Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia - Social and Behavioral Sciences 53 (2012) 84 – 95

Procedia
Social and Behavioral Sciences

SIIV - 5th International Congress - Sustainability of Road Infrastructures

The Interaction between Land Use and Transport Planning: a Methodological Issue

Colonna P.[a]*, Berloco N.[a], Circella G.[b]

[a]*Polytechnic University of Bari,Via Orabona 4, 70124 Bari, Ital*
[b]*University of California, Davis One Shields Avenue Davis, CA 95616, U.S.A*

Abstract

The interaction between Land Use and Transport Planning is not an issue clear and scientifically solved, probably due to the nature of the interactions or more likely for the methods used to analyze this topic. The paper aims to introduce an innovative proposal using a deductive approach in order to better understand the origin of modern land use policies and to optimize their future development. The matter involves many subjects and it needs the point of view of many cultural approaches. For this reason, the authors cannot claim to have fully answered the question but want to offer a useful contribution to the debate on this topic.

Keywords: land use; transport planning; functionalist approach; personalist approach

1. Introduction

This paper discusses an issue long debated by experts and that is at the core of the evaluation of the impact of many policies and projects in planning: the interaction between Land Use and Transport Planning. Today, despite the relevant quantity of papers produced, many different opinions remain about the dominant nature of these interactions [1], [2], thus suggesting the hypothesis that at the basis of this variety of opinions there might be an inconsistency in the methods used to analyze this topic.

This paper attempts to verify this hypothesis, starting from deductive evidence that has emerged in recent years, taking into account some fundamental concepts that today seem to be evolving and considering the different possible methods to deal with this topic. An innovative method is proposed using a deductive approach

* Corresponding author. Tel.: +39 080 5963388; fax: +39 080 5963329.
E-mail address: colonna@poliba.it

 doi:10.1016/j.sbspro.2012.09.862

and its consequences are discussed. This method could be useful to better understand the origin of modern land use policies such as Smart Growth, New Urbanism and Access Management and to optimize their future development.

The matter is indeed rather complex and interdisciplinary. It involves many subjects and it needs the point of view of many cultural approaches. For this reason, the authors cannot claim to have fully answered the question. However, our aim is to offer a useful contribution to the debate on this topic in the scientific and planning community. Some of the intuitions contained in this paper are the results of the continuous process of analysis of previous studies carried out by the authors, the investigation of empirical data, and the efforts to map this difficult and still somewhat unexplored scientific context. Some of these ideas are largely explorative and not yet scientifically or empirically proved, but they are reasonable within a not yet confuted hypothesis. The hope is to inspire further theoretical developments, new data and multidisciplinary contributions in this field, and to contribute to define the whole subject in a more comprehensive way.

2. Background and base concepts

In short-term transportation planning and engineering problems, the physical shape of the land use (the built environment) is usually considered a constant exogenous input. However, when the time horizon of policy and project evaluation is extended to the mid- to long-term (as it is common for large infrastructure projects and plans that are designed to meet long term goals over several years or even decades), the built environment cannot be considered a constant anymore.

In reality, the built environment changes continuously, as the result of step-by-step gradual modifications introduced in the land use system. Under these conditions, land use planning becomes a process that needs to deal with the dynamism of the land use system, while accounting for any boundary constraints and depending on the chosen aims in planning.

At the same time, transport systems are themselves dynamic systems in continuous evolution, as a result of the interactions between transport demand and supply. Besides, transport systems provide connectivity through the regional systems and evolve depending on the land use patterns. As a result, “transport planning” is a process that provides consistency over time between users’ needs (transport demand) and opportunities for transport investments (transport supply) and consistency between the evolution of land use and mobility patterns.

Given this basis, land use planning and transport planning are two processes that influence each other and therefore must be coordinated [1], [3]. Besides, the final aim of either one of these processes is to answer the needs of human beings, i.e. the final users. Every action that we make while we plan land use and/or transport services have some effects, to a greater or lesser extent, on people’s habits, behaviour and eventually on their culture and identity.

In the case of transport, the possibility to affect/modify the individuals’ habits and culture is more obvious. The act itself of traveling makes individuals get in contact with different places marked by different characteristics and with other individuals (with potentially very different background, habits and values). After any journey, the greater the cultural distance to the place visited, the higher is the cultural gain for the traveller..

In a similar way, new opportunities are nowadays offered by new Information and Communication Technologies (ICTs) and particularly by internet solutions that can contribute to modifying culture and values, through virtual and not necessarily physical movements. From this perspective, transport promotes homogenization, exactly as it happens in the physical world through physical trips and migrations.†

---

† If we have two boxes containing air at different pressures and we connect them, some particles of air from the higher pressure box will move quickly towards the second box until the pressure is the same in all parts of the two boxes (and it is equal to an intermediate level between the two initial values). In this case the particles undergo changes only in their external characteristics (pressure). We can imagine many others examples of blends in our daily life caused by movement: the particles also undergo changes in their outward appearance without

In a similar way, it is possible to rank three different kinds of homogenization produced by physical transport and by new technological solutions:

- *virtual homogenization*: the subjects undergo changes to some characteristics (way of speaking, way of thinking, fashion, wishes and desires, etc.) but they do not change their habits immediately;
- *physical homogenization*: the subjects also undergo changes in their habits, particularly when in contact with other subjects characterized by another identity (homogenization of first generation).
- *structural homogenization*: the subjects develop new habits, derived from those of the subjects that have had the first contact (homogenization of successive generations).

The three kinds of homogenization are generally subsequent, but the speed of change can be very different, depending on many factors.

Some factors tend to oppose or delay homogenization. One of the most important among them is safeguarding diversity and therefore safeguarding different identities. In this sense, diversity can be considered both horizontal (and/or geographical), i.e. between people from different places and backgrounds, and vertical (and/or temporal), i.e. between people who have different interests, culture, habits, etc. (and eventually across generations), although living in the same place. In this context, transport infrastructures and their organization have a very important role in the process of homogenization, as a catalyst of change, accelerating the natural process that derives from the contact among human beings.

3. Concepts in progress

In this extremely dynamic context, there are some concepts that seem to be evolving. Even the meaning of some words seems to be inadequate to the new situations that emerge and therefore needs to be redefined according to the modern conditions. The first concept that requires some attention is development. For many years until the end of the 20th century, "development" has been traditionally merely associated with "economic development" [4]. Therefore development was only measured in terms of GDP (Gross Domestic Product) and GDPpc (Gross Domestic Product per capita). This approach mainly focused on the aim of economic growth, while it ignored several elements essential for human life.

In the 1980s and 1990s, Amartya Sen, economist and recipient of the Nobel Prize in 1998, explained that development satisfying human beings has to be a balanced mixture where economic benefits, quality of life and freedom progress at the same pace [5], [6], [7]. Sen's concept of development highlights the need for a multidisciplinary approach to understand the aims of transport planning and lead transport studies and policy evaluations to include humanistic, cultural and social sectors, seldom investigated until then [8], [9], [10], [11]. According to this approach, GDP measure will not suffice for measuring development in the future. Indicators able to assess social, cultural and environmental welfare should also be accounted for. This more comprehensive framework for the assessment of human development is less dependent on the concept of economic growth, and it requires additional evaluation for the equality with which different human beings access services, goods and satisfy their needs. In this perspective, safeguarding identities and cultural diversity can be certainly considered an aspect of quality of life and therefore must be taken into account.

Another concept that must be revised is that of sustainability. A generally accepted definition of sustainability is "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [12]. This definition, which has important consequences on planning processes, is based on the analysis of "the needs of the present" without specifying what they are. Therefore, the problem of verifying that a process respects the sustainability criteria is often reduced to the problem of verifying the equilibrium of the development process over time. This means that verification only involves present and future

losing their identity (e.g. water and oil) or in their internal status (e.g. solution between milk and sugar). Something similar happens with traveling, migrations and cultural exchanges.

generations directly affected by the process itself. So the question becomes: what are the temporal dimensions and limits of the system that are significantly affected by the process? Should some spatial limits also be considered? The answer to this question is very difficult to assess [13]. Moreover, it is very somewhat tempting to consider specific dimensions in the evaluation of the system, excluding horizontal and vertical diversity, because it is very difficult to take into account the influence of these types of diversity and their values in different places and times. The hypothesis that such diversities are negligible and do not modify the sustainability assessment are often an easy and more convenient way to ignore the problem. This hypothesis might have been somehow acceptable some years ago, when the effects of homogenization across individuals and societies and the pressure of human settlements on the environment were lighter. Today, with the described processes of homogenization underway and the need to safeguard single identities and cultural diversity being one of the only chances to preserve these values in the future and avoid their extinction, this hypothesis is no longer acceptable.

The issue is even more complicated, because considering diversity means considering cultures: we are all aware that it is almost impossible to quantify the importance, or the weight, of several cultural traits in order to make an assessment of human development. In any case it is evident that the concept of sustainability cannot be restricted to the fourth dimension (time), but must be enlarged to all four dimensions (three in space and the fourth for time), considering all horizontal and vertical diversities in space and all the values and needs of all cultures potentially affected by the process of change at present and in future years.

4. Methods to investigate the research question

Some of the main questions that arise from the analysis of the interactions between land use and transport planning are: what limits (boundaries) of the system should we consider in the analysis (for both space and time)? Moreover, what are the weights that should be assigned to the values of cultural diversity in the analysis of planning processes and policies? Are there other variables relevant to the topic that cannot be easily measured through a numeric value or through the use of predefined categories? These questions can be answered through the use of different methods, either consciously or not. In practice the three methods that are most frequently adopted are:

- The functionalist approach, based on the idea that transport and its infrastructures are only a tool to achieve a goal, supposing that transport is only a derived activity, i.e. a function of another primary need.
- The environmentalist approach, based on the idea that human beings are in conflict with the environment, that the environment should have priority and that therefore transport and its infrastructures, being one of the main causes of pollution, should be minimised, absolutely limited and opposed in all possible ways.
- The personalist approach, that searches for an equilibrium among human beings and the environment, with the target of achieving forms of development that provide higher answers to all human needs in a balanced way, while not sacrificing the environment. In this approach transport and its infrastructure are not only a tool, but also the direct possibility to satisfy a real human need. As such, they can be used in conjunction with other policies (land use) to shape forms of communities that are naturally inclined to satisfy the needs of the individuals without depleting the amount of natural resources and cultural diversity, but if possible increasing the amount of these stocks.

In this paper the (strictly) environmentalist approach will not be considered, because it seems to the authors to be an utopistic distortion of reality, which even if somewhat fascinating would imply a contraposition between the environment and the human beings. Such an approach, which is useful to inspire other studies and support the development of analysis for the mitigation of the environmental impacts of human activities, have no practical

sense per se, as it does not correspond to the elementary needs of the human nature and it would demand enormous sacrifices for the entire human society that we believe nobody is ready to bear‡.

We will therefore focus on the discussion of the functionalist and the personalist approaches. In any case it is important to state that the system we are studying is not only a physical system, but rather a complex system, physical and social, which is critically affected by the decisions that each human being makes. In such an organic "living" system perhaps it is not correct to speak of equilibrium states, in which opposing forces are balanced. Rather, we prefer to refer to the concept of homeostasis, a state which is changing and moving constantly but which is "at rest" in terms of its fundamentals [15].

5. The functionalist approach

The functionalist approach considers transport and its infrastructures as a tool to reach a goal in the organization of the community, under the assumption that transport is only a derived activity [1], subordinated to another primary need. The consequence of this perspective is that transport is always a cost and therefore the aim of transport planning is to satisfy primary needs (benefits) with the minimum quantity of transport (cost minimization). With this approach, we can start by classifying the different kinds of movement that contribute to total transport, ranking them with regard to their economic importance and then searching for a model able to maximize the cost-benefit analysis (CBA) and therefore able to reduce total transport costs (assuming that this scenario will correspond to the maximum benefits for the individuals). Therefore it could be possible to optimize travel activities for the most important activities, from the point of view of economic efficiency, reducing traveling for the least important, and therefore unnecessary, activities. Nevertheless over the years this functionalist approach, practically the only one used until 1980 to design transport studies, infrastructure projects and transport plans, has proved to have several limits.

- The first limit emerged at the time when it was clear that all decisions related to transport have consequences on the environment and therefore it was also necessary to consider environmental aspects in the model, besides the cost and benefits for the human being. However, how is it possible to account for environmental costs and benefits? Or, better, how can we give different monetary values to different environmental scenarios?
- To overcome this limit the functionalist approach is forced to include issues that cannot only be controlled by economic tools in the model (an economic model finalized to a CBA, with additional considerations on non-quantitative dimensions). This means that it is necessary to accept an error "a priori" (due to the unobserved variables and non-quantifiable dimensions), often without the possibility of even knowing the order of size of the error.
- The second limit, very much linked to the first one but slightly broader, emerged when it became clear that not only the environment but also many other sectors, not directly linked to transport, could be significantly influenced by a transport-related decision. Therefore, how can we account for all these externalities (either positive or negative)?
- The method to deal with the second limit is the same as the first, but in this case the uncertainty, and magnitude, of the errors (and therefore of the results of the analysis) becomes inevitably higher.
- The third limit is directly connected to the most recent idea of development, as described in the previous section, and therefore defined not only in terms of economic growth, but rather as the fulfilment of all the needs of human beings in a balanced way.

---

‡ In fact the 1992 UN Conference on Environment and Development (the Rio Conference) pinpointed several strategic policy needs and resulted in Agenda 21 which claims "Human beings are at the center of concern for sustainable development. They are entitled to a healthy and productive life in harmony with nature" [14].

- To overcome this third limit we must be sure, in evaluating the costs and benefits of the proposed projects and policies, to consider all human needs, in the most comprehensive possible way. This intention is also rather difficult to apply, because of the difficulty of assessing the importance of the different needs (and therefore the weights to assign to them in the cost-benefit analysis) and their differences across various cultures and contexts. Besides, there are many needs that are very difficult to evaluate in a numerical/quantitative way, through a specific financial value associated with their fulfillment.
- The fourth limit regards the concept of sustainability that, as shown in the previous section, is linked to both horizontal and vertical diversities and possible ensuing exclusions [16]. In fact the equilibrium of cost-benefit analysis is partial because of the difficulties not only to isolate the markets but also to remove them from real-world factors such as human politics, social institutions, and physical space.

To understand these concepts, we can consider a hypothetical, but realistic situation: a regional or state planning agency that is responsible for making a decision about a particular proposed highway corridor project. There is a neighbouring state/region that could be significantly affected by the project. The agency should therefore consider the design of the project and adjust its design and specifications according to whether the project passes the cost-benefit test. We can identify a number of potential pitfalls that the agency could fall into when it conducts its analysis. First, will the agency be able to consider all the relevant economic impacts of the project? And, a closely related question, will the agency be able to consider all the parties relevant to those impacts? This agency, whose responsibility includes only its single region/state can potentially make two mistakes. One mistake can be referred to as horizontal exclusion: this refers to a situation where the agency ignores relevant decision-makers and affected parties in the adjacent territory outside its political jurisdiction. The other mistake can be referred to as vertical exclusion, and this refers to the single agency ignoring relevant decision-makers and affected parties 'below' (and conceivably 'above') its relevant jurisdiction (or perceived brief) as an agency. These concepts parallel those of horizontal equity (all people in the same stratum treated equally) and vertical equity (all people across all strata treated appropriately with respect to the relative border), except we can say that we are referring to horizontal and vertical efficiency in this case.

These questions are critically important and can be especially prone to occur when there are close but politically separate neighbours and when formal political institutions are prone to change over time. Thus political leaders can and do change and in some cases even political, and certainly jurisdictional, borders may shift. The question is of greater importance if there is an interaction caused by technological, economic or political reasons. In all of these cases it is evident that there might exist competitors able to influence decisions made by this agency, and the biases of those competitors may lead traditional CBA to fail. Putting it in economic terms once more, the potential for 'strategic' behaviour is quite high and traditional CBA tends to ignore the influence of such behaviour. In any case the question of the fourth limit seems still far from being overcome, even if some theoretical attempts are now beginning while no practical application is yet known [16]. However the third and the fourth issues (development and sustainability) together highlight that it is impossible to consider development without taking account of the equilibrium (both horizontal and vertical) and that more importantly this equilibrium must be considered dynamically over time (sustainability).

In this sense we can state that if we desire development, we must favour equilibrium, but without reaching it, to avoid the risk of total homogenization. The process will probably continue step by step, but it will happen dynamically, because the conditions will change with time and every time the new optimum equilibrium will be different from the previous one.

So in the future the real question will be: what is the optimum limit for development? How wide (horizontal) and how deep (vertical) can it be without damaging the overall system in its complexity? It is evident that it will be very difficult to answer these questions. For example, a first attempt could be made by verifying whether the ideas of Kuznets on equity could also be applied to the new concept of development. Kuznets [17] found that to enhance general equity it is necessary to pass through a previous phase of higher inequity, accepting that many

new resources can be assumed initially only by a few people and waiting subsequently for a fairer redistribution over time, when greater economic development will be effectively achieved for all people. Some researchers have tried to verify whether the theory of Kuznets could also be valid for some environmental resources [18], [19], [20] and the results, even if with many doubts, have not excluded it. Therefore we can reasonably hope that in the future new research will verify whether the theory of Kuznets could be applicable to the overall concept of development too, with the aim of finding the rules by which development itself can be distributed more fairly.

6. The personalist approach

For a long period, transport has been considered only as a derived need, i.e. linked to the necessity of satisfying other primary needs. Commuting trips to/from work and freight transport for commercial reasons are typical examples. But, in recent years, many studies have asserted that mobility is also a response to a primary human need. Many indications, coming directly from experience, seem to confirm this supposition. First of all, TTB (Travel Time Budget) or better, TTE (Travel Time Expenditure) constancy [21], [22], even if at an aggregated level, seems clearly to point out that a desired value greater than zero exists (equal to approximately 1.1 hours/day) for the time dedicated to mobility during the day [23]. This is known as the Brever law [1]. Surely, a part of this time has to be interpreted as the physiological response to the typical need for maintenance of a moving human being (i.e. search for food, or, in an advanced way, commuting). But, human beings seem to show a need for travel even when they do not have other needs [21].

The existence of a part of mobility not linked to any derived transport need is confirmed by many indications coming from experience and from human and cultural traditions [11]. Experience teaches us that, in every era, the most "natural" restriction to human beings is prison, as the most evident characteristic is a real restriction of mobility. As a consequence, for every free man, mobility is one of the first freedoms that a civil society has to guarantee, in order to satisfy this evident primary human need§. On the other hand, the pleasure of a walk in the "old town" of a city, or the pleasure of reaching a shelter on a mountain trail are only some of the simplest examples pointing out the primary nature of this need. But, why do human beings have this inevitable need for mobility? Evidently, the answer to this question is not simple, but experience helps us considering that one possible interpretation is the search that every man has for the meaning of the world and of himself (on top of the need for variety and entertainment). Some examples can be useful, going from prehistory till nowadays [9].

In a famous movie (The Truman Show, 2000) the main character has been confined since his birth, without him knowing it, in a television set, built intentionally and representing a small town. All the other actors play their roles in this virtual world, whereas the main character lives in this colossal Candid Camera, where he is surrounded with every care and he does not lack anything. He becomes aware of the deceit when someone inexplicably rejects his desire for a journey. At this point, the character realizes that his need to know the external world is stronger than the certainty of the welfare that he receives from the virtual world where he lives. He prefers to face up to the unknown hidden behind the true life meaning, leaving the television set for ever.

Back to the traveling literature, Mokhtarian and Salomon [21] stated that sometimes the desire for mobility can be the cause of travel, and travel can be considered an activity on its own. In this case the destination is ancillary and this kind of travel can be called "undirect travel". So the positive reasons for travel are not only the activities conducted at the destination (the conventional, "derived demand" component), but also the activities conducted while travelling (listening to music, talking to companions, using a mobile phone or laptop, reading, sleeping, contemplating) and, last but not least, the activity of travelling itself.

Every example described above converges with the theory that mobility is the concrete expression of an innate human need, probably corresponding to the expectation of newness, the desire for knowledge as well as the

---

§ Note that, to limit the restriction to the prisoner, he is generally allowed to benefit from one hour of mobility per day, according with the Brever law.

search for the meaning of everything and of the existence itself. As a consequence, no evaluation involving mobility can exclude this consideration. Therefore, the opinion that enhancing transport infrastructures is always against sustainability is somehow contrasted by the evidence that mobility is also a native human need, which needs to be satisfied, even if in the way that is possibly most neutral for the environment. Similarly, according to a dominant idea, the land use is often identified with the use of the built environment, while transport planning is identified with the planning of transport services, so forgetting the transport infrastructures that are considered only as a consequence of the process of interaction. According to the personalist approach, transport infrastructures are not only a tool at the disposal of a function, but rather an opportunity to satisfy some native needs. Therefore, if they have been designed with this goal, they can be considered as a positive sign of the presence of human beings in the natural environment.

7. Consequences

The previous parts of the paper have led us to these important statements:

- Transport infrastructures must favour the equilibrium states corresponding to true sustainability, for all human beings, at present and in the future.
- The functionalist approach, based on the idea that transport and its infrastructures are only a tool, can easily lead to some mistakes if planners try to fit solutions for Transport Planning to Land Use and vice versa.
- The personalist approach, which starts from the idea that transport and its infrastructure are not only a tool, leads to the statement that mobility is the concrete expression of a native human need.

However, if this is the lesson learned, how can we apply the personalist approach to the relationships between land use and transport planning without making the same mistakes of the functionalist approach? The question is not easy to answer and it will probably take a long time to be investigated in details, but at the moment it is possible to try to express some remarks derived from experience, reason and commonsense.

First of all, the personalist approach allows us to acknowledge that two kinds of mobility can be identified: derived mobility, depending only on another primary need, and "non-derived" mobility, that we can call simply "native" mobility, because it exists per se and corresponds to the original nature of the human being**. In most cases, "derived" mobility is easily associated with motorized mobility. The requirement for "native" mobility can be satisfied with several modes of transport and the majority of them correspond to non-motorized mobility. In this sense we can state that, generally, native mobility is a positive form of mobility, from the point of view of sustainability while, on the contrary, derived mobility is generally a negative form of mobility. Moreover, as already mentioned in the previous section, another important consideration derives from the hypothesis that travel time (time dedicated to any kind of mobility) during the day remains constant (at approximately 1.1 hours/day), even if at an aggregated level. Thus, if the Desired Mobility (DM) is nearly constant, and it is supposedly impossible to reduce, it could be possible to change the proportion between these two components, respectively the "derived" (d or D, with d<D) and the "native" (n or N, with n<N).

In our example, let's define the current situation as simply represented as:

$$DM = n + D \quad (1)$$

and the future objective as

** In reality all mobility is generally "native" mobility and consists of "derived" and "non derived" mobility, but we prefer only to call the "non derived" mobility"native" in order to emphasize with more efficacy the different nature of "derived" and "non derived".

$$DM = N + d \quad (2)$$

with DM constant.

If we need transport infrastructures to favour increased sustainability, we must tend to reduce the impact of transportation of derived mobility and, to do it, we must enhance the quantity, for everyone, of native mobility. To reach this goal we have two main complementary tools:

1. To promote positive native human mobility.

- To disseminate the culture and knowledge of positive native human mobility.
- To control the shapes of the neighbourhood.
- To control the position and the spread of services.
- To favour non-motorized transport networks (pedestrian and cycle).
- To enhance the aesthetics of paths.
- To enhance the human and social levels of paths, favouring opportunities to meet, talk, shop, etc.
- To improve walkway connectivity;
- To improve traffic calming tools.

2. To manage the demand for derived mobility.

- To disseminate the culture and knowledge of mobility management.
- To contrast car use.
- To have a good parking policy.
- To favour the integration of transport infrastructures.
- To favour the integration of public transport.
- To favour the comfort of public transport.
- To favour e-commuting and e-services.
- To rationalize the logistics for the transport of goods.
- To favour the transport of goods by more sustainable transport modes.
- To increase land use mix (housing, commercial, institutional).
- To increase density (people or jobs per unit of land area) and centeredness.
- To improve roadway connectivity.
- To reduce public subsidies for high speed transportation and unnecessary products, results of long-distance freight transport activities.

Many of the tools described above are becoming part of standard planning practice, as part of policies and plans to reduce the use of private vehicles, bring destination closer to residences, and make alternative non-motorized transport modes more appealing. This is one of the prominent goals of the smart growth movement, which calls for the implementation of transit-oriented development among other forms of integrated urban and transportation planning [24], [25], [26]. Land use policies that bring residents closer to destinations and provide alternatives to driving may lead people to drive less [27], [28], thereby reducing fuel consumption and emissions of pollutants and greenhouse gases. Smart growth strategies can contribute to more sustainable forms of urban and suburban development that decrease the environmental externalities of human settlements [29], [30], while decreasing travel time and the dependence on private vehicles for commuting trips (derived demand, d vs. D, in this discussion).

This topics has become even more relevant in the current planning debate, following the stringent measures to reduce greenhouse gas (GHG) emissions through innovative land use plans and transportation projects, that are

now required by modern legislations, as in the case of the Sustainable Communities Strategies (SCSs) introduced by the California Senate Bill 375, as mandatory tools with which state agencies and local governments are required to address planning processes to achieve these environmental goals.

Another important topic to deal with this problem is the availability of improved modelling tools that are able to study modifications in travel behaviour and evaluate policies addressed to achieve the goals of the personalist approach. In this field, the use of advanced activity-based models for travel demand is a natural choice, as these models are able to deal with the most realistic forecasts for travel behaviour and ensure consistency with the development of land use, and their predictions through land use models. In fact both models have a mutual core component that corresponds to the activity simulation for each household and person [31]. Additional studies and analysis should also investigate the impact of personal attitudes and preferences on these choices and on the reaction that users have to the TDM measures and smart growth policies that are implemented.

The concepts expressed until now are closely linked to a new approach regarding the optimal social speed of transport and, more broadly, the speed of urban life [32], [33]. Promoting non-motorized mobility, increasing urban density, implementing concrete policies of Mobility Management and Traffic Calming are tools that necessarily have to converge on a new analysis of speed [33]. Transport modes used for urban mobility generally have a power and performance disproportionate to the actual speed of travel, because of the intrinsic characteristics of the urban areas, the effects of congestion and the simultaneous presence of different transport modes. The concepts of development, sustainability and environmental impact would push us to choose transport modes and infrastructures because of the travel distance (and therefore on the basis of a reasonable travel time) and because of the motivation for the journey. Furthermore, both vertical and horizontal equilibrium would be facilitated and at the same time the identity of the individual user would be guaranteed. In this situation, land use and transport planning play a crucial role in the way that the choice would be "free" and at the same time socially acceptable. At the same time, socially useful choices made by the individual user can only be governed by a specific and targeted control strategy until the user becomes a "social user" [34]. Therefore, the method to achieve the best results in land use management and transport planning is to optimize modern land use policies considering the desired mobility and the optimal social speed. In other words, urban areas should be designed and managed and, at the same time, mobility should be planned and programmed by promoting “native” mobility and considering the daily Travel Time Budget. The method could use the advanced activity-based models applied to homogeneous groups of people that live in the same built environment and that share the same mobility needs throughout the course of the whole day, not only for single journeys between an origin and a destination (as it typically happens in previous generation models).

8. Conclusions

If we consider the relationships between land use and transport planning, beginning from the concept of the functionalist approach that transport is only a tool, we can obtain results that can be theoretically perfect but that are sometimes wrong in practice. The subject of the question is the human being in his entirety, with all his desires, material and immaterial. Therefore, the use of public participation, which is being used to consider people and their desires, takes on a very important role in land use and transport planning and it could be able to avoid typical mistakes related to the functionalist approach. However, the subject of the question is the human being and his innate needs, amongst which there is also mobility. It is possible to state that transport infrastructures are not only a tool to answer a basic need (traveling as needed for the participation in other activities), but rather an opportunity to satisfy some native human needs. The approach still remains to be developed, but seems to lead us toward a new direction of research in which we can recognize some first clues.

For example we envision the following areas of analysis:

- To analyse how transport and the new technologies can contribute to modifying culture, promoting three different kinds of homogenization: virtual (by which the subjects undergo changes only in some characteristics), physical (first generation homogenization, by which the subjects also undergo changes in their habits) and structural (homogenization of successive generations, by which the subjects have new habits).
- To consider that development does not only mean "more money", but is rather development of all human needs in a balanced way.
- To consider that the concept of sustainability cannot be restricted to the fourth dimension (time), but must be enlarged to all four dimensions (three in space and the fourth time), considering all the horizontal and vertical diversities in space and all the values and needs of all cultures potentially affected by the problem, at present and in the future.
- Starting from the point of view that Desired Mobility (DM) is nearly constant for everyone, to promote change in the proportion of the two constituent parts, the native (n or N, with $n<N$) and the derived (d or D, with $d<D$), so that the former can be enhanced and the latter reduced through travel demand management.
- To find new evaluation criteria taking into account all factors (such as economy, equity, globalization, values, etc.) in a CBA of a transportation network.
- To define high quality standards for transportation projects and for the construction of urban roads (including aesthetic, functionality, road safety, services, protection from bad weather, presence of intermodal connections, etc...).
- To optimize public transit networks.
- To displace private parking from destinations.
- To promote incentives for companies that provide parks and services for pedestrian and cyclists and favour non-motorized mobility for their employees.
- To reduce public subsidies for high speed transportation and unnecessary products that are hauled over long distances.

One idea that we suggest for discussion is that urban transport infrastructures should be designed and managed in order to consider the innate human desire for mobility, amounting to little more than an hour a day, and to enhance the efficiency of public transport, walkability and cyclability. The built environment and organization of urban public transport in some cities in northern Europe and other urban realities (e.g. Curitiba in Brazil) serve as examples that confirm this axiom. The challenge of the next few years will be to discover the right steps to make in order to better understand the relationships between land use and transport planning, developing tools and models able to control and manage mobility and land use, improving the native positive mobility, with the aim of reaching a better homeostatic quality of life.

References

[1] Priemus, H., Nijkamp, P., and Banister, D. (2001) Mobility and spatial dynamics: an uneasy relationship, Journal of Transport Geography, 9 pp. 167-171.
[2] Cao, X., Mokhtarian, P. and Handy, S. (2007) Examining the Impacts of Residential Self-Selection on Travel Behaviour: Methodologies and Empirical Findings, Institute of Transportation Studies, University of California, Davis.
[3] Litman, T. and Steele, R. (2010). Land Use Impacts on Transport, How Land Use Factors Affect Travel Behavior; Victoria Transport Policy Institute, With Rowan Steele.
[4] Hoover, E.M. and Fisher, J. (1949) Problems in the study of economic growth. National Bureau of Economic Research, New York.
[5] Sen, A. (1987) On Ethics and Economics. Blackwell, Oxford.
[6] Anand, S. and Sen, A. K. (1994) Human Development Index: Methodology and Measurement. Occasional papers 12. Human Development Record Office. The World Bank.
[7] Sen, A. (1999) Development as Freedom. Alfred A. Knopf, New York.

[8] Colonna, P. Fonzone, A. (2002) Analysis of the interaction between road infrastructures and social-economic development. International Conference on Advances in Civil Engineering - ACE 2002, Kharagpur, India.
[9] Colonna, P. Fonzone, A. (2003) New Ways of Viewing the Relationship between Transport and Development. Discussion Paper. Transportation Research Board, 82nd Annual Meeting, Washington.
[10] Colonna, P. (2003) Road infrastructures and socio-economic development: proposal for identifying the parameters taking into account data-collecting. Transportation Research Board, 82nd Annual Meeting, Washington.
[11] Colonna, P. (2003) "Mobility, roads, development and quality of life", XXIInd PIARC World Road Congress, Durban.
[12] Brundtland, G. H (1987) Our common future (Report for the World Commission on Environment and Development, United Nations), Oxford, UK: Oxford University Press.
[13] Mayer, V. (2007) Sustainable development of regions between ethical requirements and the social reality, International Conference to Questions of the Sustainable Development of Regions, Prague.
[14] Capello, R. and Nijkamp, P. (2002) In search of sustainable human settlements, Ecological Economics, 40, pp. 151-155.
[15] Gordon, C. (2005) Human values and transportation system homeostasis, 3rd International SIIV Congress, Bari, Italy.
[16] Colonna P., Gordon, C. (2007) Measuring total rather than partial returns to highway investments: the use of an economic equilibrium concept. 4th International SIIV Congress – Palermo, Italy.
[17] Kuznets, S. (1955), "Economic Growth and Income Inequality," American Economic Review, 49, pp.1-28.
[18] Selden T.M., Song D., (1994)«Environmental Quality and Development: Is There a Kuznets Curve for air Pollution Emissions?», Journal of Environmental Economics and Management, n. 27, pp. 147-162.
[19] Van Veen-Groot, D. Nijkamp, P. (1999) Globalisation, transport and the environment: new perspectives for ecological economics, Ecological Economics, 31, pp. 331-346.
[20] Tisdell, C. (2001). Globalisation and sustainability: environmental Kuznets curve and the WTO. Ecological Economics, 39(2), 185-196.
[21] Mokhtarian, P. L. and Salomon, I. (2001) How derived is the demand for travel? Some conceptual and measurement condition. Transportation Research Part A: Policy and Practice, Vol. 35, No. 8, pp. 695-719.
[22] Mokhtarian, P. (2003) TTB or not TTB, that is the question: a review and analysis of the empirical literature on travel time (and money) budget. Transportation Research Board, 82nd Annual Meeting, Washington.
[23] Zahavi, Y. and Talvitie, (1980) A. Regularities in travel time and money expenditures. Transportation Research Record 750. TRB, National Research Council, Washington, D.C.. pp. 13-19.
[24] Deakin, E. (2002) Sustainable Transportation. U.S. Dilemmas and European Experiences. Transportation Research Record, No. 1792, pp. 1-11.
[25] Hess, D. B., Lombardi P. A. (2004) Policy Support for and Barriers to Transit-Oriented Development in the Inner City. Literature Review. Transportation Research Record: Journal of the Transportation Research Board, No. 1887, pp. 26–33.
[26] Dunphy, R. T., Porter R. D. (2006) Manifestations of Development Goals in Transit-Oriented Projects. Transportation Research Record, No. 1977, pp. 172–178.
[27] Handy, S. L. and K. J. Clifton (2001) Local Shopping as a Strategy for Reducing Automobile Travel. Transportation, Vol. 28, No. 4, pp. 317-346.
[28] Handy, S. (2005) Smart Growth and the Transportation–Land Use Connection: What Does the Research Tell Us? International Regional Science Review, Vol. 28, No. 2, pp. 146–167.
[29] Greene, D. and M. Wegener (1997) Sustainable Transport. Journal of Transport Geography, Vol. 5, No. 3, pp. 177-190.
[30] Crawford, J. H. (2000) Carfree Cities. International Books, Utrecht.
[31] Vovsha, P. and Bradley, M. (2006) Advanced Activity-Based Models in Context of Planning Decisions, Transportation Research Record, Journal of the Transportation Research Board, No.1981, Planning and Analysis.
[32] Illich, I. (1974) Energy and Equity, Harper and Row, New York.
[33] Colonna, P. (2009) Mobility and Transport for our tomorrow roads, European Roads Review n. 14, pag. 44-53.
[34] Colonna, P., Berloco, N. and Ronchi, E. (2009) Optimising fire protection and safety in road tunnels by readjusting risk analysis strategy, Conference on Fire Protection & Safety in Tunnels, Paris.