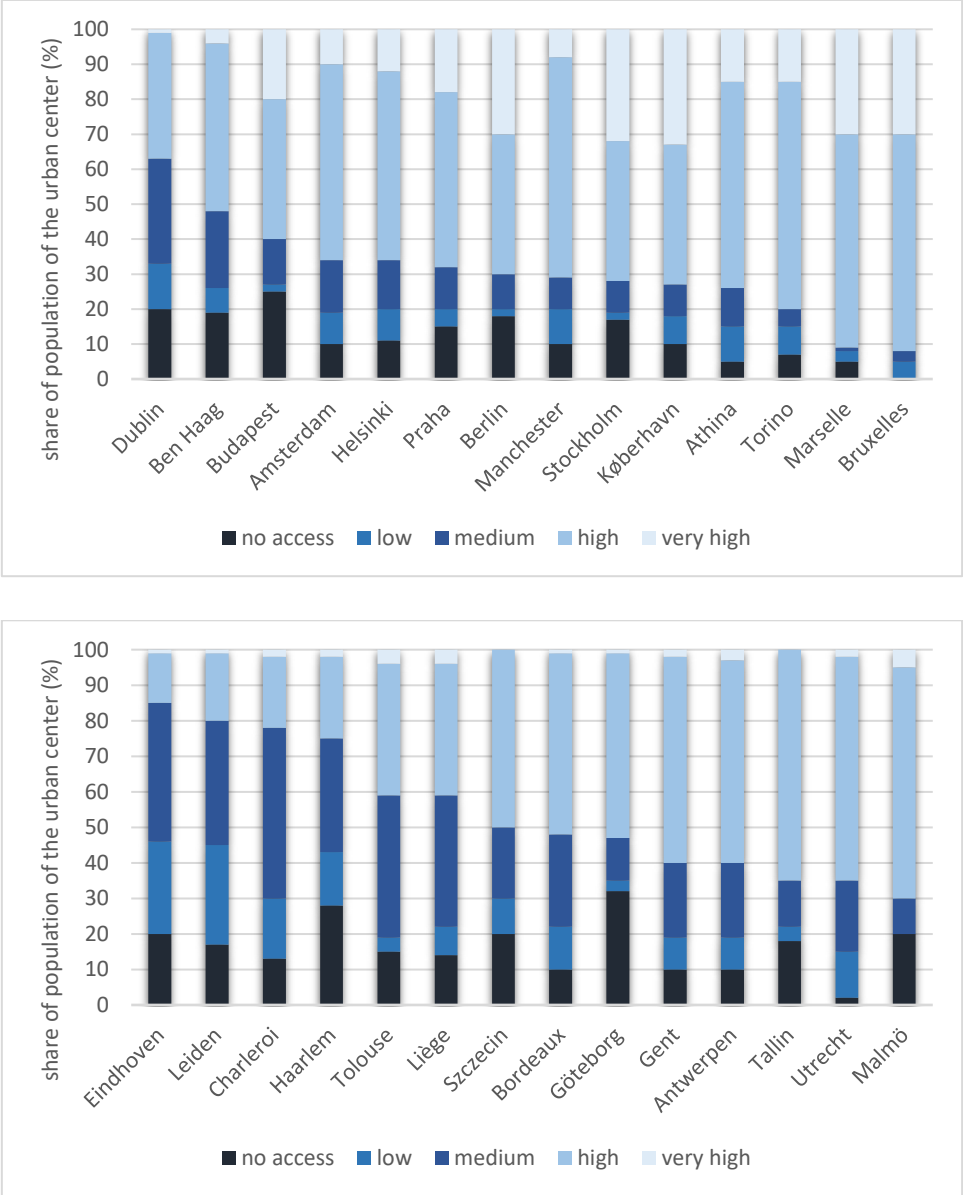

Figure 21. Access to public transport in large and medium European cities (from no access to very high access) // source: Poelman and Dijkstra, 2015

[76] E. Poelman and L. Dijkstra (2015). Regional Working Paper 2015. Measuring Access to Public Transport in European Cities. Europe. European Commission: Regional and Urban Policy, p3-4

Among the survey participants, wheelchair accessibility has low importance in improving the willingness of people walking to reach their destination. On the other hand, higher quality of sidewalks and a friendly nice environment (with respectively 38% and 45% positive responses) would highly benefit this choice.

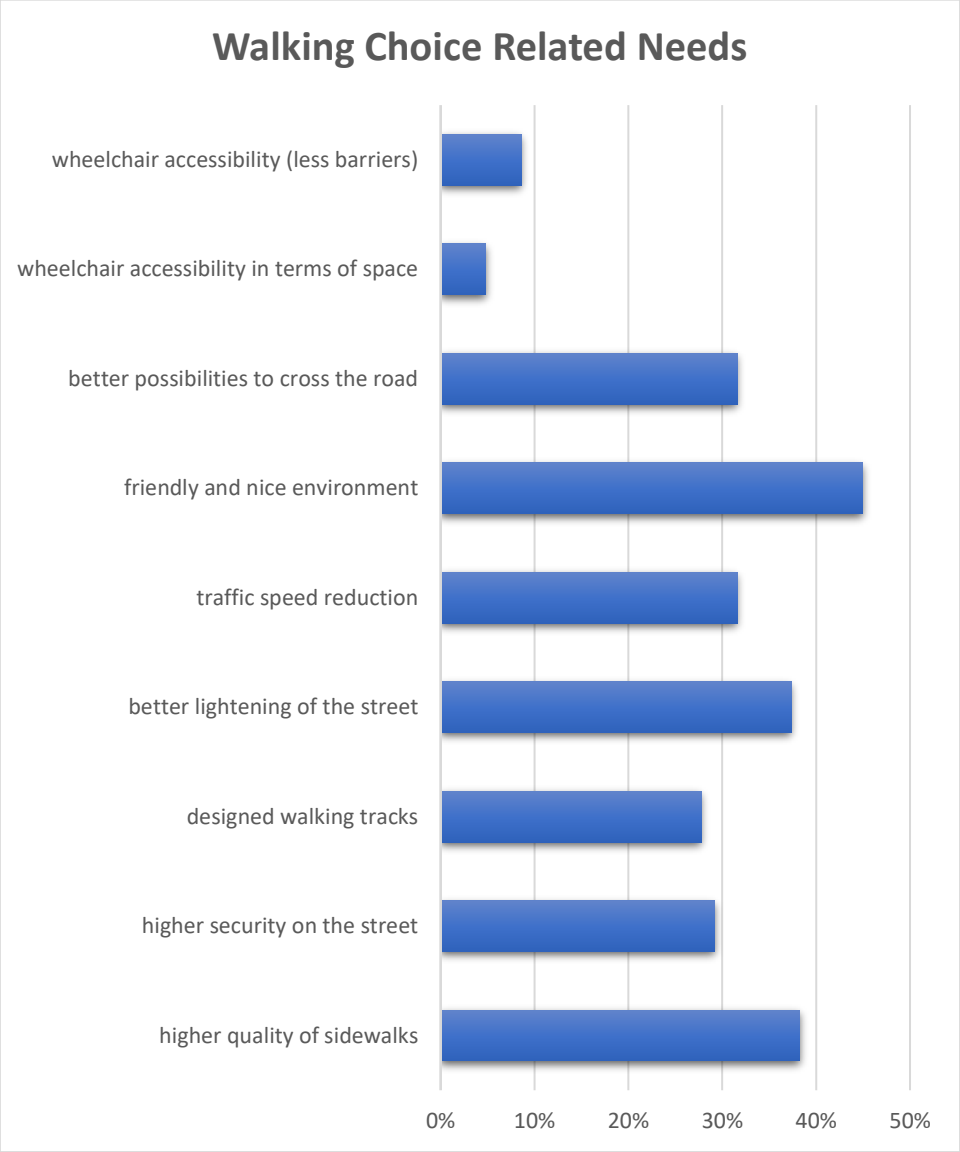

Figure 22. Needs related to choosing walking as mode of transport

Regarding other vehicles, both public and private, affecting one's decision to walk, traffic speed reduction and better possibility to cross the road impacts one

third of the surveyed population. Lastly, creating designed walking tracks and improving security on the street also play a role in important role in when considering walking choice related needs (see Figure 22).

Compared to public transport affecting factors, where other's behavior and example would not affect one's own choice on choosing, walking and cycling behaviors are slightly affected by this factor. The survey collected, respectively, 13% and 10% positively reactions (see Figure 23).

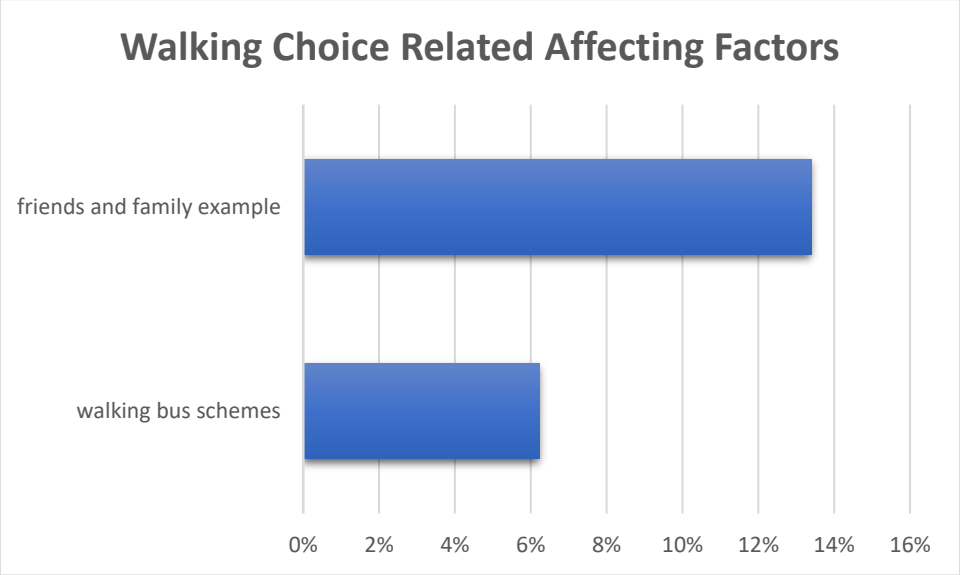

Figure 23. Factors affecting the choice of choosing walking as mode of transport

Creating and developing more cycle path around the city would encourage 67% of the respondents to cycle more. Moreover, half of the respondents said that they would prefer to have separated paths from sidewalks, but not considered the fact of having them separated from streets. A more friendly environment, traffic speed reduction, more cycle parking spots, and the availability of public/shared bikes are also among the needs related to choosing cycling as mode of transport within the city (see Figure 24).

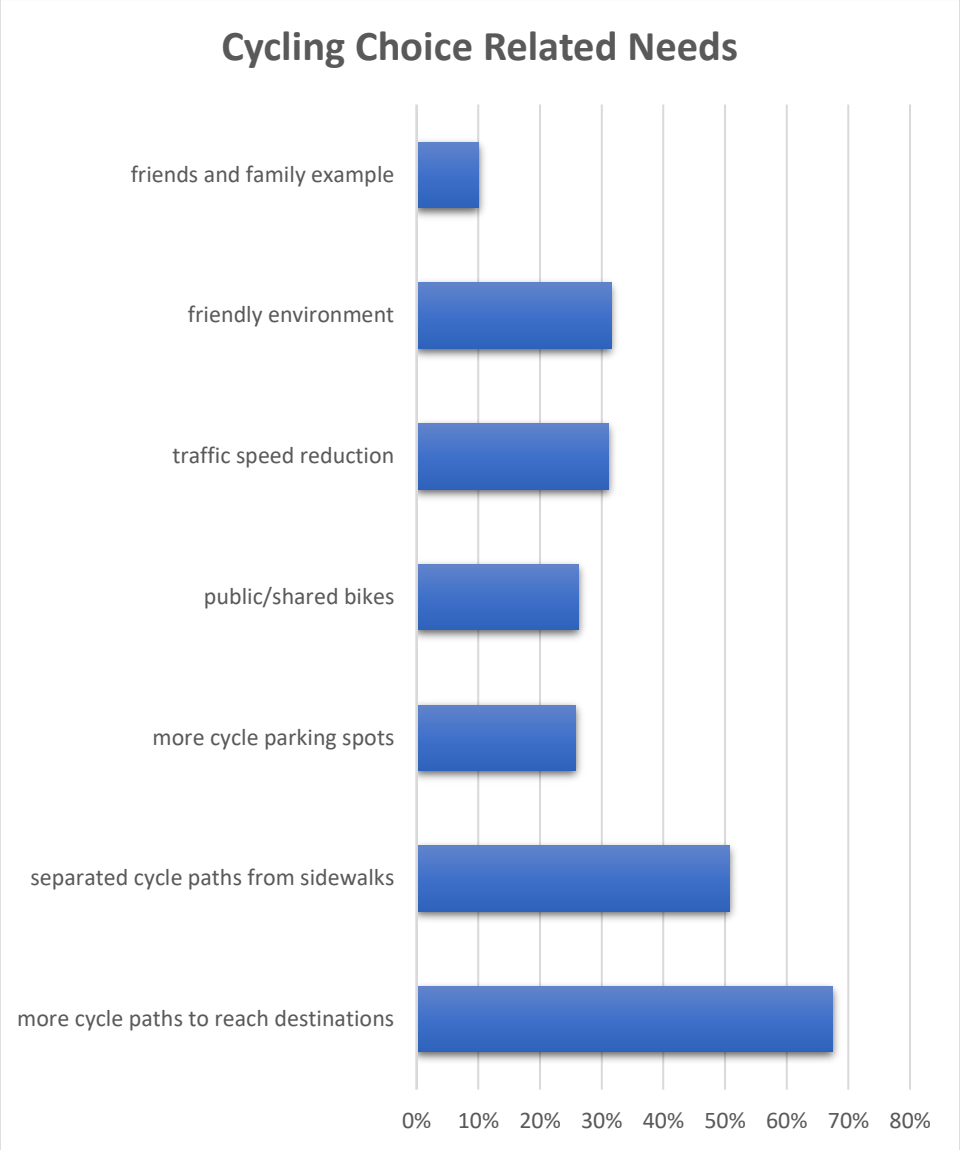

Figure 24. Needs related to choosing cycling as mode of transport

In order to make nonmotorized transports safer and more attractive, cooperation among different factors is needed. The challenge for municipalities and communities is to develop a combination between infrastructure development, traffic management, and financial measures to enhance the potential of nonmotorized active transports, which is often under-considered.

Some countries and cities focus more on motorized transport instead of nonmotorized one based on ideological preferences. Motorized transport is,

most of the times, linked to advancement in technology. This leads to a negative cycle affecting active transport. By favoring motorized and private transport, the interests of pedestrians and cyclists are sacrificed making nonmotorized transport less safe, convenient and attractive. This, in turns, enhances the choices of people to use motorized mode of transports. This negative cycle is also linked to a hostile attitude from decision-makers toward pedestrians. In fact, pedestrian space, is generally limited to make more space to motorized transport and other businesses. As the World Bank (2002) explains, sidewalks are often occupied by shops, cafes, and vendors or by parked cars, motorcycles and bicycles. Moreover, the elevated focus on providing fast and free-flowing motorized traffic leads to the implementation of passes, subways and barriers for pedestrians. However, as location is often chosen by convenience of construction, it may result in inconvenience of use for citizens.[77]Last, but not least, is the challenge to create, develop and implement connected and integrated networks. Sometimes, active transport infrastructures are constructed where is it more convenient to do so, but this might not be convenient for the end users and thus would end up with unutilized or poorly utilized infrastructure. As WHO Europe explains, requirements and needs to increase the number of pedestrian and cyclists in the city would be continuous and barrier-free network linked to major starting and final destinations and everyday habits, increase of direct routes, and connections between local, regional and different mode of transport networks. Moreover, final destination

[77] KM Gwilliam (2002). Cities on the move: A World Bank urban transport strategy review. Washington D.C., US. The World Bank, p125-126

facilities, such as bike parking and places to sit, should also be taken into account.[78]

In order to improve available transport choices, reduce transport costs, improve walking and cycling by making them safer and easier, remove barriers related to employment, and tackle traffic and transport issues, capital and revenue spending should be combined. The former focuses on infrastructure projects, while the former on bus and rail services improvements. The challenge is to focus on small projects instead of on big infrastructures.[79]

[78] World Health Organization Regional Office of Europe (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe. WHO Europe, p62

[79] S. Joseph, R. Bourn. Improving Local Transport Helps the Economy – experience from the Local Sustainable Transport Fund. London, UK. Campaign for Better Transport, p4

Scenario Analysis

Car vs Walking and Cycling

As mentioned before, most of the trips taken by car are under a 3-5km length. If those commuting trips would be made by foot or walk, it would bring not only health benefits but also economic ones.

In cities, the average speed per motorized vehicles is 50km/h and, in some areas, 30km/h. However, in big cities, give the high and increasing traffic, the average speed tends to decrease, also reaching 10km/h with the result of being blocked in traffic and waste time (see Figure 25). Citizens in the most congested cities waste 80 hours per year being stuck in the congestion.[80]

City	Average Speed (km/h)	Hours wasted each year
Milan	33.8	57
Brussels	33.3	82.9
Antwerp	31.4	78.1
London commute zone	30.1	83.4
Greater Manchester	25.9	46.9
Paris	24.2	54.8
Rotterdam	23.1	62.6
South Nottinghamshire	22.5	39.4
Gent	21.7	54.1
Stuttgart	21.2	60.7
Greater Birmingham	20.5	34
Cologne	19.3	55.2
Roma	19.2	32.3
Lyon	19.1	43.3
Greater Belfast	19.1	31.3
Karlsruhe	18.8	53.7
Grenoble	18.5	42

[80] The Guardian (2014). The 100 most congested cities in Europe and North America

Amsterdam	18.5	50.2
Bordeaux	18.2	41.3
Firenze	18.1	30.5
Utrecht	17.8	48.2
Toulouse	17.3	30.2
Toulon	16.8	38.1
Hamburg	16.8	47.9
Dusseldorf	16.6	47.6
Strasbourg	16	36.4
Cremona	15.7	26.3
Napoli	15.7	25.5
Miami	15.6	30.9
Geneva	15.4	31.6
Munich	15.3	43.6
Genova	15.1	25.4
Leeds/Bradford	14.4	25.8
Turin	14	23.6
Nantes	14	31.7
Caen	13.7	31.1
Palermo	13.4	21.4
Eindhoven	13.2	35.9
Cardiff	13.2	21.8
Bonn	13.1	37.4
Zurich	13	26.7
Verona	12.9	21.7
Greater Edinburgh	12.7	24
Luxembourg	12.3	31.7
Bielefield	12.1	34.6
Brescia	11.9	20.1
Bilbao	11.8	24.2
Darmstadt	11.8	33.7
Saarbrucken	11.8	33.7
Hannover	11.8	33.7
Tampa	11.5	21.6
Cagliari	11.5	17.5
Nuremburg	11.5	32.8
Frankfurt am Main	11.5	32.7
Madrid	10.9	22.4
Glasgow	10.9	20.6
Graz	10.4	24.3
Catania	10.3	16.1
Wien	10.2	24
Nancy	9.9	22.4

Figure 25. Average speed and hours wasted each year in European cities // source: The Guardian (2014)

Moreover, if we consider the scenarios for low and high traffic compared to walking and cycling, we could see how easily it could be to reach the recommended level of physical activity of 30 minutes per day.

Mode of Transport	Scenario	Average Speed (km/h)	Time for 3 km trip (minutes)	Time for 5 km trip (minutes)	Estimated Cost (€)
Motorized (Private transport)	Good = no traffic	50	3.6	6	6000
	Average = reduced speed limit or low traffic	30	6	10	8000
	Bad = high traffic	10	18	30	10000
Walking	Average	5	36	60	100
Cycling	Average	12	15	25	315

Figure 26. Average speed and time to cover 3-5km

The scenarios based on motorized transport are usually more convenient in terms of time, however they are the most expensive ones. The scenarios based on walking and cycling have low cost but required more time, however, on the long term it would bring health benefits as it allows people to be more active and easily reach the recommended level of physical activity while simply commuting (see Figure 26). To analyze the scenarios based on time and cost, the

SMART (Simple Multi Attribute Rating Technique) method can be used to determine the aggregate value of each scenario. Using the linear criterion and considering the highest cost and time as the worst, and the lowest cost and time as the best alternatives, we can draft comparable values on a range from 0 to 100. Time for 3km and for 5km provide the same comparable value as they are proportionate to each other (see Figure 27).

$$Linear\ Criterion: y = 100 \times \frac{x - x_{worst}}{x_{best} - x_{worst}}$$

$$with\ \ cost_{worst} = 10000\ and\ cost_{best} = 100$$

$$and\ time_{worst} = 36\ and\ time_{best} = 3.6$$

Scenario	Cost	Time
Motorized (Good)	40	100
Motorized (Average)	20	93
Motorized (Bad)	0	55
Walking	100	0
Cycling	98	65

Figure 27. Using SMART method to compare multiple criteria – note that value for time (3km) and time (5km) are the same, and therefore can be merged

To calculate the aggregate value, we need to assign weights to the attributes. Considering that cost and time have equal importance when people choose their mode of transport, we can assign a value of 50 to both criteria. The weights are then obtained by dividing the value of the attributed by the sum of all the values (see Figure 28).

$$w_{cost} = \frac{v_{cost}}{v_{cost}+v_{time}}\ and\ w_{time} = \frac{v_{time}}{v_{cost}+v_{time}}$$

$$with\ v_{cost} = 50\ and\ v_{time} = 50$$

$$w_{cost} = 0.5 \; and \; w_{time} = 0.5$$

$$aggregate\ value = cost \times w_{cost} + time \times w_{time}$$

	Alternatives	Aggregate Value
X	Motorized (Good)	70
	Motorized (Average)	56.5
	Motorized (Bad)	27.5
Y	Walking	50
Z	Cycling	81.5

Figure 28. Aggregate value of time and cost based on different scenarios

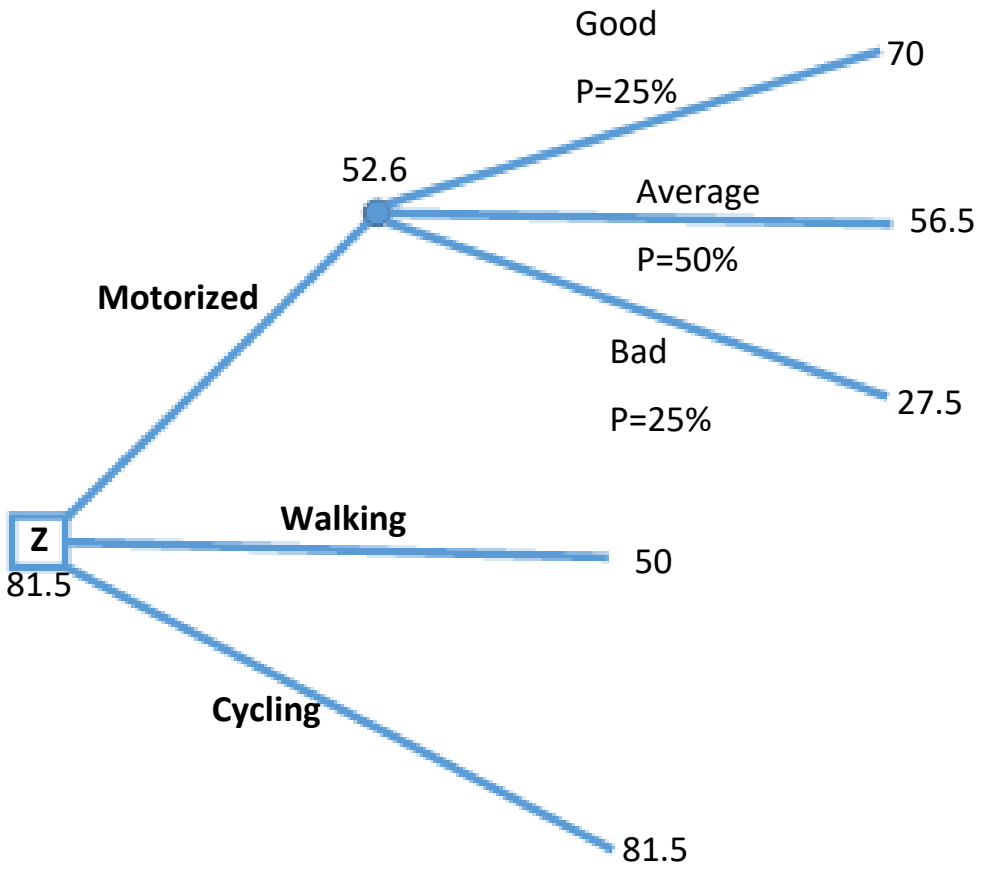

Figure 29. Scenario analysis motorized vs non-motorized transport on a distance of 3km and 5km

The expected value of the motorized scenario is 52.6, making cycling the best alternative in terms of cost and time. This considering that there is equal probability to be in low traffic or in an area of reduced speed limit as to be in high or no traffic. Walking appears to be slightly a worst alternative compared to the motorized transport as it required much more time to reach a destination (see Figure 29). However, it has a low cost and it brings social and health benefits that private transport does not.

As the probability of high traffic increases, keeping the probability of the average scenario at 50%, walking becomes a slightly better alternative than motorized transport. We can take as example the following probabilities:

$$P(motorized_{good}) = 10\%, P(motorized_{ave}) = 50\%, P(motorized_{bad}) = 40\%$$

In this case, the expected value of the motorized scenario is 46.25. Using goal-seeking analysis, the break-even point is reached with

$$P(motorized_{good}) = 19\%, P(motorized_{ave}) = 50\%, P(motorized_{bad}) = 31\%$$

In this case, cycling is still a better option, but there is no main preference between walking and using private transport.

Improving Active Transport

We consider three alternatives: improve public transport, improve sidewalks and cycle paths, and implement traffic-calmed areas. For each of them, we consider three scenarios: good/successful, average, and bad/unsuccessful. We then considered affordability, accessibility, availability, acceptability and city settings as criteria to compare the scenarios. The elements of the criteria vary partially from scenario to scenario. Regarding the first four criteria, data was collected from the survey based on the questions on which type of improvements would make people use more public transport, walk or cycle when commuting. The fifth criterion, city settings, focuses on the benefits that those improvements would bring to the population, such as decrease pollution and congestion, increase social interaction, well-being and health, positively affect employment and the enjoyment of the city.

Every person is affected differently by the elements and drivers in each criterion. In a successful scenario, those already active and those not physically active would all be affected, leading to an increase in the use of active transport, based on the factors that would affect them. In an unsuccessful scenario, the effects of the different strategies would reach only those already highly active. In an average scenario, active transport would affect the part of the population that is already physically active and highly rely on active transport, leaving out those that do not meet the recommended level of physical activity within their daily life. This data was collected in the first part of the survey.

For alternative A (improve public transport), 26.7% of the population would be affected in an average scenario and 5.7% in a bad scenario (Figure 30). For alternative B (improve sidewalks and cycle paths), 61.5% would be affected in an average scenario and 3.9% in a bad scenario (Figure 31). For alternative C

(implement traffic-calmed areas), 41.9% and 1.3% would be affected respectively (Figure 32).

Criteria		Alternative A: Improve Public Transport		
		Good	Average	Bad
Affordability	convenience	34.4	9.2	2.0
	more ticket option	23.0	6.1	1.3
	lower cost	41.1	11.0	2.3
	TOTAL	**32.9**	**8.8**	**1.9**
Accessibility	comfort	15.3	4.1	0.9
	wheelchair accessibility (less barriers)	7.2	1.9	0.4
	more illuminated stops	6.2	1.7	0.4
	better quality	30.1	8.0	1.7
	more frequency	60.8	16.2	3.5
	accessibility in terms of space	7.2	1.9	0.4
	TOTAL	**21.1**	**5.6**	**1.2**
Availability	possibility to reach key places	38.8	10.3	2.2
	TOTAL	**38.8**	**10.3**	**2.2**
Acceptability	security (night)	21.5	5.7	1.2
	security (day)	6.2	1.7	0.4
	TOTAL	**13.9**	**3.7**	**0.8**
City Settings	decrease pollution	50.0	13.4	2.9
	decrease congestion	40.0	10.7	2.3
	increase social interaction	40.0	10.7	2.3
	increase well-being	50.0	13.4	2.9
	increase health	60.0	16.0	3.4
	possibility to reach 30 min goal	60.0	16.0	3.4
	employment	80.0	21.4	4.6
	enjoy city	70.0	18.7	4.0
	TOTAL	**56.3**	**15.0**	**3.2**

Figure 30. Criteria to analyze alternative A: improve public transport

Criteria		Alternative B: Improve Sidewalks and Cycle Paths		
		Good	Average	Bad
Accessibility	wheelchair accessibility (less barriers)	8.6	5.3	0.3
	better quality	38.3	23.5	1.5
	accessibility in terms of space	4.8	2.9	0.2
	traffic speed reduction	31.6	19.4	1.2
	better lightening of street	37.3	23.0	1.5
	TOTAL	**24.1**	**14.8**	**0.9**
Availability	possibility to reach key places	67.5	7.1	0.0
	more cycle parking spots	25.8	2.7	0.0
	designed walking tracks	27.8	17.1	1.1
	better possibilities to cross the road	31.6	19.4	1.2
	separated paths	50.7	5.3	0.0
	TOTAL	**40.7**	**10.3**	**0.5**
Acceptability	security on the street	29.2	17.9	1.1
	friendly and nice environment	45.0	27.7	1.8
	TOTAL	**37.1**	**22.8**	**1.4**
City Settings	decrease pollution	70.0	43.1	2.7
	decrease congestion	70.0	43.1	2.7
	increase social interaction	80.0	49.2	3.1
	increase well-being	80.0	49.2	3.1
	increase health	80.0	49.2	3.1
	possibility to reach 30 min goal	90.0	55.4	3.5
	employment	80.0	49.2	3.1
	enjoy city	80.0	49.2	3.1
	TOTAL	**78.8**	**48.4**	**3.1**

Figure 31. Criteria to analyze scenario B: improve sidewalks and cycle paths

Criteria		Alternative C: Implement Traffic-Calmed Areas		
		Good	Average	Bad
Accessibility	accessibility in terms of space	4.8	2.0	0.1
	traffic speed reduction	31.6	13.2	0.4
	TOTAL	**36.4**	**15.2**	**0.5**
Availability	better possibilities to cross the road	31.6	13.2	0.4
	TOTAL	**31.6**	**13.2**	**0.4**
Acceptability	security on the street	29.2	12.2	0.4
	friendly and nice environment	45.0	18.8	0.6
	TOTAL	**37.1**	**15.5**	**0.5**
City Settings	decrease pollution	30.0	12.6	0.4
	decrease congestion	20.0	8.4	0.3
	increase social interaction	50.0	21.0	0.7
	increase well-being	60.0	25.1	0.8
	increase health	70.0	29.3	0.9
	possibility to reach 30 min goal	70.0	29.3	0.9
	employment	60.0	25.1	0.8
	enjoy city	80.0	33.5	1.0
	TOTAL	**55.0**	**23.0**	**0.7**

Figure 32. Criteria to analyze scenario C: implement traffic-calmed area

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Regarding the affordability criteria, convenience, increasing the ticketing option and reducing the cost are factors affecting public transport. Regarding the accessibility criteria, comfort and quality, traffic speed reduction, wheelchair accessibility, better lightening of streets and bus stops are among the factors affecting the choice of and active mode of transport. Availability refers to the possibility to reach key places, parking spots, separate lanes and the possibilities to cross the roads. Acceptability, the perceived and real safety and the surrounding environment. Last, city settings criterion refers to social, health,

environment related benefits linked to traffic, well-being and social interaction, employment and the possibility to reach the recommended level of physical activity per day. To make the criteria comparable, the average among the elements composing each criterion should be made (see Figure 33).

Criteria		Alternative A			Alternative B			Alternative C		
		Good	Ave	Bad	Good	Ave	Bad	Good	Ave	Bad
Aggregate Benefits	Affordability	32.9	8.8	1.9	0	0	0	0	0	0
	Accessibility	21.1	5.6	1.2	24.1	14.8	0.9	36.4	15.2	0.5
	Availability	38.8	10.3	2.2	40.7	10.3	0.5	31.6	13.2	0.4
	Acceptability	13.9	3.7	0.8	37.1	22.8	1.4	37.1	15.5	0.5
	City Settings	56.3	15.0	3.2	78.8	48.4	3.1	55.0	23.0	0.7

Figure 33. Averages for each criterion for the 3 alternatives

To compare the alternatives, aggregate benefits need to be calculated. First, weights need to be assigned and then data needs to be ordered on a range from 0 to 100, using the linear criterion with 0 being the worst/lowest value and 100 the best/higher value among all scenarios of all alternatives.

$$Linear\ Criterion: y = 100 \times \frac{x - x_{worst}}{x_{best} - x_{worst}}$$

As mentioned above, time and comfort, followed by distance and possibility to reach a destination, are among the main factors affecting people choice on the preferred mode of transport. Moreover, security and the surrounding environment also play a crucial role in impacting active transport. The health motivator is often obstructed by time. A last note we should make, before determining the level of importance for each criterion is that affordability, in this analysis, only affects the alternative A and therefore cannot be used to compare the three alternatives. We can therefore give the following value to the criteria

chosen: 100 accessibility, 80 availability, 60 acceptability, 0 affordability, and 90 city settings. The weights are then calculated as follow:

$$w_{criterion} = \frac{v_{criterion}}{v_{access} + v_{av} + v_{accept} + v_{city\_set}}$$

$$w_{accessibility} = 0.303$$

$$w_{availability} = 0.242$$

$$w_{acceptability} = 0.182$$

$$w_{city\_settings} = 0.273$$

The aggregate benefits are then calculated as the sum of the average value of each criterion multiplied the respective weight (see Figure 34).

Criteria		Scenario A			Scenario B			Scenario C		
		Good	Ave	Bad	Good	Ave	Bad	Good	Ave	Bad
Aggregate Benefits	**Accessibility**	57.6	14.4	2.0	65.9	40.0	1.3	100	41.1	0
	Availability	95.2	24.7	4.5	100	24.6	0.1	77.4	31.8	0
	Acceptability	36.6	8.8	0.8	100	61.0	2.6	100	41.1	0
	City Settings	71.2	18.3	3.2	100	61.1	3.0	69.6	28.6	0
	TOTAL	**66.6**	**16.9**	**2.7**	**89.7**	**45.9**	**1.7**	**86.2**	**35.5**	**0**

Figure 34. Aggregate benefits for the 5 criteria: affordability, accessibility, availability, affordability, city settings

Considering different probabilities of success and failure for the three alternatives, improving sidewalks and cycle paths (alternative B) results to be the best option in most cases, followed by implementing traffic-calmed areas (alternative C). in the following decision tree, a high probability of success (75%) in taken into consideration (see Figure 35).

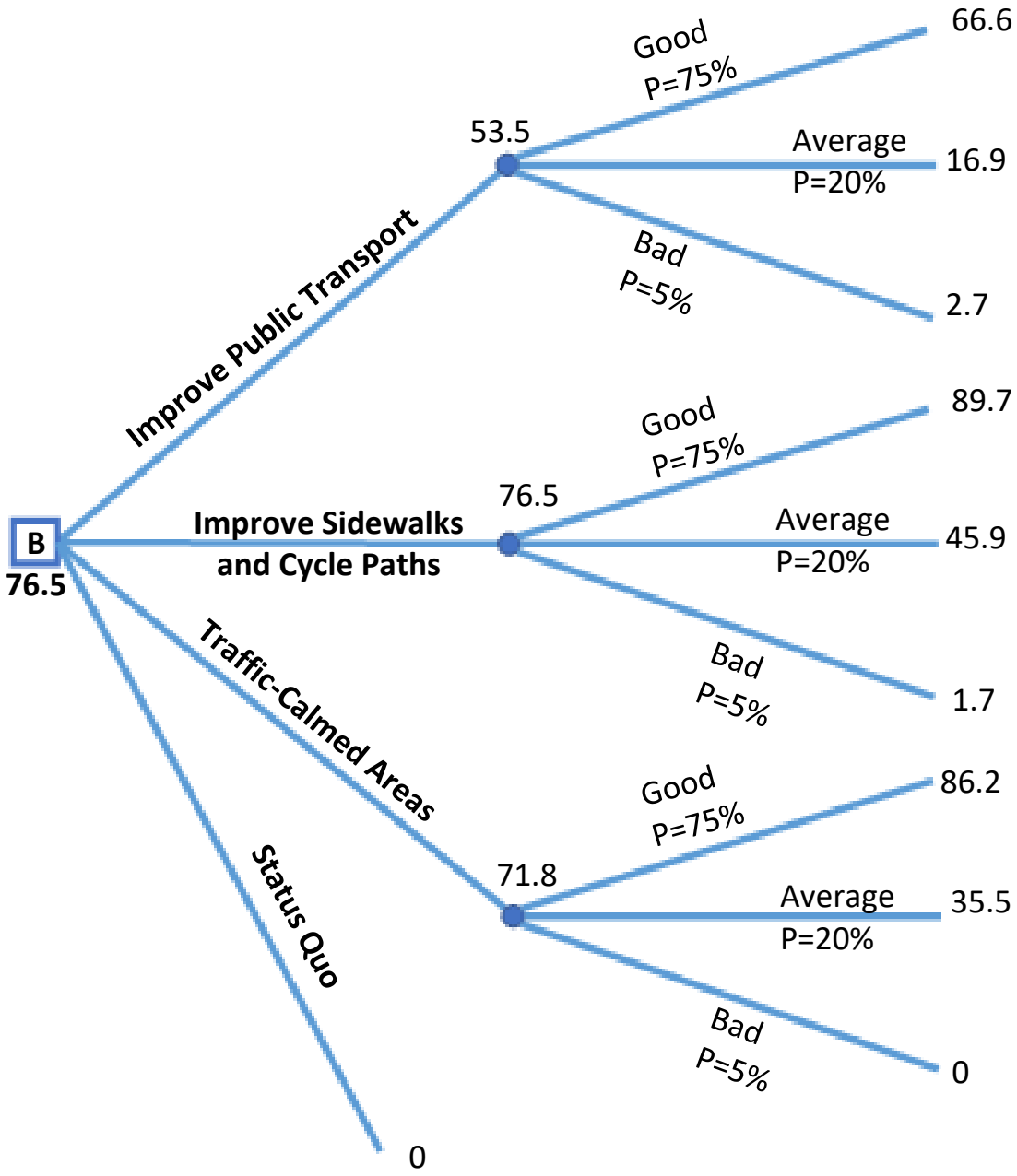

Figure 35. Scenario analysis of different strategies to improve the use of active transport within the citizens with high probability of success

We can compare the three alternatives considering different probability of success and failure. We can, for instance, consider a high probability of success (75%), a low one (10%), and an average one (see Figure 36). In any case, we will

see that improving possibilities to walk and cycle around the city would produce more benefits than focusing just on public transport.

Alternative	Expected Value		
	High probability of success P_{good} = 75% P_{ave} = 20% P_{bad} = 5%	P_{good} = 33.3% P_{ave} = 33.3% P_{bad} = 33.3%	Low probability of success P_{good} = 10% P_{ave} = 30% P_{bad} = 60%
A	53.5	28.7	13.4
B	**76.5**	**45.7**	**23.2**
C	71.8	40.5	19.3

Figure 36. Expected values for scenario analysis of different strategies to improve the use of active transport with different probability of success (high, average and low)

Different strategies have different costs depending on the size of the city, the position, the history and the current setting and urban planning. Costs also differ depending on the change that decision-makers focus on. A more radical change would require more money in a short period of time, while an incremental change would require money to be spread in the long-term. A long-term project based on incremental change would also give the benefits to be modified depending on the citizens needs while the project is ongoing. Improving public transports have higher costs than improving cycling and walking as it does not only require better infrastructures, but also work on facilities and services provided. A challenge encountered by European city is the long history their city centers have, which are sometimes unsuitable for dramatic changes in the urban planning. However, improving active transport and decreasing the amount of traffic in it would benefit the preservation of the historical parts. This affects which type of developments can be made and how the roads are shared among

the different modes of transport. In the final cost, it has also to be considered the economic benefits that improving active transport would bring. As mentioned before, lower is the level of physical inactivity among the citizens, higher is the economic savings linked to health expenses.

Conclusions

Municipalities and cities have an elevated impact on the level of physical activity among citizens. Both on the offered activity and on the urban planning sides. There are various challenges that they need to face. First, there is the need to understand the problem of physical inactivity and increase the awareness and knowledge of its costs and benefits related to including physical activity within the population everyday life. Second, the needs of the population vary widely. Children and adults, pregnant women and elderly, and people with reduced mobility face different challenges. However, addressing one group's needs would also benefit the other groups. Third, Europe have a long history and most of the centers have historical and cultural heritage. This could be a challenge when developing public transport but also an opportunity in promoting non-motorized transport which would help preserve the history of the city. Fourth, safety and reallocation of road space are among the main challenges to be faced. It follows the possibility to reach places without having to rely on private transport, convenience and other needs above described, Fifth, the level of transport affects the local economies, such as employment level, tourism, and everyday routines. Last, there is often the expectation to reach quick results. However, the challenge is to focus on long-term objectives starting also from short-term and small projects.

As the city and its setting play an important role in promoting healthier lifestyles and the time spent in commuting takes u a big portion of people's life, focusing on improving modes and the variety of choices of transport would bring long-term benefits to both the population and the city itself. As we saw above, depending on the probability of success, different scenarios can take place. Cycling reveals to be the best alternative to motorized and walking mode of

transport because of a balance between cost and time spent. However, considering congestions and traffic pollution, choosing walking or cycling as mode of transport would increase the level of acceptability of a city by increasing the security in the street, given the reduced number of cars, and would lead to a nicer and friendly environment. Those will, in the long-term, bring benefits in the social and well-being environment. Moreover, improving sidewalks and cycle paths would lead to an increasing in the level of physical activity among the citizens. Three alternatives have been considered based on five criteria, each consisting of different factors. based on different probabilities of success and failure, improving facilities for cycling and walking turns out to be the best strategy to improve physical activity within citizens everyday life.

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Reference

1. B. P. Shrestha, A. Milonig, N. B. Hounsell, M. McDonald (2017). Review of Public Transport Needs of Older People in European Context. Journal of Population Ageing (10), p344-351
2. C. Hass-Klau. (1993). Impact of Pedestrianization and Traffic Calming on Retailing: a review of the evidence from Germany and the UK. Brighton, UK. Environmental and Transport Planning. Transport Policy 1993 1 (1), p22-25
3. C. Horn (2014). Towards Active Mobility. Europe. Urbanplanet
4. Commission of the European Communities (July 11th, 2017). White Paper on Sport, Brussels, p4
5. E. Poelman and L. Dijkstra (2015). Regional Working Paper 2015. Measuring Access to Public Transport in European Cities. Europe. European Commission: Regional and Urban Policy, p3-4
6. European Commission (2004). Directorate-General for the Environment, Reclaiming City Streets for People: Chaos of Quality of Life?. European Commission, p9-27
7. ICSSPE and PACTE Project members (2019). Physical Activity Policies at Municipal Level in Europe, Analysis of the Passport Survey. Erasmus+ co-funded project. Europe, p8-27
8. ISCA / Cebr report (June 2015). The Economic Cost of Physical Inactivity in Europe. p7-77
9. KM Gwilliam (2002). Cities on the move: A World Bank urban transport strategy review. Washington D.C., US. The World Bank, p125-130

10. LV Kielgast et all (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity. Copenhagen, Denmark. World Health Organization Regional Office for Europe, p29-31
11. Masanobu Kii, Shinya Hanaoka (2003). Compatison of Sustainability between Private and Public Transport Considering Urban Structure. IATSS Research Vol.27 No.2, pp. 6-15
12. Nike In. (2012). Designed to Move. Nike Inc., 2, p2-14
13. P. Edwards and A. D. Tsouros (2008). A Healthy City is an Active City: a physical activity planning guide. Europe. World Health Organization, p1-4
14. P. Walker (February 16th, 2019). Cities with Physically Active Residents More Productive as well as Healthier. The Guardian
15. Pere Pärtel-Peeter. The Effect of Pedestrianisation and Bicycles on Local Business: Case studies for the Tallin High Street project. Future Place Leadership, p11
16. S. Joseph, R. Bourn. Improving Local Transport Helps the Economy – experience from the Local Sustainable Transport Fund. London, UK. Campaign for Better Transport, p4-17
17. Special Eurobarometer 472 (December 2017). Report, Sport and physical activity, European Commission, p4-64
18. T. Litman (May 16th, 2011). Evaluating Non-Motorized Transportation Benefits and Costs. Victoria Transport Policy Institute, p4-10
19. T. Litman (July 24th, 2018). Economic Value of Walkability. Victoria Transport Policy Institute, p2-4, 9
20. TAFISA (2014). Triple AC: The 5 Key Success Areas. Europe
21. The Guardian (2014). The 100 most congested cities in Europe and North America

22. UN (2018). 68% of the World Population Projected to Live in Urban Areas by 2050, Says UN. New York, USA. United Nations: Department of Economic and Social Affairs
23. WHO/FIMS Committee on Physical activity for Health (1995). Exercise for Health. Bulletin of the World Health Organization, 73(2): 135-136
24. World Health Organization French Healthy Cities Network (2014). Active Mobility Every Day: the role of local government. Presses de l'école des hates études en santé publique, p8-41
25. World Health Organization, Regional Office for Europe (2002). A Physically Active Life through Everyday Transport with a Special Focus on Children and Older People and Examples and Approaches from Europe. Copenhagen: WHO Regional Office for Europe, p6-15
26. World Health Organization Regional Office of Europe (2017). Towards More Physical Activity in Cities: Transforming public spaces to promote physical activity – a key contributor to achieving the Sustainable Development Goals in Europe. WHO Europe, p18-62