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## THE CHALLENGE OF A NEW URBAN MOBILITY

A TRANS-NATIONAL COMPARISON BETWEEN THE ACTUAL AND THE POTENTIAL  
CYCLING DEMAND IN UTRECHT AND IN MILAN CITIES



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### **SUMMARY**

The research purpose is to analyse and compare the Utrecht and Milan's data of the urban bike's share, to finally reach the number of both cities' actual cyclists. This goal will be reached by following a circular conceptual scheme which integrates the main variables taken into account. These variables are: 1)distances and itineraries, 2)modes of transports connected to each other (intermodality), 3)travel motivations and attitudes, 4)urban transports infrastructural strategies and statute bike's plans.

These variables will be theoretically analysed, with the literature articles revision on travel behavior modal choices and with some exemplar empirical cases, but also analytically, by using quantitative statistical data.

The literature scan and the conceptual model's indicators will be divided into the demand (bike users) and supply side (policy makers, transports managers, urban planners).

The core concept of the research is to find the most determinant variables that affect the actual number of cyclists in the Italian city context which is expected to have a less share of: cyclists number, bike's infrastructural provisions, policies and strategies, than the Utrecht case study.

The conclusions will be drawn by focusing on both demand and supply views that are expected to be very practical (from the demand side) and more theoretical (from the supply side).

## PART 1

### 1.1 INTRODUCTION

Many cities and urban areas have to deal with tremendous traffic problems, causing congestion, pollution, noise, and increase of road casualties. One of the measures to reduce the inconvenience of congested roads is the promotion of the public transports together with the use of the bike. Both national governments and local authorities are trying to persuade people to switch mode, from private car to public transport. Moreover, there is a need to create a new sustainable urban mobility culture in Europe (CEE, 2007, p.6). Sustainable transport is about giving priority to people over traffic and more road space to pedestrians, cyclists and public transport and thus improving the quality of life within urban areas. The growing accessibility problems in urban areas can constitute an opportunity for the further development of cycling promoting policies (Doolittle and Porter; Hagelin, in: Martens, 2006, p.326).

To replace car use, there is a need to combine measures for car reduction with measures to promote cycling, and to use money that is taxed on car use for planning for the bicycle. Facilities can be of a various kind to provide for a good bicycle climate (Legambiente, 2008, p.1).

This paper presents a rationale for promoting bicycles for urban basic transportation, in the context of global efforts to achieve more sustainable urban development, by enhancing the actual number of urban cyclists. The importance of urban transportation intermodal systems, and the negative impacts of motorvehicles are discussed. An empirical approach to develop local sustainable transportation initiatives is presented, based on a comparative study of Utrecht city's bicycle use and infrastructural provisions, which have successfully promoted alternatives to motortvehicles use, and the Milan municipality case.

The first section is the research topic introduction, followed by the literature review of the travel behavior modal choice, in particular referred to the modal split choices academic articles, divided into the supply and the demand side perspectives and linked to the: distance and itinerary, travel motivations and attitudes, transports and bicycles policies and infrastructural provisions variables.

In the following section will be described the operational research model, followed by the Dutch national public transports policies and bicycle plan. The four section concerns the Utrecht city's case study, its urban form and land use characteristics and the bikes oriented policy. Moreover, will be analysed the public transports intermodal strategies at disposal for the city's cyclists. In the same section, the Utrecht's cyclists data will be reported for the transnational comparison. Next section will introduce the Italian national public transports' policies and strategies, followed by the analysis of Milan bikes' users data, regarding their itineraries, motivations, and distances runned by bike and the potential and actual gap demand of cyclists.

The following section is the most relevant one because it covers the comparison between both municipalities data and bicycle policies. Both the the case studies outcomes and data correlations are discussed and compared in this section. In the last section a theoretical conclusion will be underlined, in order to answer the research main question and subquestions, and conclusion remarks and suggestions will be proposed for a better promotion of urban bikes' users.

I must acknowledge the important impact on my thinking of studying one year in a country such as the Netherlands. I cannot underestimate the profound life experience this was for me, and in many ways it was very important for the development of this research study.

Living in the old lovely city of Utrecht and travelling in Randstad's cities made me realize how differently the Dutch urban transports are hierarchically planned and connected compared to the Milan and Italian's ones.

How culturally and practically the use of the bike, as a real mean of transport for all the residents, is lived and experienced differently from both the demand and planning parts.

## 1.2 RESEARCH GOAL

The aim of the research results of individual behaviors, for a collective need, of encouraging the transportation policies towards a more environmentally, economically and healthily sustainable mode of travel, will be done by making a comparison between two different urban contexts: the city of Utrecht and the city of Milan. It will be found the most relevant variables, that strongly affect the use of the bicycle, in order to consider the best policy solutions that effectively can enhance the urban population to use the bike as a real mean of transport.

While the interest in bike-and-ride is on the rise and the number of countries that are developing policies to promote bike-and-ride is increasing (Department of Environment, Transport and the Regions; Bundesministerium fuer Verkehr, Bau-und Wohnungswesen; Hagelin, in: Martens, 2006, p. 327), there is hardly any knowledge on the success of different types of measures to promote the combined use of bicycle and public transport.

Improve accessibility and the quality of urban life by encouraging cycling is the driving force of this research. The attempt is to discover the actual number of bike users in both urban provincial contexts, of Milan and Utrecht, and to analyze the difference between the cyclists actual demand and the potential one referred to the urban and policy strategies contexts.

The success of the best plan policy, that enhance the actual number of bike users demand, will be determined by using transports data of both municipalities and by comparing the actual and the potential demand number of both contexts.

While it is true that cycling is the classic example of a policy that has to be decided at the most local level, and that 'subsidiary' should rule, this thinking has limited the progress for cycling. Of course the best level for decisions on routing and the precise provision of cycle facilities should be the local one. However, local government needs an overall framework within which their policies, priorities, and programmes fit.

The expected outcomes of the analysis should underline which of these variables are the most important in affecting and increasing the actual cyclists number in both urban cases.

## 1.3 SCIENTIFIC RELEVANCE

The research academic scientific importance is referred to the discover and discussion of which of these variables most strongly influence the use of the actual bike in the two urban contexts by helping the policy transports makers to relate their plans and infrastructures to the real demand and needs of cyclists and to enhance the potential one.

While comparing the two different urban cases, of the Netherlands and Italy, it has to be remembered the strong locational, cultural and contextual differences. The Dutch case has more familiarity with the use of the bike, so it is expected to help Italian transports planners, policy makers and bike users to find the best enhancing policy to increase Milan's use of this sustainable mean of transport, that under certain conditions can replace the polluting use of cars and motorbikes. The comparison should bring the policy makers closer to find the best planning and transport strategy to enhance the urban cyclists mobility and reduce the number of motor vehicles.

The Dutch case study, of Utrecht city's bike's use, is expected to be exemplar for Milan city, since the Netherlands has the highest level of bicycle use within the industrialized world. More than 27% of all trips are made by bicycle, a figure that has been relatively stable over the last decades (Pucher and Dijkstra, in: Martens, 2006, p. 327).

Medium-sized cities, in particular, show high levels of bicycle ridership, with some reporting a bicycle share of trips exceeding 35% (de la Bruheze and Veraart, in: Martens, 2006, p. 327).

There is an intimate relationship between urban land-use development and transportation (Tomlinson, 2003, p. 6).

Academically this research can help the transports' policy makers to individualize the main strategy and strongest points in order to increase the actual demand of cyclists, by taking into account the potential one and the cyclists needs.

The research will follow the thinking of Tomlinson, about the strong link between urban land-use development and transportation (Tomlinson, 2003, p.6). It is important to keep under consideration here that, as the author John Pucher wrote, the more compact land-use patterns in European cities lead to average trip distances that are only about half as long as in American cities and thus are easier to cover by foot or by bike (Pucher, Dijkstra, 2003, p.1-2). Moreover, the research will consider the fact that increasing trip length has an important and significant negative effect on the attractiveness of cycling (Hunt & Abraham, in: Van Hout Kurt, 2008, p. 25).

#### 1.4 SOCIETAL RELEVANCE

In general, the Dutch measures to promote bicycle use in access trips have been generally successful. A country-wide program to upgrade regular and secure bicycle parking at train stations has led to an increase in user satisfaction and a growth in bicycles parked at stations. Smaller programs to stimulate the combined use of bike-and-bus have resulted in an increase in bicycle use, bus use, and share of infrequent bus passengers (Martens, 2006, p. 326). In the Netherlands, commuting by bicycle is a very common phenomenon, as well as the combined use of the bicycle with means of public transportation, for practical but also ecological reasons. In their programs for the parliamentary elections, almost all Dutch political parties add paragraphs in which they vow to enhance facilities for bicycle commuting. The political party GreenLeft even promotes a principle called "Groen Reizen" (green travelling), in which the choice to use bicycles and public transportation plays a key role (Groenlinks, 2010). Opposite to that the Italian case has no national cycling strategy, it has only a policy on safety.

The research societal importance is referred to the sustainable urban mobility, that should aim at the recovery of the urban quality in order to decrease the congestion and the pollution of cities, by improving the possibility of bikes moves for urban residents. This brings less pollution, more physical activity and moves safety, equal social accessibility and less costs, all topics that should be taking into account in promoting a transport policy plan.

Nowadays pedestrian friendly urban areas and proper provisions for cycling, such as physically separated cycle lanes that connect destinations, are a must. Bicycle lanes should be uninterrupted and separated, from roads as well as from sidewalks (FIAB, 2000, p.2).

These are some examples of the transport planning strategies that this research investigates and compares in Utrecht and Milan urban contexts, in order to find out which plan and which policy effectively decreases the differences between the actual and potential number of bikes' users. Nowadays road design is often in line with the overall car-oriented structure of the traffic and transport system. Motorised traffic is considered to be 'normal', all the rest is additional, catered for as long as space and money is available. This approach results in low quality bicycle facilities (Legambiente, 2008, p.1). Examples are the diversion of cyclists to the sidewalks, thus ignoring the vehicular characteristics of the bicycle; and the creation of too narrow bicycle tracks or lanes, ignoring the required profile or clearance.

Such practices would be inconceivable with regards to motorised traffic.

The analytical discussion and reflection of the spatial and urban transport policies in one hand and in the other hand the reaction and answer of the demand side, the cyclists, in both Italian and Dutch contexts, are the main topics of this research.

The learning aspect of this research is to provide some suggestions for what might can be done to move urban contexts further in the direction of bikes transport policies.

## 1.5 CENTRAL RESEARCH QUESTION AND THE CONCEPTUAL MODEL

### **“WHAT CAN BE LEARNED FROM THE EXPERIENCE OF UTRECHT AND MILAN'S TRANSPORT POLICY TO ENHANCE THE ACTUAL AND POTENTIAL NUMBER OF CYCLISTS ?”**

The main research question will be answered by following the logical circular order of the conceptual model. By empirically and theoretically analyse the variables and the correlated data, the central question problem should be found.

The conceptual model below hierachically suggests the importance of the variables and their linkages, in order to formulate the best enhancing cycling policy, where different goals and strategies need to fit together to be successful.

**BIKE TRAVEL BEHAVIOR POTENTIAL AND ACTUAL DEMAND:** independent variable

The collected data from the Province of Milan and the Utrecht Municipality, correlated to the following dependent variables, will help to answer to the central topic question.

Not only the analytical data will guide the research towards the comparison and conclusion parts, also the theoretical scan of prior academical articles and researches on travel behavior modal choices, will be determinant.

The dependent variables taken into account are:

DISTANCES AND ITINERARIES

MODES OF TRANSPORTS CONNECTED TO EACH OTHER (INTERMODALITY)

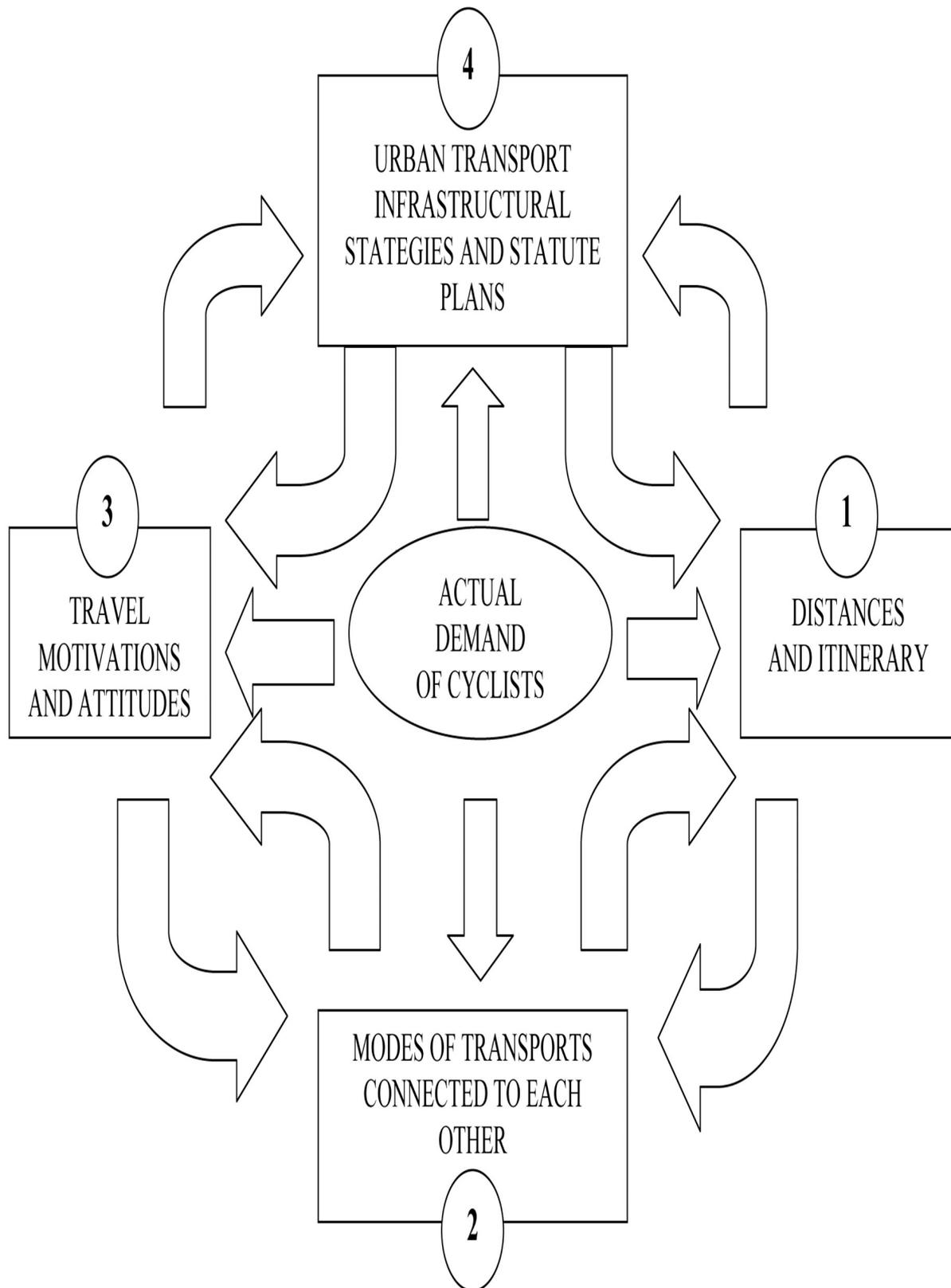
TRAVEL MOTIVATIONS AND ATTITUDES

URBAN TRANSPORTS INFRASTRUCTURAL STRATEGIES AND STATUTE BIKE'S PLANS

Subsequently, these variables will be sub-divided in: the demand (bike users) and supply (policy-makers, executive staff, transports managers, etc.) sides. This sub-division regards the importance given to both parts, in order to improve the quality and the practical stages of the local and national cycling policies and therefore enhance the actual cyclists demand.

The literature review and the actual Dutch and Italian transports data and policies, will direct the conceptual model in order to follow the path towards the research central question and sub-questions answers.

The subquestions' answers will be reached, in specific, by looking at each single variable hierarchical data.



## 1.6 CONCEPTUAL MODEL CONTENTS DESCRIPTION

### CYCLISTS ACTUAL AND POTENTIAL DEMAND

Hierarchically influenced by:

- I. DISTANCES AND ITINERARY (less than 20 km) (THE DEMAND AND SUPPLY PERSPECTIVES)
- II. MODES OF TRANSPORTS CONNECTED TO EACH OTHER (infrastructural organization and provisions, THE DEMAND AND SUPPLY SIDES)
- III. TRAVEL MOTIVATIONS AND ATTITUDES (linked to socio-cultural aspects and infrastructural and policy satisfaction, THE DEMAND SIDE)
- IV. URBAN TRANSPORT INFRASTRUCTURAL STRATEGIES AND STATUTE PLANS (THE SUPPLY SIDE)

These variables will be divided in the literature and in the transnational comparison between the demand and the supply sides, referred to the cyclists' need and the transport policy makers' perspectives that, in the most positive case, should correspond.

All these variables are linked together in a circular way but, which one is the most relevant for enhancing the urban bike use?

In order to answer to the main research question the analysis has to take into account all the dependent variables that do (or don't) influence the number of the actual bike users, in Utrecht and Milan urban contexts. From the dependent variables, some subquestions come out in order to assess the answer to the principal research question.

The indicators are referred to the questions to be answered, in order to find out the most policy influencing one. The distances and the itinerary, that an individual runs in both cities, are expected to be the most strongly influencing ones. A good planning policy maker should take into account them to best enhance the use of the bike in both city contexts. These variables follow the idea that in the growth of urban areas, the distances to be covered will become longer and the result will be that bicycles lose ground, in favour of the car and public transport, so that the compact city urban form is the best one for enhancing the bike's use. This indicator is followed by the ones relating to a good intermodal connection between public transports (that should have inside places for bikes) and the bikes. For example, a regional, provincial or suburban commuter can easily run the short urban distances by bike, while the longest ones by train, bus, underground, whose stations should be provided by connected bike paths, vans and parking areas.

Other important indicators are grouped together into the personal motivations and attitudes category. It is expected that these variables influence strongly the individual choice to use the bike instead of the private car, bus, etc., therefore the transport policy makers must best include these personal variables in their strategies and plans and support them in practice.

As in the literature review will be shown, some studies have compared evaluations of different travel modes and they found that the advantages of using the car, instead of other means of transport, were costs, flexibility, convenience, travel time, and protection against the weather (Bamberg & Schmidt, Fujii, Gärling, & Kitamura, Van Lange, Van Vugt, Meertens, & Ruiters, Verplanken, Aarts, Van Knippenberg, & Van Knippenberg, in: Gatersleben, Uzzell, 2007, p. 419).

On the other hand, people indicate that they walk or cycle for reasons such as health, the enjoyment of doing so, the environment, and costs (Hopkinson & Wardman, in: Gatersleben, Uzzell, 2007, p. 419). These motivations are very important because they affect people's travel demand choice, as the authors Rietveld and Daniel wrote: "municipalities with a higher degree of satisfaction (about bicycle policy) have in general a higher share of short trips by bicycle" (Rietveld, P. & Daniel, 2004, p.p. 531-550).

The last variables to analyse is referred to the urban transports infrastructural strategies and statute plans that should develop and enhance a more consistent use of bikes, as real means of urban transport in practice, by increasing the quantity and quality number of cyclists.

As in the travel behavior literature is underlined by the author Michael Replogue, (1992), bicycles are the fastest growing and predominant mode of access to express public transportation services in many European communities and in Japan. Provision of secure bicycle storage at rail stations, development of bicycle-friendly street networks, and the creation of a climate of community opinion supportive of bicycling are all important factors behind the success of bike-and-ride systems in these countries. The acknowledgment of this is expected to enhance the Milan case study from the abroad Utrecht experience.

Moreover, it is expected that the results would provide a better understanding of the perceived impediments of the cycle demand side, to be dealt with by policy makers and transports managers.

## 1.7 SUBQUESTIONS

Different categories of variables are expected to be actual and potential determinant, such as:

### **1) distances and modes of transports utilized (interconnected)**

Is the distance affecting the number of the actual bikers in Utrecht and Milan provinces?

Are the bikes more used instead of other means of public and private transports in both urban contexts?

How relevant is the form of the two cities in the transport bike choice?

### **2) travel motivations and attitudes**

What are the main travel motivations that influence the travel behavior and the bikes mode choice?

### **3) urban transport plans and strategies and statute bikes plans**

In both bikes' plans which infrastructural strategy effectively helps to increase the actual number of the urban cyclists?

## 1.8 METHODOLOGY

The research methodology will focus on comparison of quantitative data analysis.

The research used a range of methods and information sources according to the question and sub-questions addressed, including manipulation of public statistics, to provide consistent data for these two comparable areas.

The potential demand will be assessed on the base of the contained information in the matrix origin/destination estimated from the Province of Milan and the Gemeente of Utrecht (Municipality of Utrecht), Dienst Stadsontwikkeling (Town Planning Department) and Afdeling Verkeer en Vervoer (Traffic Section).

From such matrix are drawn out the above-local trips of the province of Milan and Utrecht on distances lower than the 15 km with the following ways of transport:

bike, bike + interchange with railroad / subway, local public transports (TPL), TPL + interchange with railroad / subway, car, car + interchange with railroad / subway.

It has to be underlined that it is referred on daily moves of a single run. The general number of daily trips is therefore double of that of the moves.

The potential resulting demand is only a part of the real actual users esteem.

Such numerical part must be made to vary on the distance variable of the move, for keeping into account the decreasing use of the bicycle linked to the distance.

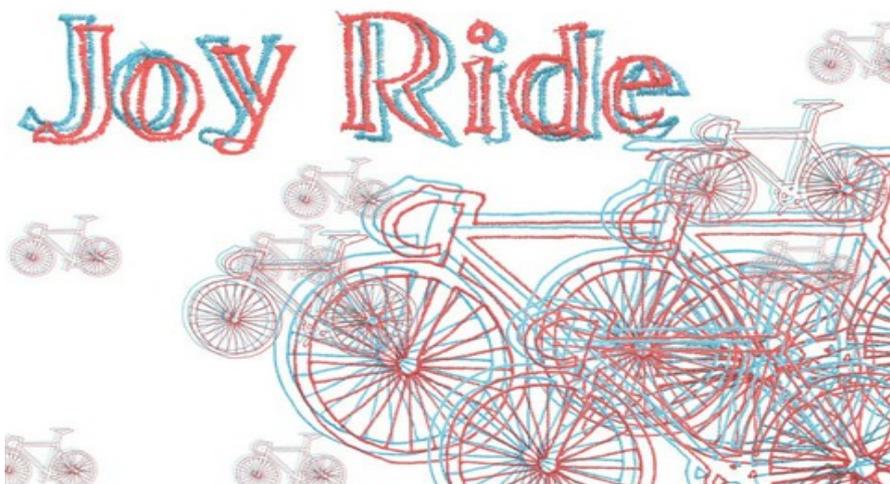
Operationally the hypothesis-objective is assumed to attract to the use of the bicycle to a demand percentage comparable to the one of the more advanced European contexts under the aspect of the cycling travel behavior.

The potential demand will be assessed on the base of the contained information in the matrix origin it is characteristic of the reality that introduces a good use of the bicycle, even if broadly lower than the existing (30-35%) most elevated values.

A new “function of cut” of the total demand is, therefore, calibrated, in such way to obtain a modal division assumed as objective, to maintain constant, for the different classes of distance, the relationships between the indeed found demand and the esteemed one. The adopted functional form is that of an exponential inverse, it is precisely :

$$T = a / (1 + e^{(B \cdot \text{dist} + y)})$$

Where: T= potential users a. B (= parameters of the balancing of the curve, respectively places equal to 0,55, 0,23, -0,4. Dist= moves distance.



## 2 LITERATURE OVERVIEW

### 2.1 THEORETICAL LITERATURE ON TRAVEL BEHAVIOR MODAL CHOICE

Travel behavior lies at center of everyone's daily life since facilities are separated in space and time dimensions, so that people have to travel to reach them. Travel behavior modal choice literature is wide and covers different theoretical and empirical perspectives, some of which are linked to the research's variables so that they will be discussed and take into account after a short general introduction.

Most models of modal choice are macroanalytic in nature, focusing on the behavior of large groups of travelers and therefore, they have limited explanatory power. Transportation managers need to know more about the decision processes of individual travelers in selecting a mode for a particular trip, if they are to be able to develop strategies for influencing these decisions (Lovelock, 1975, p. 253).

### 2.2 THE SUPPLY SIDE PERSPECTIVES

The following theoretical literature scan presents both the supply and the demand sides. The first are referred to the policy makers priorities, strategies and perspectives, while the second are related to the bike and infrastructural users. They have often contrasting opinions which, in practice, can produce opposite effects. It is important to analyse these resulting effects so that, in the future, a theoretical and practical consensus can be reached.

The perspectives and strategies of the policy-makers taken into account, in this review, regard first the land use and the compact city form, which is expected to have a great impact on the individual travel behavior modal choice and which can strongly influence the journey lengths. Afterwards, the modal shift policy perspectives are presented and are expected to be, from the research point of view, important variables which contribute to the quality of the travel behavior experience. In these perspectives are presented the personal motivational options and circumstances that, the policy makers and transports managers, should take under great consideration, to satisfy the demand side.

The nature of travel choice decision is fundamental to model split modelling. A person selects all the transports alternatives he has to reach a destination. The decision will be based upon the person's own system of preferences, tastes and constraints regarding the transports alternatives. This mental process is the utility theory, one of the main methods by which the decision-making process has been modelled to represent travel modal choice (Banister, 1978, p.5).

#### 1) THE LAND USE AND COMPACT CITY INFLUENCE ON...

While the desire to partake of urban activities generates a demand for travel, transportation facilities can also induce travel. When discretionary (non-vital) activities are more easily accessible as a result of a new transportation facility, more people choose to take advantage of them. Conversely, when transportation facilities are temporarily or permanently eliminated, demand for travel may decline, as some people choose to forgo certain activities, or combine them with other activities that also require a trip (Cairns, Hass-Klau & Goodwin, in: Tomlinson, 2003, p. 6). Thus there is an intimate relationship between urban land-use development and transportation (Tomlinson, 2003, p. 6). Journey lengths are strongly related to land use. Journeys, in densely populated areas with mixed land use, tend to be shorter (Van Hout Kurt, 2008, p. 25).

The existence of complex relationships between land use and transportation has long been recognized and widely accepted, but, the nature of these relationships is not at all well understood. In particular there is the "chicken-and-egg" problem of whether the predominant relationship is one where land use affects transportation or vice versa (Legambiente, 2000, p. 1).

The mass motorization of the 1960s and 1970s fueled a large-scale suburbanization of middle-class households.

Suddenly it became possible, for many households, to reside further away from the workplace, in a large, attractive house at the edge of the city with green surroundings.

One of the unintended consequences of the decentralization of the population was a rise in the level of road congestion. This prompted the expansion of the road network, which in turn facilitated a further dispersal of residence and other land uses.

Travel budgets can be reduced considerably by cycling. Not only the individual benefits from reduced travel budgets, society as a whole benefits as well. Investments in bicycle infrastructure and maintenance are much cheaper than investments in (extension of) car infrastructure. Considerable savings can be made when investment in bicycle facilities make expansion of the car infrastructure unnecessary (Buis & Wittink in: Van Hout Kurt, 2008, p. 6). Moreover, the motor vehicles traffic is not only considered the cause of: pollution, stress and time consuming, but, it is seen mostly as an economic problem. The time that a person passes in the traffic jam, to go to work, is considered precious time removed from the productive work hours. The Western developed countries perceive the traffic problem as an economic and unproductive problem, therefore, they are focused on solving this problem by using various practical methods and campaigns.

With regard to travel behavior, a consensus has developed that, because of the negative environmental consequences of car use, more extensive use of other transport modes together with the development of more compact settlement patterns should be stimulated.

In a shift away from infrastructure expansion, policymakers looked for ways ad hoc to influence people's travel behavior with pricing measures: systems of pricing the use of road space, parking policy, subsidizing public transport and the regulation of land use patterns, with the aspiration to reduce private car use and stimulate public transport and walking and cycling.

All of these policy initiatives are based on the premise that changes in the spatial configuration of land use and transport infrastructures are capable of influencing people's travel behavior. But the academic literature is equivocal about the extent to which travel patterns and the relationship with the urban form. The more compact land-use patterns in European cities lead to average trip distances that are only about half as long as in American cities and thus are easier to cover by foot or by bike (Pucher, Dijkstra, 2003, p. 1511). Increasing trip length has an important and significant negative effect on the attractiveness of cycling (Hunt & Abraham, in: Van Hout, 2008, p. 25).

Furthermore, while it is easy to understand that mode choice is sensitive to locational characteristics, a vice versa relationship is still lacking in the previous research.

Instead of a strong concentration of jobs in the city centre, urban regions have developed several office and shopping centres districts outside city centres, in polycentric structures. As a result, patterns of daily travel became tangential instead of radial in many metropolitan areas. For example, in the late 1980s, 57% all the inter-municipal trips taken by the inhabitants of the Randstad Holland were between suburban communities. Travel between the central cities and the suburban communities of the Randstad was less frequent: 41% of the inhabitants' trips (Cortie et al., in: Dieleman, Dijst, Spit, 1999, p.p. 612-613 ).

As car ownership increases, a bigger proportion of present "captive riders" on public transport will have the choice of car or public transport. While public transport vehicles share the same road as private vehicles, the shift of commuters from public transport to private car will increase congestion and will delay both types of vehicles. But this shift will happen as long as commuters continue to find a relative advantage in driving their own cars. It seems that, under present policies, this relative advantage will persist even as conditions worsen.

Many countries now have policies to reduce distances travelled by private car and to favour the use of public transport, cycling and walking (Legambiente, 2000, p. 3).

In a number of worldwide towns and cities, development programs have been organised to provide designated bike surfaces reserved for the movement of cyclists along the city network (Ciclobby, 2009, p. 6).

There has been an increase in the use of a bicycle as a regular mean of personal transport, particularly in recent years when technical solutions and modern materials have allowed more active use of bicycles in big cities (Stanic, Vuijn, 2005. p. 257).

As far as non-motorised modes of travel are concerned, a transport and land use policy, aiming at shorter travel distances, might favour the use of these modes. The development of compact urban forms and the design of urban communities which favour walking are seen as particularly effective strategies for reducing car dependency (Jenks, Burton, Williams, 1996, p.p. 190-191).

The factors which determine travel behaviour are not fully understood, so that effective policies, influencing travel patterns, are difficult to formulate.

For example, the growth of car use in the Netherlands has been somewhat curbed, by spatial planning policies, to encourage: walking, cycling and public transport use. For example, residential growth areas are well served by public transport networks and retail developments face strict zoning policies preventing the development of out of town megaplexes surrounded by car parks (Schwanen, Dijst, & Dieleman, 2004, p. 304). While the polycentric city forms has developed through the widespread ownership of cars, a flexible, individual transport mode, in the Netherlands polycentric cities do not appear to have a high share of car trips (Schwanen, Dijst et al., 2004, p. 304).

Rietveld and Daniel (2004), found that municipalities with a higher degree of satisfaction (about bicycle policy) have in general a higher share of short trips by bicycle (Rietveld, Daniel, in: Van Hout Kurt, 2008, p. 17).

While the interest in bike-and-ride is on the rise and the number of countries that are developing policies to promote bike-and-ride is increasing (Department of Environment, Transport and the Regions, Bundesministerium fuer Verkehr, Baund Wohnungswesen, Hagelin, in: Martens, 2007, p. 327), there is hardly any knowledge on the success of different types of measures to promote the combined use of bicycle and public transport (Martens, 2007, p. 326).

## 2) THE MODAL SHIFT POLICY PERSPECTIVES

Even today, the European debate over investment in the infrastructure for private versus public modes as a means of reducing congestion has a higher profile than the debate on air quality. Up to the present, efforts to stimulate public transport have seldom led to the desired modal shift; public transport seems to be incapable of competing with private car. From the customers' viewpoint, the quality of public transport is not high enough, which prevents the public transport system from being an attractive alternative to replace travelling by private car. One of the factors that contribute to public transport quality is travel information. Information provision in itself does not have the capability to persuade people to switch modes, though in various studies this service has been indicated as important, and hence it can substantially contribute to the overall satisfaction with public transport quality (Balcombe et al., Stradling et al., in: Grotenhuis, Wiegman, Rietveld, 2007, p. 27).

Personal attributes and circumstances have an impact on modal choice and distances travelled and it is important that transport policies take them into account. People with higher incomes are more likely to own and use a private car than low-income households. Families with children use cars more often than one-person households.

On modality choices in general there is a rich literature available of travel behavior.

Haney's (1969), belief that modal choice is a function of four group of decision variables: transportation system characteristics, community characteristics, trip characteristics and trip-maker characteristics. Transportation is a derived demand and so the modal choice decision is preceded by the consumer's decision to make a travel which will satisfy other needs.

Each trip has specific characteristics of its own which will have a major impact on the consumer's choice of a mode of transportation (Lovelock, 1975, p. p. 258-259).

To a large extent mode choices on short trips are influenced by habits: although it is not necessary to take the car, the car is used a lot.

These habits are hard to change. Habits are the results of frequent and consistent behavior; they can best be changed when long term decisions are made politically from the top but applied from the down. A good moment to try to change people's travel habits could be when one has a new job or moves to another residential area. These meaningful situations in life could pertain to long term mobility changes. On the other hands, short term changes in mobility choices (for example as a result of a positive experience with public transport) are not expected to last long (Kitamura, 2009, p.p. 680-681).

The literature scan, shows a positive relation between attitudes and modal choices: a positive attitude towards travelling by train, results in increased travel by train. However, attitudes and perceptions are also hard to change: although a bike is, in some situations, the quickest travelling mode as a result of congestion, one-way traffic etc., people persist to perceive bikes as a slow vehicle. They deny all information that could refute their perception of bikes, just because they are not interested enough in bikes: bikes are not in their "evoked set". This is of great interest, because giving "the right" information is clearly not enough to change peoples attitudes. People select the information they use in their decision making process (Wierenga & Van Raaij, 1987).

In general there are three types of motivations that are at the basis of mode choices: instrumental motives: fast, flexible and comfortable mean, affective-emotional motives: driving a personal car gives the feeling of freedom and privacy and motives based on social comparison, (Slotegraaf et al., in: Gatersleben, Uzzell, 2007, p. 418).

There is a close relation between modality choice and availability: having a bus stop in front of the residence, for example, increases the chance of using the bike to travel to that station instead of using the car.

When people live in the vicinity of an ongoing road the number of car trips is also increased. Biking increases when shops are available in the neighborhood (Connekt, 1999). In addition to that, results of a survey among shopkeepers in the Dutch cities Utrecht and Enschede showed that more shopkeepers found the accessibility by foot and bicycle more important than the accessibility by car (Buis&Wittink, in: Van Hout Kurt, 2008, p.12).

Moreover, the composition of the household is of influence on mode choices. Households consisting of one or two persons prefer travelling by car more often. Also in households with little children, parents tend to use their car more often when bringing their children to school; mostly due to reasons of perceived traffic unsafety and time pressure (Mackett & Robertson, 2000).

In the literature, other factors influencing modality choice are: demographic factors (living in urban or rural areas); demand and supply factors (parking possibilities, car ownership, supply of alternatives); personal factors (genders, age et etc.), indirect personal factors (ownership of driver's license, place of residence, working location etc.); travel motives (i.e. commuter traffic, recreational traffic etc.); and situational factors (weather conditions; perceived social safety).

## CONCLUSION

On the basis of this literature review, it can be concluded that, when studying mode choices, it is important to differentiate and pay attention to the differences in transport patterns between rural and urban areas and the degree of municipality infrastructural development, to the costumers preferences, choices and to the urban design projects.

From the supply side perspectives what has been found is that, mostly, policy makers' perspectives are related to the fact that changes, in the spatial configuration of land use and transport infrastructures, are capable of influencing people's travel behavior. What seems most important in their views is a transport and land use policy aiming at shorter travel distances.

This is the reason why, policy makers and urban planners recommend the development of compact urban form and urban communities plans, where walking and cycling is taken into account from the earliest steps of the design projects. Moreover, what is resulting determinant in the modal shift policy is the determinant role that personal costumers' attributes and circumstances have on the choice of public versus private modes of transports.

Haney's reports (1969), about the four group of modal choice decision variables, will be taken under great consideration in the following parts of the research. The last important point that should be considered, by the policy makers, is the fact that, the availability of different public transports and infrastructural services are connected variables, both influencing modal shift choices. Therefore they should be included in the supply side strategies of supporting the demand side needs and influencing the choice towards the use of public transports and bikes.

## 2.3 THE DEMAND SIDE PERSPECTIVES

### 1) THE TRAVELERS ATTITUDES AND EXPERIENCES

Behavioral research on travel mode choice, to date, has principally focused on examining instrumental cognitive appraisals of private car use and public transport, or the affective travel experience with an emphasis on commuter stress as experienced by drivers and users of public transport (Gatersleben, Uzzell, 2007, p. 417) There has been comparatively little research examining the positive as well as the negative affective experiences of different mode users. This is a significant shortcoming in the research literature as affective experiences can have an important affect on people's overall attitudes toward a particular experience and therefore may influence their future behavioral intentions (Eagly, Mladinic, & Otto, in: Gatersleben, Uzzell, 2007, p. 417).

Moreover, most of the researches has been limited in comparing only private car use and public transport. No comparisons have been made between these groups and commuters who walk or cycle. Research on people's experiences of using different travel modes can be divided into two categories: (a) those studies undertaken by environmental psychologists that focus on drivers and users of public transport and (b) those undertaken by health psychologists that focus on walkers and cyclists.

According to Stradling (2002), making transport choices involves reconciling the anticipated demands of a journey with the physical (e.g., walking and waiting), cognitive (e.g., route planning and navigation), and affective (e.g., uncertainty) resources available to the traveler (Stradling, in: Gatersleben, Uzzell, 2007, p. 419).

From a sustainable transport policy point of view, which aims to persuade people to use their cars less and other modes more often, limited comparisons provide only a partial insight into the reasons that people prefer certain travel modes to others and how they can be persuaded to change their choices (Gatersleben, Uzzell, 2007, p. 417).

### 2) THE USE OF THE CAR

People mostly choose to use a bicycle for positive reasons: it's fun, it's healthy exercise, good for the environment, it's fast, it's inexpensive (Fietsverkeer; Ege & Krag, n.d.; Stinson & Bhat, Stinson & Bhat, in: Van Hout Kurt, 2008, p. 12). Furthermore, concerns regarding automobile use (environmental impact) are important considerations to take under great consideration. Almost all bicycle commuters make the conscious choice of using the bicycle and are not captive to bicycle use (Van Hout Kurt, 2008, p. 13).

Attention is typically drawn to the negative effects of car use such as driving stress caused through congestion, speed and general overstimulation, and acute poor health caused through air pollution (Godlee & Walker, in: Gatersleben, Uzzell, 2007, p. 417). There are, however, also positive effects such as improved accessibility, speed, and control of our lives.

The possession and use of a car is positively related to psychological factors such as mastery and self-esteem (Ellaway, Macintyre, Hiscock, Kearns, in: Gatersleben, Uzzell, 2007, p. 417).

Moreover, the use of a car can enhance feelings of autonomy, protection, and prestige, whereas this is not the case for public transport. Steg, Vlek, and Slotegraaf (2001) demonstrated, by means of qualitative nonobtrusive research methods, that car users find their cars attractive not only because of their instrumental advantages (e.g., flexibility, cost, and speed) but also for affective-symbolic reasons (e.g., driving thrill, excitement, feelings of power, and status), (Gatersleben, Uzzell, 2007, p. 418).

### 3) COGNITIVE ASPECTS ABOUT DIFFERENT TRAVEL MODES

Most studies comparing evaluations of different travel modes focus on the cognitive beliefs people hold about different travel modes. These studies have typically found that when people are asked why they use cars as opposed to other modes of transport, they refer to the advantages of cars in terms of costs, flexibility, convenience, travel time, and protection against the weather (e.g., Bamberg & Schmidt; Fujii, Gärling, & Kitamura; Van Lange, Van Vugt, Meertens, & Ruiters; Verplanken, Aarts, Van Knippenberg, & Van Knippenberg, in: Gatersleben, Uzzell, 2007, p. 419). On the other hand, people indicate that they walk or cycle for reasons such as health, the enjoyment of doing so, the environment, and costs (Hopkinson & Wardman, in: Gatersleben, Uzzell, 2007, p. 419). Research has shown that the use of more sustainable transport modes such as walking, cycling, or the use of public transport is related to environmental awareness as well as social and personal norms (Hunecke, Bloebaum, Matthies, & Hoeger; Joireman et al.; Matthies, Kuhn, & Kloeckner; Nilsson & Küller, in: Gatersleben, Uzzell, 2007, p. 419). According to Stradling (2002), making transport choices involves reconciling the anticipated demands of a journey with the physical (e.g., walking and waiting), cognitive (e.g., route planning and navigation), and affective (e.g., uncertainty) resources available to the traveler. Wardman, Hine, and Stradling (2001) showed that bus travel is perceived to be more taxing, especially emotionally taxing than car use, largely because of the necessary interchanges (Wardman, Hine, and Stradling, in: Gatersleben, Uzzell, 2007, p. 419).

The combined use of bus and bicycle has been neglected for quite a long time in the Netherlands. Generally the bicycle has been viewed as a competitor of bus lines. In comparison to the private car, bike-and-ride offers a number of environmental and social benefits (Martens, 2004). These include reduction in energy use, air and noise pollution, as well as lower congestion levels on specific corridors and access routes to public transport stops. The combined use of bicycle and public transport may also increase public transport ridership on specific lines, thereby strengthening the economic performance of these services. Furthermore, bike-and-ride may help to enable car-free lifestyles, as it will improve the overall competitiveness of the 'green' modes of transport (public transport, cycling, walking) vis-a-vis the private car (Martens, 2004, p. 326).

Bike-and-ride may especially play a role here for trips of intermediary distance, i.e. trips that extend beyond 'normal' walking or cycling distances but are too short for truly competitive public transport like long-distance train services (Martens, 2004, p. 327). Especially these intermediary trips prove to be difficult to serve by regular public transport services (Kraemer-Badoni, in: Martens, 2005, p. 327).

Taken together, the environmental and social benefits provide the impetus for many public bodies to stimulate the combined use of bicycle and public transport (Karel Martens, 2004, p. 327).

Very little research has examined both the positive and negative affective experiences of commuters and how these experiences are related to mode choice.

### 3) TRAVELERS' PERCEPTIONS AND PREFERENCES

Preferences and perceptions about (safe) cycling differ among different kinds of cyclists and non-cyclists. Stinson and Bhat (2004) indicate that the most important factors in choosing a commute mode are travel time, convenience, needing a car for work or other purposes and cost. Other deterrents to bicycle commuting to work include dangerous traffic conditions, lack of bicycle infrastructure facilities, physical exertion (especially in hilly terrains) and adverse weather conditions. Bicycle commuters more often cite unpleasant weather and an injury/illness as being deterrents than do non-bicycle commuters. On the other hand, non-bicycle commuters have a much higher likelihood of identifying lack of daylight, unsafe neighborhoods, distance to work being too long, dangerous traffic and lack of bicycle facilities as being deterrents than bicyclists. While some of these differences may be reasonable, others may be due, at least in part, to misperceptions and misconceptions on the part of the non-bicycle commuters (Stinson & Bhat, in: Van Hout Kurt, 2008, p. 21).

Stinson & Bhat (2005) also found a clear distinction between the sensitivity towards different aspects according to the level of cycling experience. In general, experienced commuter bicyclists are far more sensitive to factors related to travel time and far less sensitive to factors related to separation from automobiles than the inexperienced individuals. Compared to route choices for the inexperienced cyclists, the route choices made by experienced bicycle commuters are not as impacted by variables that reflect perceptions of safety from automobile traffic (Stinson & Bhat, in: Van Hout Kurt, 2008, p. 21).

Comfort with automobile traffic allows experienced bicycle commuters to place a higher premium on travel time. While safety-related attributes are also clearly important to experienced bicyclists, they are much less influential in the route choice selections of experienced bicyclists compared to inexperienced bicyclists. On the other hand, travel times and delays are not as influential for the inexperienced group as for the experienced group (Van Hout Kurt, 2008, p. 21).

### 4) THE IMPORTANCE OF EMOTIONAL AFFECT ON TRAVEL MODE CHOICE POLICIES

The emotional affect ought to be an important consideration in examining commuter travel mode choice. First, it is likely that people prefer a positive commuting experience and therefore gravitate to the travel mode most likely to provide that experience. Second, affect has been shown to be important for the formation of attitudes and may therefore indirectly influence intentions and behaviors (Eagly et al., in: Gatersleben, Uzzell, 2007, p. 419). Steg (2004) examined the affective experience of using the car for commuting journeys). She found that the more positively the affective experience of driving or being a car passenger was rated, the more often the car was used. She also found that respondents used their cars less often when car use was perceived as stressful (Steg, in: Gatersleben, Uzzell, 2007, p. 419).

From a policy perspective, it is also important to know the sources of commuter experiences. Research to date on the factors that influence commuter affect largely comes from studies on commuter stress.

Commuter journeys by car and public transport can be stressful and that the main sources of this stress are delays caused by traffic volume, the behavior of other road users (for car users), and poor infrastructure provision for users of public transport (Gulian; Matthews; Glendon; Davies & Debney; Rasmussen; Knapp & Garner, in: Gatersleben, Uzzell, 2007, p. 419).

A survey among university employees revealed that in support of previous research, car commuters find their journey more stressful than other mode users. The main sources of this stress are delays and other road users. Users of public transport also "complain" about delays; however, this results in stress as well as boredom. Walking and cycling journeys are the most relaxing and exciting and therefore seem the most optimum form of travel from an affective perspective (Gatersleben, Uzzell, 2007, p. 421).

Generally, the data propose that each travel mode elicits a different affective response: driving is relatively unpleasant and arousing, public transport is unpleasant and not arousing, cycling is pleasant and arousing, and walking is pleasant and not arousing. Each travel mode serves to discriminate on the two affective dimensions developed by Russell and Snodgrass, (Russell and Snodgrass, in: Gatersleben, Uzzell, 2007, p. 428).

The study also revealed the main sources of positive and negative affect for respondents; they appeared to be closely linked to both pleasure and arousal (Gatersleben, Uzzell, 2007, p. 428).

Berlyne (1974) suggests that people strive for an optimum level of arousal. This study suggests that the use of private cars may be too arousing (stressful), whereas the use of public transport may be not arousing enough (boring). Walking and cycling, however, score positively on arousal as well as pleasure (i.e., exciting and pleasurable) and therefore seem an optimum form of travel from an affective perspective (Berlyne, in: Gatersleben, Uzzell, 2007, p. 428).

The attitudes of public transport users toward their daily commute are more negative than the attitudes of other mode users. This appears to be related to stress as well as boredom caused by delays and waiting times.

Previous research had already suggested that public transport journeys may be stressful due to unpredictability (e.g., Evans et al., 2002) and travel time (e.g., Wener et al., 2004). In policy terms, especially in relation to the promotion of sustainable transport behavior, this may have important consequences. The main sources of pleasure for public transport users appear to be reading, listening to music, interacting with other people, or looking at the passing scenery. Perhaps improvements in public transport provision that enhance people's ability to do these things might significantly improve people's attitudes toward the use of public transport (Evans; Wener, in: Gatersleben, Uzzell, 2007, p. 428).

It is interesting to note that many previous studies on travel mode choice suggest that people tend to prefer a car to other forms of transport for reasons such as flexibility and control. Stradling, Meadows, and Beatt (1999), for example, showed that almost all of their respondents felt that the car provides freedom and control (90%), (Stradling, Meadows, and Beatty, in: Gatersleben, Uzzell, 2007, p. 428).

Journeys by bicycle are evaluated to be the most interesting and exciting. Journeys on foot are perceived to be the most relaxing journeys. Walkers travel the shortest distance, and they enjoy the activity itself. These research findings have important policy implications, particularly in relation to the promotion of walking and cycling to work. It is well documented that commuting stress can lead to emotional and behavioral deficits on arriving home or at work (Cohen; Novaco, Kliever, & Broquet, in: Gatersleben, Uzzell, 2007, p. 429).

To inform the development of organizations' transport plans, it seems worthwhile to further examine the potential positive affective consequences of walking and cycling as well, especially in relation to performance and health and sustainability (see Hu et al.; Lumsdon & Tolley; Oja; Vuori & Paronen, in: Gatersleben, Uzzell, 2007, p. 429).

A thorough comparison of used and unused travel modes, using both experimental or longitudinal data and with a greater range of cognitive and symbolic evaluations of travel experiences (e.g., Steg et al., 2001), provides a better insight into the relative importance of the various motives underlying travel mode choices, (Steg, in: Gatersleben Uzzell, 2007, p. 429).

People won't travel further unless it is easy to do so. What we need, then, to curb the problems of congestion and unreliable transport is to reduce the demand on, rather than increase the supply of, transport. An "antitransport policy", so to speak. One way of forcing the pace of change is to use economic controls such as rail fares and motoring taxes, says Professor Sir Peter Hall, director of the Institute of Community Studies in London (J. Jowit, transport correspondent Financial Times).

To help address health and other policy concerns, policy makers and professionals are looking at ways to increase the use of walking and bicycling for everyday travel.

While most of the focus on “active living” has been on walking, bicycling may have a greater potential to substitute for motorized vehicle trips because of its faster speed and ability to cover greater distances.

The potential for bicycling as a transportation mode has been recognized through objectives to raise bicycling rates and significant increases in funding for building new infrastructure. Several states and cities have also adopted aggressive policies and programs to increase bicycling, however, the United States lags far behind many other developed countries, particularly several European countries, with respect to the share of people traveling by bicycle. Moreover, most bicycle travel in the United States, particularly among adults, is for recreation, not daily travel.

This is in contrast to bicycling in countries such as the Netherlands, Denmark, and Germany (Dill, 2009, p. 96).

Factors operating to motivate, support or inhibit the journey by bicycle are well documented.

People mostly choose to use a bicycle for positive reasons: it’s fun, it’s healthy exercise, good for the environment, it’s fast, it’s inexpensive (Fietsverkeer, feb. 2004, p. 3-4; Ege & Krag, n.d.; Stinson & Bhat, in: Dill, 2009, p. 96-97).

Foremost amongst the impediments are: logistics – time, distance, level of organization, family responsibilities, dealing with weather; safety – high volume and fast traffic, inconsiderate drivers, pollution; cycle infrastructure and facilities – lack of on-road continuous cycling space, secure parking, cycle paths; cultural norms and ridicule (e.g. Daley et al., in: Bonham, Koth, 2010, p. 95 ). Distance (and strongly correlated trip time) is probably the most important determinant of bicycle use. Distance and time are mentioned as the most important factors for cycling to work as well as not cycling to work in Copenhagen (Ege & Krag, in: Van Hout Kurt, 2008, p. 12). In general bicycle use is highest in the range up to about 5 km (except for very short distances where walking takes over). Bicycle use decreases sharply when the trip distance increases above 5 km. Nevertheless some bicycle trips are much longer. The average length of a bicycle trip is 2 km (Hydén et al, in: Van Hout Kurt, 2008, p. 25). In Denmark and in the Netherlands the bicycle trips are longer than 16 in other European countries. The willingness to cycle over longer distances differs between countries with good amenities and a flat topography (Denmark and the Netherlands) and other countries. However, in general we should not expect people to use a bike for transport on distances longer than 3-5 km (Van Hout Kurt, 2008, p. 25).

The physical context of the cycling environment, from spaces available to interactions with other travelers, affects the embodied and emotional content of journeys by bike. In detailing the embodied experience of the cyclist, Fincham (2007), Spinney (2007) and others provide insights into the travail of the journey and the personal costs borne by cyclists when making journeys through the urban environment (Fincham; Spinney, in: Bonham, Koth, 2010, p. 95).

McKenna and Whatling (2007) argue the embodied experience of cycling is largely ignored in the literature (McKenna, Whatling, in: Bonham, Koth, 2010, p. 100).

On the one hand, giving voice to that experience is likely to deter others from cycle commuting while on the other hand, in not acknowledging it, cyclists’ rights to safe travel environments can be readily ignored.

Broadly, focus group findings suggest that addressing en-route safety and multi-modal issues as well as fostering a cycling culture through social, contextual and policy-information measures are important elements in enhancing commuter cycling, (Bonham, Koth, 2010, p. 102).

## 5) LIFE-STYLE INFLUENCE

There has been no commonly accepted definition of the term “life-style” in the field of travel behavior analysis and demand forecasting. Little empirical evidence exists on how an individual acquires a particular life-style, how it is correlated with measurable attributes of the individual and his household, and how it is related to travel behavior. Nevertheless, the life-style concept extends the scope of travel behavior analysis and may possibly lead to improved predictive performance of forecasting models (Kitamura, 2009, p. 680).

Proposed definitions of life-style range from quantitative to conceptual. Reichman's definition offers important implications: "Life-styles are assumed to be shaped by recurrent behavioral responses to socioeconomic conditions, as well as to deeper personal or social attitudes, roles, or values." Life-style is thus seen to underlie travel behavior and is related to fundamental human values and needs. In particular, Reichman (1975) challenges the wisdom that travel demand is a derived demand: "Is transportation only a means to an end, or does it really fulfill some ends in itself?"

First, according to Reichman, life-style is not merely a typology of observed behavior but a latent factor that motivates behavior. Life-style thus defined is termed "life-style as behavioral orientation" as opposed to "life-style as a behavioral typology."

Second, if an individual's travel behavior is driven by his life-style aspirations, adaptation behavior cannot be studied without knowledge of the values that the individual holds. Driving a car to work may not necessarily imply that driving has been chosen by an objective cost-benefit calculation of alternative modes; it may be an indication that the commuter assigns value to the act of driving itself. Using life-style as a framework, however, poses an immediate problem, because values and orientation are not measured in typical transportation surveys (Reichman, in: Kitamura, 2010, p. 681).

In conclusion, the literature articles, of the demand side, are important to assess travel behavior theoretical implications and transfer them in practice.

The final aim of the research is to help transportation managers and urban planners to know more about the decision cognitive and emotive processes of individual travelers when selecting bicycle mode for a trip, if they are to be able to develop strategies for influencing this decision.

The above literature frames the attitudes, perceptions and motivation variables, in order to understand how and why travelers behave as they do. It offers different strategies and perspectives available for encouraging or discouraging the use of particular modes (private motor vehicles) and enhancing the use of the bicycles. The concern of the transportation manager, meantime, is to be able to make operating decisions on: facilities and design, services configurations, pricing, advertising and public information. In this regard, the following research sections will compare these concerns, which are expected to be the greatly influential on the actual number of bicycle users, in Utrecht and Milan urban contexts.

## 2.4 EMPIRICAL EXAMPLES OF TRAVEL BEHAVIOR MODAL CHOICES

### THE EXEMPLAR "COMPLETE STREET" DESIGN PROJECT

For years, transportation planners have designed roads with enough room for bicyclists, motor vehicles, pedestrians and buses. Recently, though, communities have begun unifying those efforts under a set of shared policies called Complete Streets. Last year, Illinois was the first government to pass a Complete Streets policy, which requires the state's Department of Transportation to include safe bicycling and walking paths in, all road projects in urban areas. The Complete Streets movement began in 2003 as the result of a push by America Bikes, a Washington based coalition of national bicycling and trail advocacy groups, to include more funding for bicycle and pedestrian projects in the federal transportation reauthorization act, says Stefanie Seskin, state and local policy fellow for the Complete Streets Coalition, which was formed in 2005. The basic concept behind Complete Streets is to enact policies and practices that require new street projects to be designed to safely accommodate all users. Roads and sidewalks that follow the principles would include wheelchair ramps, hike lanes and audible crossing signals for the blind.

Complete Streets also promotes more livable communities and healthier lifestyles,(Ed Brock, 2008).

## THE ROLE OF THE INFRASTRUCTURES OF THE PORTLAND CASE

Several studies have tried to assess the relative effects of specific types of infrastructure, including bike lanes (a striped lane on a roadway) and paths separated from motor vehicle traffic, using both stated and revealed preference methods. Stated preference methods ask participants what they would do given a hypothetical situation. Revealed preference methods collect data on how participants actually behave. Simple stated preference studies usually find that people prefer bike paths and lanes or indicate that having such infrastructure would encourage them to bicycle more. Findings from revealed preference studies are mixed. At a city level, two studies have found that bike lanes are associated with higher rates of bicycle commuting. However, at an individual level, other studies have not found such a link.

Several studies have found that bicyclists will take a longer route to use bicycle facilities, such as lanes or paths. Preference for lanes or paths may depend upon the type of bicyclist.

One study found that bicycle commuters diverted very little from the shortest path and preferred not to ride on paths or trails. A national survey found that frequent bicyclists preferred bike lanes rather than paths. Infrequent bicyclists were more likely to want more bike paths rather than lanes.

This study took place in the Portland, Oregon metropolitan area (“region”), with a population of about 1.6 million. The City of Portland (about one third of the population) has received national attention and awards for its commitment to bicycling. The city has a relatively high number of bike lanes, compared to other large US cities. Rates of bicycle commuting are higher in the region than most comparably sized regions. Yet only about 1.2% of the region’s and 4.2% of the City of Portland’s workers regularly commuted by bicycle in 2006. Bicycle infrastructure in the region includes bike lanes on streets, separate bike paths, and “bicycle boulevards.” Bicycle boulevards are low-traffic, minor streets, usually running parallel to a major road, that use traffic calming features to give priority to bicycles over motor vehicles. For example, barriers at some intersections force cars to turn while bikes can continue on a through path. Traffic signals allow bikes traveling on the boulevard to cross busy streets safely.

The bicycle boulevards are located in the older neighborhoods that are covered with a grid-type street pattern made up of small blocks. A supportive environment, like that found in the Portland region, appears necessary to encourage bicycling for everyday travel, allowing more adults to achieve active living goals.

The first part of that environment is bicycle infrastructure that addresses people’s concern about safety from motor vehicles. In Portland, this includes a network of bike lanes, paths, and boulevards. Building such a network requires a comprehensive plan, funding, and political leadership. A network of different types of infrastructure appears necessary to attract new people to bicycling. Simply adding bike lanes to all new major roads is unlikely to achieve high rates of bicycling. For people concerned with safety and avoiding traffic, a well-connected network of low-traffic streets, including some bicycle boulevards, may be more effective than adding bike lanes on major streets with high volumes of motor vehicle traffic. Opportunities to build separate paths are often limited in existing neighborhoods due to space constraints and costs. Public agencies can, however, look for such opportunities when building other infrastructure, such as new rail transit lines, along existing transportation corridors, and when expanding to new undeveloped areas. Finally, the role of bike lanes should not be dismissed in planning for a bicycle-friendly community. A disproportionate share of the bicycling occurs on streets with bike lanes, indicating their value to bicyclists. These facilities may provide important links in the network, connecting neighborhoods when low-volume streets cannot.

The bicycle infrastructure in Portland appears to work, in part, because of a supporting land use and street network structure. The areas within Portland where the highest levels of bicycling occur also have a well-connected street grid and mix of land uses. This allows bicyclists to link their trips together in an efficient manner.

The grid street patterns allows the installation of bike boulevards that provide options to bicycling on major streets with more traffic, without increasing travel distances too much.

For new development, street connectivity standards and zoning that allows or even mandates a mix of land uses can create such an environment (Dill, 2009, p.p. 105-107).

Empirical results from past analyses of urban household travel behavior exhibit strong commonality as to the association between life-cycle stages and travel patterns (Kitamura, 2010, p.p. 693-694).

#### THE AUSTRALIAN UNIVERSITY SUSTAINABLE CHOICE

An empirical study undertaken at the Mawson Lakes Campus of the University of South Australia shows that cycling has been evaluated as a sustainable transport option.

A survey of university staff and students in 2004 found transport to be a key environmental issue (Koth, 2006). Following on from that survey, the University provided funding for a study into cycling as a possible way of reducing the impacts of motor vehicle based transport.

Following on from that survey, the University provided funding for a study into cycling as a possible way of reducing the impacts of motor vehicle based transport. The aims of the study were to gather baseline data on the journey-to-university of staff and students, determine how the campus might be 'read' as an active travel environment and understand the choices people made to cycle, or not, including the factors that encouraged or impeded cycling and the experiences of the journey.

In the latter instance, the research focused on understanding cycling sub-populations and why some cyclists commuted and others did not. This residential pattern suggests the possibility of developing major cycle transportation corridors in all cardinal directions.

The empirical conclusions out of this Australian survey are that Mawson Lakes Campus has a significant 'Active Travel' base upon which it can build. Public transport has a high share of commuters which might be enhanced through multi-mode (i.e. bike-bus, bike-train) commuting. Cycle commuting currently comprises less than 2% of modal share but student residential patterns, evidence of interest in environmental implications of transport and the physical and emotional benefits and pleasures discussed in focus groups suggest commuting participation can be increased. The study indicates that motivations for cycling are broadly similar amongst commuters and non-commuters but the concerns and issues within each group tended to break down along staff/student lines.

Safety is important for all cyclists contemplating the ride to University but staff and students differed over the importance of affordability, on-campus facilities and the integration of cycling into broader transport networks.

Broadly, focus group findings suggest that addressing en-route safety and multi-modal issues as well as fostering a campus cycling culture through social, contextual and policy-information measures are important elements in enhancing commuter cycling. At present, the physical environment of the Mawson Lakes Campus fails to acknowledge cyclists (Bonham, Koth, 2010, p.p. 95-97).

Moreover, most of the research to date has been limited to comparing private car use and public transport only. No comparisons have been made between these groups and commuters who walk or cycle. From a sustainable transport policy perspective, which aims to persuade people to use their cars less and other modes more often, limited comparisons provide only a partial insight into the reasons that people prefer certain travel modes to others and how they can be persuaded to change their choices.

#### PRACTICAL RECOMMENDATIONS FOR THE SUPPLY SIDE

Based on these empirical researches, it can be recommended the following urban developmental policies in order to help reduce the amount of travelling and increase the share of the less polluting modes of transportation: avoid further urban sprawl, increase a good public transport provision and reduce, or at least refrain from increasing the road and parking capacity.

In cities where there is political willingness to take sustainability challenges seriously the urban planning strategies underlined above could make an important contribution in order to enhance a more actual cyclists demand.

In conclusion, these empirical findings, related to different theoretical perspectives, have implications for sustainable transport policy initiatives that aim to persuade people to abandon their car. While the Netherlands represents a special case, given the near-universal availability of bicycle infrastructure and related high levels of bicycle use, lessons will be drawn for countries that are currently characterized by lower levels of bicycle ridership and a less developed bicycle infrastructure, as the comparison between Utrecht and Milan' cities wants to underline.

### OVERALL CONCLUSION

It can be underlined that there are some common views linking the supply and the demand side perspectives which involve the distance and infrastructural strategies variables of the study. It has been remarked, both from the theoretical and empirical examples, that the infrastructural provisions such as bicycles lanes, walking paths, public transport availability and differentiated lanes for bikes and motor vehicles are the most important keys for improving the demand and the use of bikes and public transports and reduce the cars dependency. This is one of the shared point which link the supply and demand views. More in depth, what concerns in specific the policy makers's effort, is the fact that urban planning and design should follow the direction against the urban sprawl, towards a more compact cities form development. This is related to the second common supply and demand sides perspectives: the distance and the itinerary variables, which in both parts are seen as determinant characteristics affecting travel behavior modal choice.

A part from these shared views there are some specific different points which from the supply side should be very important such as the individual's life styles, perceptions, attitudes and motivations of travels while from the demand side are more important the perceived and lived travel experiences, the practical facilities and design provisions and the personal satisfaction and the safety.

The lesson to be learnt is that the concern of the transportation manager, meantime, is to be able to make operating decisions concerning: facilities and design, services configurations, pricing, advertising and public information, but more important is to understand and realize the demand side needs and expectations.

This is seen as the most successful key to affect the public and bikes' travel demand and their actual use in urban contexts.

### 3. OPERATIONAL MODEL

The number of policy initiatives to promote the use of bike-and-ride, or the combined use of bicycle and public transport for one trip, has grown considerably in the Netherlands over the past decade as part of the search for more sustainable transport solutions (Martens, 2006, p. 326).

One of the purposes of the research is to highlight the Utrecht's bike's solutions as a sustainable way of short travel suitable also for the Milan city's context. This goal will be reached by analysing both number of cyclists and dividing them between the potential and the actual cycles users. The biggest difference between the potential and the actual cyclists numbers will emphasize a lack of transports policies towards the promotion of the bike's use in short trips urban contexts.

Unlike most other European countries cycling in the Netherlands never lost ground completely, as the NATCYP Report 2001 found (Velo Mondial In association with I-ce the Netherlands and OGM Belgium 2001, p. 14). The downward trend of the 1960's and early 1970's in bicycle use stopped as a consequence of growing environmental consciousness and another approach of road safety in the mid 1970's. In the late 1970's first state funded experimental pilot projects were executed with specially designed urban bicycle routes. In the 1970's and 1980's the National government subsidised regional and local authorities for implementing bicycle facilities. An experimental scheme was implemented based on the concept of urban bicycle route network, accompanied with an extensive research programme on the effects of this approach.

The main focus of bicycle oriented policies was road safety. The 2nd Structured Scheme for Traffic (SVV2) and Transport of 1990 had as its main objective to find a balance between accessibility, environment and freedom of choice. For the first time it was recognised that unlimited growth of car use needed to be countered. This resulted, amongst others, in objectives for bicycle use which went beyond road safety problems, and recognised the problem solving potential of cycling. These objectives were elaborated in the Dutch Bicycle Master Plan, which was the first integral and comprehensive strategy for the promotion of bicycle use in the world. The Dutch Bicycle Master Plan Project ran between 1990 and 1997 (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 2).

#### -RESEARCH GOALS

From the urban planning point of view the following research will take into account the compact city perspective referred to the Utrecht urban intermodal transports' choices in comparison with the Milan ones. It will be highlighted that the continuous growth of the average trip length is expected to be the biggest threat for cycling in both cases study. This has to do with urban sprawl, sub-urbanisation and the growing number of commuters which don't live in the city where they have their job. Since 1970 there has been a shift in Europe from the supply to the demand side of transportation. This means that instead of extending the road network, policy became increasingly concerned with the more efficient use of the existing road network. Often, the threads when promoting bicycle use should comprehends the fact that, as a result of the growth of urban areas, the distances to be covered will become longer which will result in the bicycle loosing ground in favour of the car and public transport (Dieleman, Dijst, Spit, 1999, p.p. 609-610).

In the Netherlands, for example, the car is also still the dominant means of transport, therefore, the interests of the cyclist are always weighed up against the interests of the car user. It appears difficult to increase the bicycle share by taking share from the car; an increase in bicycle use is normally at the expense of public transport; immigrants often do not originate from cultures in which bicycling is normal; the road manager considers the large number of bicycles parked by the side of the road undesirable (Gemeente Utrecht, 2008, p. 20).

In the following paragraphs will be analysed in depth the meaning of the different variables, ordered in categories, and the related literature findings by following the operational research order.

#### 3.1 DISTANCES AND ITINERARY VARIABLES

The first conceptual variables are referred to the travel distances so that the compact city planning strategy can help to answer to the subquestion if the distance is affecting the number of the actual bikers in Utrecht and Milan provinces.

As the NATCYP Report underlined (2001), Utrecht, the fourth largest city in the Netherlands, proves that regular cycling can be easy and fully integrated into the transportation choices available to travelers, while the cyclist's of Milan city are less stimulated to use the bike because of the motor-vehicles traffic and the lack of bike's lanes and the urban sprawl.

The NATCYP (National Cycling Policy Benchmarking Program), found that most countries have a big cycling potential with the majority of all trips made shorter than 5 km. The biggest threat to cycling is the continuous growth of the average trip length, as the bicycle is less appropriate for longer distances (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p.p. 17-18). The figures on the potential of cycling strongly suggest that the bicycle can replace short trips by car if suitably supported. This can be linked to the first major variables of this research regarding how the distances and the itinerary, usually less than 20 km, can affect the use of the bike.

### 3.2 MODES OF TRANSPORTS CONNECTED TO EACH OTHER (INTERMODALITY)

Referred to the second important variables, the modes of transports connected to each other, the statistics of the NATCYP found that in the Netherlands the bicycle also has a strong position in relation to the railway system: 30% of all train passengers arrive by bicycle at the station of departure, and 8% leave the destination station by bicycle. However, these percentages have been much higher in the past. The decrease can be explained by the introduction of a free public transport pass for student in the early 1990's, (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 10). These intermodalities of travel can be related to the literature articles of Slotegraaf et al., 1997, concerning the basis of mode choices, related to the motivations and emotional variables that can help to experience better the travel behavior, with more comfort and less traffic stress and delays.

While in Italy only recently the trains have been equipped with some bike's spaces and not many trains stations provide bike's parks (Fiab Ciclobby, Legambiente, in ANPA, 2000, p.3).

As the Connekt's modality choice and availability literature perspective found (1999), having a bus stop in front of the residence, or near the offices and schools, for examples, increase the chance of using the bike to travel to the station instead of using the car.

In the Netherlands the combined use of bicycle and public transports is substantial as it is shown by the Bicycle Master Plan which is a concentrated effort to bring a change in attitude amongst all relevant actors in recognition of the significance of good cycle policies for overall transport policy (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p.11). From the point of view of the Fiab Ciclobby Onlus, the fact that Italy is still much more behind, reflects the reluctance of politicians to take push measures to discourage car use, because the italian cultural attitude is still car oriented.

National cycling policies are on the move in Europe, as can be seen from the NATCYP Report 2001 but, despite this, there are still wide variations of cycling policies in Europe, and the situation is developing quickly. There are countries, which are at a starting stage of development, such as Italy, those who have some achievements, and those who have integrated cycling into the overall transport policy, as the Netherlands (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 3).

### 3.3 TRAVEL MOTIVATIONS AND ATTITUDES (THE DEMAND SIDE)

Another important focal point is the emotional cyclists' perceived experience affected by their motivations and attitudes. People mostly choose to use a bicycle for positive reasons: it's fun, it's healthy exercise, good for the environment, it's fast, it's inexpensive (Fietsverkeer, p. 3-4; Ege & Krag, n.d.; Stinson & Bhat, in: Van Hout Kurt, 2008). Moreover, the physical context of the cycling environment, from spaces available to interactions with other travelers, affects the embodied and emotional content of journeys by bike, as Fincham (2007), Spinney (2007) found.

The travelers' emotional attitudes and experiences variable will be analysed to discover how it can affect, by increasing or decreasing, the actual number of urban cyclists.

Following Karel Martens point of view, that bike-and-ride offers a numbers of environmental and social benefits, the research will analyse how the dutch transport and bike's policies may help to increase the actual number of cyclists and may help to enable car-free lifestyles also in Milan urban context. The above author fundings, of the emotional perceived travel experience perspective, can help to answer to the subquestions related to the main travel motivations that can influence the travelers behavior and their mode choice.

A central role of the demand side is covered by the representatives of cyclists forming specific bikes organisations which understand from the inside the bike users' needs, motivations and attitudes and therefore they help to translate them in practice.

As the NATCYP Report found, a substantial part of the transport policy strategies has to be done by regional and local authorities.

Co-ordination, funding, research, making guidelines and legislation are the main tasks for the national level in all countries (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 3).

In the Italian case most efforts and pushes for a political and cultural shift, is coming from the national Fiab Ciclobby Onlus organisation and from Legambiente (FIAB, 2009, p. 1; Legambiente 2000, p.3-4). The Ciclobby Onlus is the Milan's environmental organisation which promotes the use of the bikes for the everyday urban mobility and leisure time. Moreover, it protects the cyclists' rights and claims the development of a sustainable and safe urban mobility. Ciclobby organisation helps to set targets for a modal shift from car to bicycle, for intermodality options, for cyclists' safety and bicycle parking provision and for well connected lanes. Legambiente is the Italian national more spread environmentalist organisation.

As the SWOV (Institute for Road Safety Research, the Netherlands) states, the best way to know if measures for cyclists will work and serve the needs of cyclists, and if they provoke a good use of facilities and safe behaviour, is to involve representatives of the cyclists in the planning process. In any country, even if there are hardly cyclists on the road, there is an advocacy group for cycling. Cyclists Unions in Europe have a European Cyclist Federation and the ECF organises every two years a Velo City Conference. So there is a lot of exchange of information and experience that may be very helpful for the politicians and planners. Moreover, in cities and regions with less cycling, designers may not be cyclists themselves. The criteria for quality of bicycle facilities have to be implemented according to local circumstances. For this, the cyclists themselves are the best proof of the pudding. They know the characteristics and limitations of cycling regarding pavements, curves, gradients etc. In the Netherlands, the Cyclist Union is represented in advisory committees and platforms on the national and regional levels, while the Italian FIAB (Italian Federation of Bicycles' Friends) and the Ciclobby Onlus, are not represented.

#### 3.4 URBAN TRANSPORTS INFRASTRUCTURAL STRATEGIES AND STATUTE PLANS

An angle to look at the suitability of a country for cycling is the overall presence of dedicated bicycle-infrastructure. From the perspective of transport policies, it has been found that infrastructural bike's provisions are very important: smart traffic timing, dedicated bicycle lanes, roadside enhancements, make it safe for cyclists, and a culture that understands the rules of the road is very important in the attempt to increase the actual cyclists demand (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 10; FIAB, 2009, p.3). Measures to promote the use of the bicycle have met with more varying results. In Netherlands, projects to introduce leasing bicycles for egress trips have failed to attract passengers, for both train and bus services. In contrast, the introduction of flexible rental bicycles at train stations has resulted in a small reduction in car use, growth in train trips, and growth in bicycle use for non-recurrent trips (Karel Martens, 2006, p. 326).

As the Illinois' case of the Complete Street showed and the simple stated preference studies, like the one of Portland by Jennifer Dill, (2008), usually find that people prefer to use the bike if there are paths and lanes. It has been indicated that having such infrastructure would encourage them to bicycle more (American City&County Journal, 2008).

The transports infrastructural strategies is an important variable of the research, as it is one of the main planning goals to increase the actual number of cyclists in Utrecht and Milan urban contexts. This variable will be linked comprehensively to the national and local transport policies and statute plans of both cities. As the conceptual model scheme shows, all the variables are linked and connected together, so that the infrastructural strategies variable is also linked to the travel motivations and attitudes, the itinerary variable, etc.

Most countries have guidelines for planning and designing of bicycle infrastructure and for traffic calming as the National Cycling Policy Benchmarking Report (2001), reported.

While these guidelines may have no legal power, they are influential (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p.3).

From the point of view of travel behavior and safety the National Cycling Policy Benchmarking reported that the risk to be killed per km cycling per country, tends to be inversely proportional to the level of bicycle use (Velo Mondial In association with I-ce the Netherlands and OGM Belgium 2001, p. 3). This can be a good campaign in order to promote and encourage the use of the bike.

From the transports policy incentives aspect, to show that cycling needs investments, and that car use in cities has to be reduced, cities may use taxes from car drivers for investments in bicycle facilities. For example the city of Utrecht in the Netherlands is investing money they receive from car parking fees, into bicycle parking facilities (Dutch Ministry of Transport, Public Works and Water Management Directorate-General for Passenger Transport, 2009). Moreover, in the Netherlands there is a distinction between the ways in which travel costs for different travel modes can be deducted from the income tax: more deduction is possible for the use of public transport; motorists and cyclists are treated in the same way. The indirect tax incentive mentioned is trying to do at least something to give cycling an advantage (Velo Mondial In association with I-ce the Netherlands and OGM Belgium, 2001, p. 14). This incentive can help to enhance the actual number of cyclists as the system of pricing the roads and car parking can reduce strongly the number of car drivers. Italy should take into account this strategic system, above all regarding the inner cities. Milan's municipality has already a motor-vehicles and cars' pricing system, called "Ecopass", which is based on the fact that the old vehicles registered before the year 2000 have to pay to enter in the inner part of the city, while the new vehicles do not have to pay (Milan Ecopass City Council). This strategy didn't succeed in reducing the number of vehicles in the city because the price is relatively low, 5 euro of all day, neither it succeeded in the quantity of air pollutants as the ARPA, (the Regional Agency for the Environment Protection) air analysis reported, (Repubblica of Milan journal , article 23 february 2009).

From the demand side perspective, Balcombe (2004) and Stradling (2000), suggest that one of the factors that contribute to public transport quality is travel information, the knowledge-based information is considered to be the most effective way to change attitudes, even if it doesn't work always (Balcombe et al., Stradling et al., in: Grotenhuis, Wiegman, Rietveld, 2006, p. 1). Although research outcomes vary about the extent to which travel information influences modal change, it is obvious that information would have most potential to affect customers' behaviour if multimodal data were integrated (Egeler, Kenyon and Lyons, in: Grotenhuis, Wiegman, Rietveld, 2006, p. 1). This aspect will be kept under great consideration as it can affect the bike's users travel choice motivation, the second most important variable.

### 3.5 THE OPERATIONAL PROCESS

The most important variables in enhancing the actual number of cyclists and bring it close to the potential one, are the personal attitudes and motivations that good strategic urban and transports policies can influence towards the cycling choice.

The Netherland's example, and in particular the Utrecht city context, will be reported and analysed as it strengthens the sustained cycle tradition in which cycling is an ordinary mode of transport, and it is expertise in designing dedicated bicycle infrastructure.

The research perspective follows the idea that while 'bottom up' planning is necessary, a 'top down' approach to policy-making (including targets, funding and coordination etc.) is also required if there is to be significant and sustained progress for cycling. For this reason, the demand side of transport and bike's related policies, with both national and local cyclists' organisations programs and efforts, are taken into great account. Moreover, the research supports the Karel Martens' perspective that the Dutch experiences suggest some lessons for promoting bike-and-ride in countries and cities with a less well-developed bicycle infrastructure (Martens, 2006, p. 326).

## **THE RESEARCH OPERATIONAL SCHEME**

### **THE DEMAND&SUPPLY SIDES INDICATORS:**

- 1) DISTANCES AND ITINERARIES (VARIABLES)
- 2) MODES OF TRANSPORTS CONNECTED TO EACH OTHER (VARIABLES)

### **THE DEMAND SIDE INDICATOR:**

- 3) TRAVEL MOTIVATIONS AND ATTITUDES (VARIABLES)

### **THE SUPPLY SIDE:**

- 4) URBAN TRANSPORTS INFRASTRUCTURAL STRATEGIES AND STATUTE PLANS (VARIABLES)

As it has been said before, it is important to understand the different views and perspectives of both demand and supply sides because the research belief is that each single variables should involve the two points of view and find a consensus. It is important that both perspectives make an effort to find shared solutions in order to translate them into overall pro-bikes solutions and enhancing the actual bike use.

As the research operational scheme shows, the variables are categorised in order from the expected more influential ones.

The variables categorical order reflects the fact that the research takes into account principally the demand side perspectives, the bike's users and public transports customers: their needs requests, points of view and their motivational choices. For this reason the distances and the itinerary are in the first position, followed by the travel motivations and attitudes.

Firstly the distance and modes of transports utilized (interconnected) variable and its subquestions will be find by taking into account the related literature and the data of Utrecht and Milan contexts. Distance (and strongly correlated trip time) is expected to be the most determinant variable of bicycle use as Van Hout Kurt argued (2008).

In general bicycle use highest in the range up to about 5 km (except for very short distances where walking takes over). Bicycle use decreases sharply when the trip distance increases above 5 km. Nevertheless some bicycle trips are much longer. The average length of a bicycle trip is 2 km (Hydén et al., in: Van Hout Kurt, 2008, p. 15). In Denmark and in the Netherlands the bicycle trips are longer than in other European countries. The willingness to cycle over longer distances differs between countries with good amenities and a flat topography (Denmark and the Netherlands) and other countries. However, in general, people do not use a bike for transport on distances longer than 3-5 km (Van Hout Kurt, 2008, p. 25). These topics will be than linked to the second variables category: the travel motivations and attitudes. These variables also part of the demand side perspective which should mostly influence the policy makers, planners and transports managers side perspectives. The motivations and attitudes variables will be referred to the literature articles of Stinson and Bhat (2004), who suggest that, like other modes of commuting, bicycle use for commuting is also habit forming. Alternatively, it may be that comfort in bicycle commuting comes from experience (Stinson and Bhat, in: Van Hout Kurt, 2008, p. 22).

The last variables, referred to the urban transport and strategies and statute bikes plans, are expected to be influenced by the demand side but, also, are expected to affect the travelers and their behavior.

### 3.6 METHODOLOGY FOR ASSESSING MILAN'S POTENTIAL DEMAND AND DISCOVER THE ACTUAL ONE COMPARED TO UTRECHT'S ONES

The quantitative analysis here is finalized to answer to a series of matters of policies and planning perspectives in order to discover which of these variables can mostly enhance the actual number of cyclists in Milan urban centre.

In the first ones the verification of the correct identification of the carrying net of Milan bike plan is taken into account: it deals particularly with the understanding if such net, essentially individualized with topological criterions succeed in covering the most important arteries of application, according to layouts the more possible coherent with these last.

In the seconds it is estimated the cycling demand that is reasonable to hypothesize to conquer with the realization of the plan.

The net Mibike is destined in fact to satisfy the moves that develop in the short ray to staircase the local, in the conviction that such typology of relationships, rarely considered in the politics of the local corporate body, potentially represent in effects a component of meaningful demand.

Moreover it is necessary to understand if the dimensions of this segment of demand were such to, specifically, justify a politics revolution that leads to the transfer of it on the cyclists mode and which are the correct dimensions of the resources to hock in such politics.

A third matter concerns then the individualisation of a staircase of a necessary intervention priority with the purpose to direct the activities of the plan. These should focus on the purpose to maximize the effectiveness of the expense, on the realization of the corridors to great demand.

The potential demand will be assessed on the base of the contained information in the matrix origin/destination estimateed from the Province of Milan and Ciclobby Census data.

From such matrix are drawn out the above-local trips of the province of Milan on distances lower than the 15 km with the following ways of transport: bike, bike + interchange with railroad / subway, transport local (TPL) public, TPL + interchange with railroad / subway, auto or motion, auto or motion + interchange with railroad / subway.

It has to be underlined that it is referred on daily moves of a single run. The general number of daily trips is therefore double of that of the moves.

The potential resulting demand is only a part of the use that currently uses the mechanized ways. Such numerical part must be made to vary on the distance variable of the move, for keep into account the decreasing use of the bicycle with the distance.

Operationally the hypothesis-objective is assumed to attract to the use of the bicycle to a demand percentage comparable to the one of the more advanced European contexts under the aspect of the cycling travel behavior.

Such percentage has been set equal to 20%, it is characteristic of the reality that introduces a good use of the bicycle, even if broadly lower than the existing (30-35%) most elevated values.

A new "function of cut" of the total demand is, therefore, calibrated, in such way to obtain a modal division assumed as objective, to maintain constant, for the different classes of distance, the relationships between the indeed found demand and the esteemed one. The adopted functional form is that of an exponential inverse, it is precisely:

$$T = a / (1 + e^{(B \cdot \text{dist} + y)})$$

Where: T= potential users a. B (= parameters of the balancing of the curve, respectively places equal to 0,55, 0,23, -0,4. Dist= moves distance.

To the obtained function it has to be imposed a cut in order to eliminate the moves superior of 15 km.

The esteemed demand has been assigned to the Mibike net, formalized in a directed integrated graph with the necessary connections with the 409 points of generation/attraction of the regional matrix moves, that are the 212 municipalities and the 197 railway stations to which are attributed the intermodal change travels.

In the following chapters the transports policies and the specific bicycle's plans, of Utrecht and Milan municipalities will be analysed more in depth.



*Fig 2: Italian bike road sign.*



*Fig 3: Italian road sign of no cycling.*



