

THE ROLE OF ASSESSMENT IN THE URBAN MOBILITY PLANNING PROCESS

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ABSTRACT

The complexity of the urban mobility system requires a careful and comprehensive planning to help decision makers choose the appropriate alternatives in order to improve the system, especially in relation to the configuration of its network. Yet there are many approaches on planning and decision making as well as methodological procedures to support the development and the choice of alternatives, but none of them adequately emphasizes the role of assessment neither the discussion about the mobility network characteristics at strategic level. In this sense, the main objective of this paper is to make a contribution to the urban mobility planning process by restructuring its methodological steps in order to highlight the role of assessment with special attention to the network configuration issues.

Keywords: Urban Mobility, Mobility Network, Planning Process, Assessment

INTRODUCTION

The Urban Mobility System (UMS) is a complex urban subsystem of great autonomy of organization whose ultimate goal is to provide an efficient level of mobility and accessibility through a multimodal mobility network to allow the performance of all functions taking place within the city. Such complexity requires therefore a careful and comprehensive planning to help decision makers choose the appropriate alternatives that enhance the efficiency of the system, especially in relation to the configuration of its network, and at the same time minimizes its impacts. Although there are many decision making approaches to deal with the UMS complexity, no single method can be pointed out as the ideal one to be conducted. In line with such diversity, there are also different methodological procedures or planning process structures used for the development of alternatives, where the assessment task receive different levels of emphasis and the discussion regarding the mobility network at strategic level is not yet considered.

In this sense, the main objective of this paper is to make a contribution to the urban mobility planning process by restructuring its methodological steps in order to highlight the role of the assessment with special attention to the network configuration issues. The specific objectives and the correspondent paper structure are: (i) analyze if there are paradigm shifts occurring in the transportation planning field (section 2); (ii) discuss the role of some concepts considered as of key importance on transportation planning (section 3); (iii); analyze the traditional methodological procedure of decision-making processes (section 4); (iv) propose a new methodology that addresses the issues identified in the previous analyzes (section 5). The conclusions and further recommendations are presented in the section 6.

PARADIGM SHIFTS IN TRANSPORTATION PLANNING

The need for paradigm shifts in the transportation planning field has been pointed out by several authors over time. They are usually associated with the consideration of new values and principles in the development of the planning process. Sometimes these changes are presented in the form of a focus shift from accessibility to mobility in order to make more evident the integrated planning of transport and land use (Handy, 2005; Macário, 2012). Sometimes are related with the incorporation of sustainability and equity concepts to ensure the achievement of more lasting and socially fair strategic objectives (Kenworthy, 2007; Banister, 2008). However there are some paradigms that are not explicitly explored or are even neglected during the process, which may compromise the quality and efficiency of the proposed alternatives and consequently of the decisions taken.

Both in research and technical transport field there has been a growing use of the expression “**mobility system**” instead of “**transport system**” in the last decades. Sometimes the intention of this change is merely to expand the view of the transport system for the consideration of non-motorized modes, especially when “mobility” comes associated with the word “sustainable”, as seen in some governmental guidebooks (MCidades, 2007; APA, 2010). But in fact the preference for the use of the word mobility over transport can be seen as an attempt to express more clearly the issues related to individual mobility instead of only infrastructures and services offered. This change brings out two important issues of transportation planning: the supply-demand dichotomy and the solution vs. problem orientation.

Traditionally, the perception of transport system has been related to the offer of infrastructures, services and modes, which restricts the focus of the **transport planning** to the supply side of the system (Meyer and Miller, 2001). For decades this was the emphasis of several transport plans whose main concern was to accommodate the increasing use of motorized vehicles by building new infrastructures. This clearly represented a planning process aimed at proposing solutions and centered on the achievement of a predefined goal (meeting the growing demand of car use) instead on the identification of the real needs and problems faced by users in their displacements.

The introduction of the mobility concept expands the concerns of the planning process to the demand aspects allowing the consideration of issues related not only to the system offer, but

also to the needs and preferences of their users. This focus change allows the identification of imbalances in supply-demand relationship, i.e., the identification of problems associated with the system. The planning is then to be oriented by the identification of problems followed by the proposition of solutions that aimed managing (and not only increase) the system supply, but also managing the demand in order to reduce the impacts of traffic and enhance mobility options (Meyer and Miller, 2001).

Therefore, the use of the expressions “mobility system” and “**mobility planning**” seems to be more adequate than “transport system” or “transport planning” if the concern is to join the consideration of both demand and supply aspects in the planning process and to redirect the focus of the process from proposing solutions to resolving problems. It is important, though, to note that the system (mobility or transport) as an object of planning remains the same: a system formed by infrastructures, services, agents and networks that together contribute to the provision of its final product, the mobility chain (Macário, 2005). The main difference is in fact in the approach considered to carry out the planning process, whether it is focused on the supply side and proposing solutions (transport planning) or whether it expands its concerns to the demand aspects and focus on resolving problems (mobility planning).

However, there is yet another important issue that became more evident when the mobility planning approach is considered: the intrinsic relationship between the mobility and the land use systems. Considering that demand for travel is a function of the spatial distribution of activities, incorporate aspects related to the land use and transport interactions in the planning process becomes easier when the focus is to plan the individual mobility. Thus the ultimate goal of the urban mobility system - allowing travelers to have access to its main activities - can be better achieved if the land use and mobility dynamic interactions are considered in the planning process, especially if it occurs in its early phases (Meyer and Miller, 2001).

This approach, known as **integrated planning**, has been advocated since the early of the 1960s and was followed by the development of many land use and transport (LUT) models (Meyer and Miller, 2001; Banister, 2002). Even so, the combined planning of both domains has failed in practice. Generally the planning process of each domain is performed independently with each one developing its own separate visions, scenarios, plans and projects focusing on its specific issues. This difficult integration can be explained by two factors: the institutional/procedural discrepancies regarding institutional agencies, financial arrangements, etc., and substantial differences such as planning object, information and knowledge (te Brömmelstroet and Bertolini, 2008).

More recently various authors have promoted the integrated planning under the name of **accessibility planning** (Bertolini et al., 2005; Curtis, 2008; Halden, 2009). This new planning approach besides evidencing the importance of interactions between transport and land use, have its emphasis on the demand, focusing on planning the access of individuals to their main activities and/or the accessibility of destinations to a specific groups. In some cases, such as in UK, this approach brings out the equity issues in relation to distribution of the access to the main services (Halden, 2009), while in the Netherlands it is more related

with sustainability concerns, especially in relation to the provision of accessibility by more sustainable modes (Bertolini et al., 2005).

It is possible, therefore, to note that over time the transportation planning has undergone some paradigm shifts that resulted in the proposal of different methods with appealing denominations. However, despite all these changes there is still a gap regarding the consideration of the **mobility network** as a structural element of the system. Under the concept of mobility system the network should be viewed as a single mobility network of modes and services, instead of a set of several unimodal networks that work together to deliver multiple mobility options to users (Macário, 2005). Such a view highlights the network's role as a key component of the mobility system and a strategic element of planning, since it represents the backbone of the system linking its components (infrastructure, services and agents) and enabling users to satisfy their mobility requirements and access activities of interest.

Furthermore, the implications that these value changes can bring to the sequence of methodological steps of the planning process are still underexploited. Probably one of the major difficulties that currently exist to operationalize these value changes is the lack of a **strategic approach** for the system as defended by Macário (2007) as well as procedural steps to accurately **identify the real needs and problems** of users in order to propose the most appropriate solutions based on these values and to **assess if the solutions** implemented are helping to achieve the system's goals.

In this sense the assessment task assumes an important role in planning and decision making process, especially regarding the mobility network, once its strategic assessment can help defining the configuration that is more adequate to attend the user's needs and consequently contribute for the formulation of better alternatives for the system. In other words, the network's strategic assessment allows bringing to the initial phase of the planning process issues such as prioritization of modes, level of accessibility and network coverage, which usually are subjects of tactical decisions only, but need to be addressed in an early stage in order to guarantee the achievement of the value changes discussed previously.

KEY CONCEPTS ON URBAN MOBILITY PLANNING

Mobility, accessibility, sustainability and equity are concepts or values of paramount importance for the urban mobility planning. They serve as a foundation for the development of the process, helping planners to better delineate the object to be planned and set the path to be followed during the process. The first two can be seen as the main concerns or ultimate goals of the planning process, while the last two may be considered as guiding principles. Depending on the emphasis that is given to each of them, the approach considered for the planning process may change.

Mobility and accessibility are commonly viewed as the main concerns of the planning process. However the concept of mobility is generally associated and often confused with the concept of accessibility, which can bring different results to the planning process depending

on the definition assumed. Generally the mobility concept can be assumed as the ease of movement and is related with the individual ability to move from one place to another, while accessibility can be understood as the ease to reach destination and is dependent on the characteristics of both mobility and land use systems (Levine and Garb, 2002).

The consideration of these two different, albeit interrelated concepts, is crucial for the development of the planning process. Depending on the meaning considered for each of them or the emphasis they received, significant alterations can be brought to the planning process with regard to the definition of problems, the types of solutions that can be considered and how they can be evaluated. Therefore, having a clear understanding of their meanings and the consequences that each of them can bring to the planning process it is of extreme importance.

A change in direction of planning for accessibility instead of mobility has been defended by many authors (Handy, 2005; Litman, 2007; Curtis, 2008). They argue that planning for mobility emphasizes solutions that increase motor vehicle travel and hence promote the unsustainability of the system, while planning for accessibility favors solutions that focus on the travelers rather than the system and allows the consideration of other transport improvement options such as promoting walking and biking and creating more accessible land use (Litman, 2007).

Planning based on accessibility concept can thus lead to better mobility systems, since the alternatives produced by this approach tend to have less environmental impact, are significantly cheaper and provide a wider range of choices (Handy, 2005). In addition, this approach provides a better understanding of the options available to the community and allows the combination of general and individual interests in the perspective of sustainable mobility (Crozet, 2009). However, the implementation of accessibility solutions are more challenging once it requires the joint efforts of the authorities responsible for the mobility planning and the land use planning (Handy, 2002).

Besides mobility and accessibility, sustainability is a concept of major importance in the planning field and has been defended as a guiding principle for the development of the planning process (Meyer and Miller, 2001; Goulias, 2003; Jeon, 2007; Litman, 2007). Its consideration provides a more comprehensive approach to the process and consequently allows the assessment of the different impacts caused by the system. Moreover, the integration of sustainability concerns in the planning process can help decision makers prioritize strategic objectives, since different dimensions of sustainability may become more significant as the mobility needs, the land use patterns, the quality of environment and economy of the city evolve (Jeon, 2007).

Each sustainability dimension serves a specific objective to support effective policies and need to be considered together in order to improve alternatives and avoid solution that favor only one of the aspects (Goulias, 2003). In relation to the UMS each sustainability dimensions has a particular meaning. While the economic dimension is related with the efficiency of the system and consequently with the levels of accessibility that support the activities and the economic development of the cities, the environmental dimension is related

to problems generated by the massive use of cars and by the growing demand for space to build road infrastructures. The social dimension in turn is related with the UMS aspects that might affect the preferences, well-being and behavior not only of their users but also of the society in general (Geurs et al., 2008). It has an intrinsic relationship with the other two dimensions, since the variations on accessibility provision and pollutant exposure may have a significant impact on the citizen's quality of life.

Although the sustainability concept can be seen as the primary guiding principle for the UMS planning process, it cannot be considered in dissociation with the concept of equity. While the first broadens the spectrum of the issues to be considered in the planning process, the second deals with the distribution of impacts related to each of the sustainability dimensions. The equity concept thus functions as an attribute of the sustainability concept, since to achieve the system sustainability is necessary to ensure the adequate distribution of its impacts in a way that the citizens welfare and the cities quality of life is not compromised in the long term.

In more precise terms, equity can be considered as been related with the fair distribution of both resources and impacts (positive or negative) of the urban mobility system. It is different from equality in the sense that it implies a need for justice and impartiality in the distribution of gains and losses by the community (Beder, 2000). It can also be viewed under two different perspectives when associated with urban mobility: one related to the distribution of impacts between individuals considered equals in their mobility needs (horizontal equity) and other related with the distribution of impacts between individuals and groups that differ according to their social classes and income or to their mobility needs (vertical equity) These different perspectives frequently overlap and conflict, which implies the need to make tradeoffs between different equity objectives during the planning process (Litman, 2002).

Despite the dissociated use of the concepts discussed here is an important contribution to the planning process, the combined use of them can bring improvement not only to the whole process, but especially to the proposal of alternatives. Therefore it is necessary to think about what combination of values or concepts is the most relevant to be adopted. Mobility for example is a concept that complements the concept of accessibility since it is not possible to provide people with accessibility without first ensuring their individual mobility. Sustainability in turn is a concept that usually complements the other two, expanding the context and the way mobility and accessibility issues are considered. Equity on the other hand can be seen as an attribute of sustainability or even as a prerequisite to achieve it.

The most common combination of concepts founded in the literature is of sustainability and mobility. The association of sustainability issues to the mobility system broadens its ultimate goal by incorporating concerns with the external impact related with the provision of mobility. Besides, the use of sustainable mobility concept in the planning process can be seen as a way to strength the link between land use and transport, once to achieve this goal it is not enough to provide mobility, it is also necessary to reduce the distances between the desired destinations or even the need to travel, to encourage the modal shift to more environmentally efficient modes and to promote the technology innovation (Banister, 2008).

However, as the primary concern of planning has been changing from mobility to accessibility, some authors have been put emphasis on the combination of sustainable issues with accessibility (le Clercq and Bertolini, 2003; Curtis, 2008; Doust and Black, 2009). For them the planning based on the sustainable accessibility concept allows achieving the main objective of the system of providing cities with more sustainable travel options. Besides the development of analysis based on accessibility measures is the best way to address the land use and transportation interactions and at the same time be directly related to the economic, social and environmental objectives of the system (Bertolini et al., 2005).

The start point for the definition of the combined concept of sustainability and accessibility results from the fact that individuals do not seek mobility, in fact they seek opportunities to participate in spatially disjointed activities (Bertolini and le Clercq, 2003). Therefore, urban policies should aim to increase the synergy between these concepts, which can be achieved by creating conditions so that there is an increase in the percentage of environmentally sustainable modes, while it maintains or even increases the quantity and diversity of activities that can be reached within an acceptable travel time.

The best policy to achieve the sustainable accessibility would be thus to create sustainable urban infrastructures which offers good levels of accessibility by modes with less environmental impact (le Clercq and Bertolini, 2003). Such policies must promote the use of public transport and bicycles, and include land use measures that encourage the use of these modes. However, to promote this type of planning new practices are needed not only regarding the methods and tools for planning, but also concerning the establishment of new relations between the stakeholders involved (Curtis, 2008).

Although the sustainable accessibility concept confers a broader approach to planning, it still leaves out issues of equity or considers it in an implicit way. The consideration of the equity concept in the planning process gives it a sense of justice in relation to the provision of access and allows to minimize the inequitable effects on minority and low-income communities due to the limiting access to social and economic opportunities (Sanchez et al., 2003). Therefore the combined use of the concepts of equity, sustainability and accessibility in the development of the planning process seems to be the most appropriate one. Urban policies based on these concepts should thus consider not only the offer of good levels of accessibility by more environmentally friendly modes, but also the minimization of the spatial and social effects of the accessibility distribution.

THE TRADITIONAL METHODOLOGICAL PROCEDURES FOR TRANSPORT PLANNING AND DECISION MAKING

There are many approaches in the literature to deal with the transport complexity, but no single method can be pointed as the ideal to conduct its decision-making process (Button, 1993; Tolley and Turton, 1995; Mackie and Nellthorp, 2003; Weiner and Riklin, 2005; Cascetta, 2009). For Macário (2005) in this process three distinguishable levels can be identified: the strategic level where the political objectives of the system and the means to achieve them are defined; the tactical level where the previous objectives are translated into

operational specifications; and the operational level where mobility services are produced and consumed.

May et al. (2005) suggest the organization of the transport decision-making approaches in three different categories: vision-led, plan-led and consensus-led. The first is based on the decision-maker vision of the system and aim to implement policy instruments already known as effectively as possible, which reflects a strong solution-oriented character. The second is based on the adoption of an ordered procedure that start by the specification of objectives and problems and followed by the identification and choice of the possible solutions. The third is based on the discussion between stakeholders to reach agreement on each of the stages of the plan-led approach. These latter two approaches have a more problem-oriented character, either by prioritizing the identification of problems or even allowing stakeholder participation in this activity.

Each of these approaches has its own pitfalls and the common practice has been the use of a combination of approaches, with the preference being the plan-led and consensus-led mix over the vision-led and plan-led mix (May et al., 2005). However regardless of the combination of approaches adopted, the definition of a methodological procedure or logical structure to support the development of the planning process is crucial. In this regard, three different examples of methodologies are analyzed in order to understand what are the main advantages and drawbacks founded in the traditional methodological procedures, especially in relation to the role of the assessment.

The first structure analyzed, proposed by Meyer and Miller (2001), emphasizes the role of planning activities as support tools to the decision making process and is centered on the use of performance measures. Such measures are seen as indicators of transport effectiveness and efficiency that reflect either concerns related with the system operation as with the strategic objectives, and provide feedback to the decision-making process allowing the performance assessment of the system. For the authors the general configuration of a decision-oriented transport planning process presented in Figure 1 is comprised by four phases as described below:

- The first one is the **identification/definition of the problems** which can be understood as the perceived differences between desired states of affairs and the decision maker's perception of the actual situation. To assist in this task two planning actions should be considered: the definition of the vision of what a community desires for the future and the establishment of goals and objectives to achieve the desired state of the system;
- The second phase refers to the **debate and choice** of feasible alternative strategies for the system. This process is characterized by a conflict of interests due to the limited resources available and the need for the establishment of priorities. In this sense the planning can help the decision makers by generating alternative strategies based on analytical methods and establishing evaluations criteria to allow the identification of the best alternatives;

- The third phase concerns to the **strategies implementation** which requires the definition of a detail program of execution based on the financial resources, political priorities and strategic objectives. The program developed by planners can help to determine which and when the strategies should be implemented, but the final decision will always relies on the political intuition over the technical analysis;
- The final phase consists in the **monitoring of the system** by the systematic checking of its operation. These checks allow the evaluation of the impacts and effects of the implemented strategies in order to verify if they are helping to achieve the desired states defined in the beginning of the process.

The second structure proposed by May et al (2005) incorporates aspects related with the three approaches discussed previously, specially the stakeholder's participation. It recognizes the importance of consider the city vision and the sustainability principle in the definition of the objectives. It also emphasizes the use of scenarios to deal with uncertainty and indicators to measure the performance of strategies, and most important it stresses the role of assessment in the process establishing a differentiation between appraisal and evaluation¹. The proposed structure is originally organized as a continuous sequence of steps as shown in Figure 2, but is described here in the form of groups or phases just for the sake of simplicity:

- The first phase in the methodology refers to the definition of objectives and related indicators, and the identification of problems. The **definition and prioritization of objectives** should be done through a participatory process having in consideration the city vision when it exists and the ultimate goal of increase sustainability. The definition of scenarios and the specification of indicators should be a complementary action to help measure the performance of the objectives now and in the future. The **identification of problems** can be done through stakeholders consultation which allow determine the areas of major concern for citizen, or through objective analysis and monitoring which allow a more deeply investigation of the causes of the problems. One alternative in this phase is start by the identification of problems instead of objectives definition and that way have a more problem-oriented approach to the strategies formulation;
- The second phase consists of the policy instruments listing, the identification of barriers and the formulation of strategies. The **selection of potential policy instruments** should consider the policy type, the city area where it will be implemented and the stakeholders participation as they may have new ideas which otherwise would be disregarded. The **identification of barriers** helps to define which are the most favorable policies to be implemented and should consider the stakeholder opinions in order to reduce its severity and encourage joint action to overcome them. The **formulation of strategies** consists in the combination of policy

(1) According to May, A. D., A. Karlstrom, et al. (2005). Developing Sustainable Urban Land Use and Transport Strategies - A Decision Maker's Guidebook. Deliverable 15 of PROSPECTS. The terms appraisal and evaluation are used to refer to two different forms of assessment. Appraisal can be considered is the *ex-ante* process of deciding how well a strategy will perform. Evaluation is the specific application of appraisal to the *ex-post* assessment of implemented strategies. However, this classification is not always followed in the transport planning literature, where it is common to find the term evaluation referring to ex ante assessments (EC, 1996c).

instruments that reinforce one another in meeting the objectives and in overcoming barriers and should be tested for different future scenarios;

- The third phase comprises the prediction of strategies impacts and its appraisal against the objectives. The **prediction of strategies impacts** should be performed through a model, which can vary in terms of complexity and specialist skills. The **appraisal of strategies impacts** allow the choice of the best solution and should consider the indicators and scenarios already defined, different methods of appraisal and stakeholder participation in order to identify the ones adversely affected and avoid potential objections. The use optimization techniques can be also used to help identify better strategies;
- The final phase refers to the strategies or policy instruments implementation and evaluation, and the monitoring of the system. The **strategies implementation** should be done following a correct sequence and avoiding the barriers previously cited. Its **evaluation** against the objective is then performed using the same appraisal framework and the results can be used to improve future predictions. Finally the **monitoring of the system** condition should be carried out in order to assess changes in problems, based on the objectives. Stakeholder participation in this phase allow consider the concerns of those adversely impacted by the strategies and reformulate it if necessary;

The third structure of Magalhães and Yamashita (2009) in turns consist in an integrated planning, monitoring and evaluation process based on a strategic, tactical and operational (STO) hierarchical framework similar to the one proposed by Macário (2005). Likewise in the other two processes, the authors also point out the importance of using performance measures, but more than that they defend the role of the assessment task and consequently the use of a system of indicators to support such activity. This indicators are used to represent the characteristics of the object planned, not the strategies, and can be related to the different levels of decision making. Moreover, it also permits the link of the strategies proposed to an existing indicator facilitating its assessment. The Figure 3 presents the structure of the process which can be described as following:

- The strategic level responsible for defining what should be done by setting the solution requirements to be developed during the planning. Its main steps are the definition of the **image or vision for the object** considered in the planning process, in this case the Urban Mobility System; the development of a **diagnosis of the system** based on performance measures that will guide the exploration of the most relevant issues in the process; the identification of the **problems** considered as the differences between the current state of affairs and the stakeholder's expectation or the stipulated reference to the system; the establishment of **principle and values** to guide the formulation of the objectives and the development of alternative actions or strategies; the formulation of **objectives** to lead the development of the actions envisioned to achieve the expected results and the specification of **goals** to achieve the objectives proposed;

- The tactical level is responsible for developing the solutions for the problems posed by the strategic level decisions. It comprises the definition of **guidelines** to conduct the development of strategies; the formulation of **strategies** which consists in projects and actions defined to achieve the objectives and restricted by the guidelines as well as the definition of all **instruments** necessary for developing and implementing the proposed strategies; and the development of **programs** that comprises the strategies proposed as well as all instruments necessary for its implementation;
- The operational level is in charge of the execution of the actions established at the strategic and tactical levels, as well as the provision of information for the monitoring and evaluation of the process. It consists in the definition and execution of all procedures necessary for the **implementation** of the proposed strategies and for the **spreading of the information** regarding the plan, as well as for the establishment of a **monitoring** tool as consequence of the development of an evaluation system based on indicators that support the process along of all its levels.

The three structures analyzed here present different levels of emphasis on the role of assessment activities. While the methodology proposed by Meyer and Miller (2001) merely consider the assessment as just another planning activity, the other two proposals show an more clear emphasis on the role of assessment throughout the process, even if in an implicit way as in the case of the methodology proposed by May et al (2005). Magalhães and Yamashita (2009) in turn propose more clearly in its structure the different assessment moments in the process, but without making the necessary justifications for each. Nevertheless, these methodologies also present some weaknesses in its structures that limit the role of assessment and the performance of the methodologies itself.

One of the first shortcomings noticed in the structures analyzed refers to the consideration of both vision and values and principles in the process. Meyer and Miller (2001) and Magalhães and Yamashita (2009) highlight the importance of having a vision for the system, which should not be considered as an activity of the process itself on the risk of trying to anticipate solutions for the system without even having identified their problems. The approach proposed by May et al (2005) of consider the city vision instead of define one seems more appropriate if the focus is to avoid a solution-oriented approach. Furthermore, although in two of the methodologies values and principles are considered an important input to the process, this occurs sometimes inappropriately, as in the proposal of Magalhães and Yamashita (2009). In this case values and principles are inputting only the definition of objectives, guidelines and strategies/alternatives, when its consideration should be prior to the consideration of the vision and the development of the diagnosis.

Another major deficiency of these methodologies refers to the absence of a diagnostic of the current situation of the system which is essential to define the problems to be addressed as well as the development of objectives. In all three cases despite the first stage of the process consists in the identification of problems, it is not derived from an assessment activity in which specific procedures are defined to help identify problems related to the system. The methodology of May et al (2005), though it includes a description of possible methods for

identifying problems, do not consider them in a more systemic approach of diagnosis. Meanwhile the methodology of Magalhães and Yamashita (2009) recognizes the diagnosis as an important activity of the process, but considers it as a separate activity from the identification of problems.

Other minor shortcomings in these methodologies are worth being mentioned. In Meyer and Miller (2001) proposal activities such as data collection, use of analytical methods and performance measures definition are considered as planning activities when in fact they should be seen as support activities. In May et al (2005) proposal there is no clear specification in what level of decision the planning activities should take place, which can cause some confusion regarding to whom is responsible (institution) for each phase of the process. Finally, in the structure proposed by Magalhães and Yamashita (2009) the specification of goals should be placed at the tactical level since it refers to the specification of the strategic objectives and can be seen as tactical objectives; and the assessment of strategies/alternatives before its implementation is not considered in the process. Nonetheless, it is worth noting the emphasis by all methodologies analyzed on the importance of using indicators as a support tool in the process.

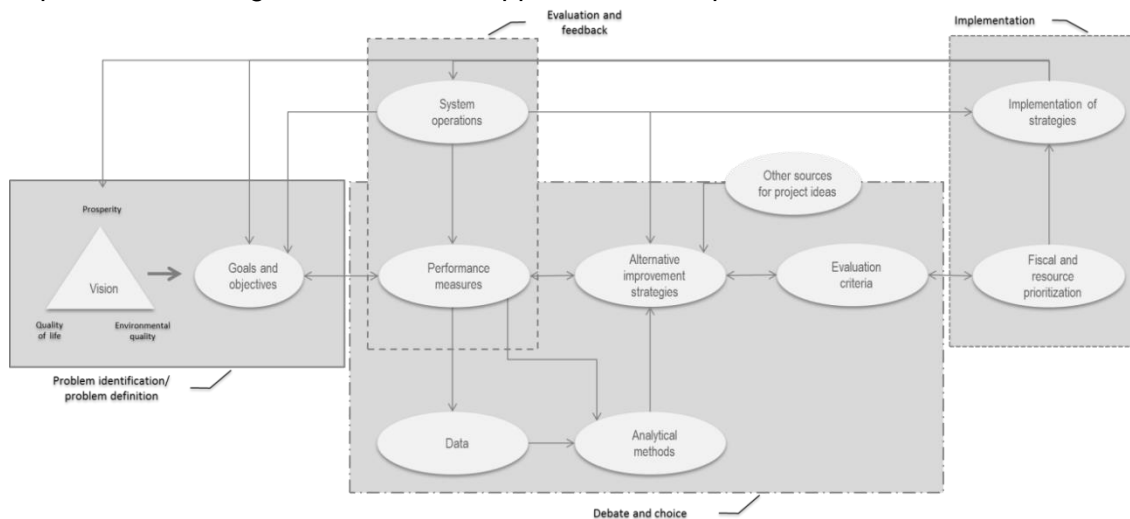


Figure 1: Decision-oriented transport planning process (Meyer and Miller, 2001)

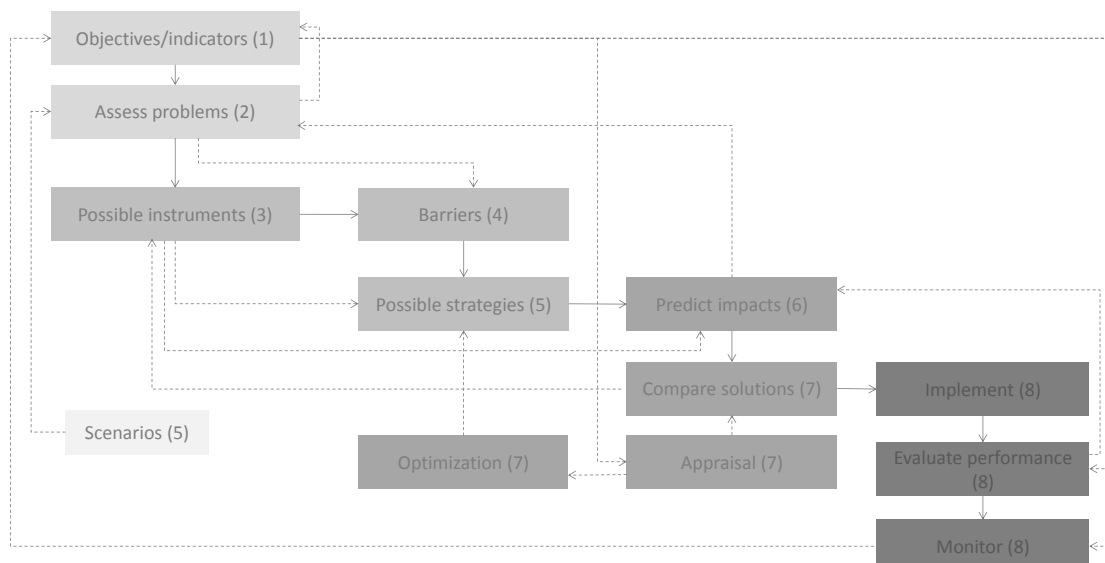


Figure 2: Logical structure for transport decision-making (adapted from (May et al., 2005))

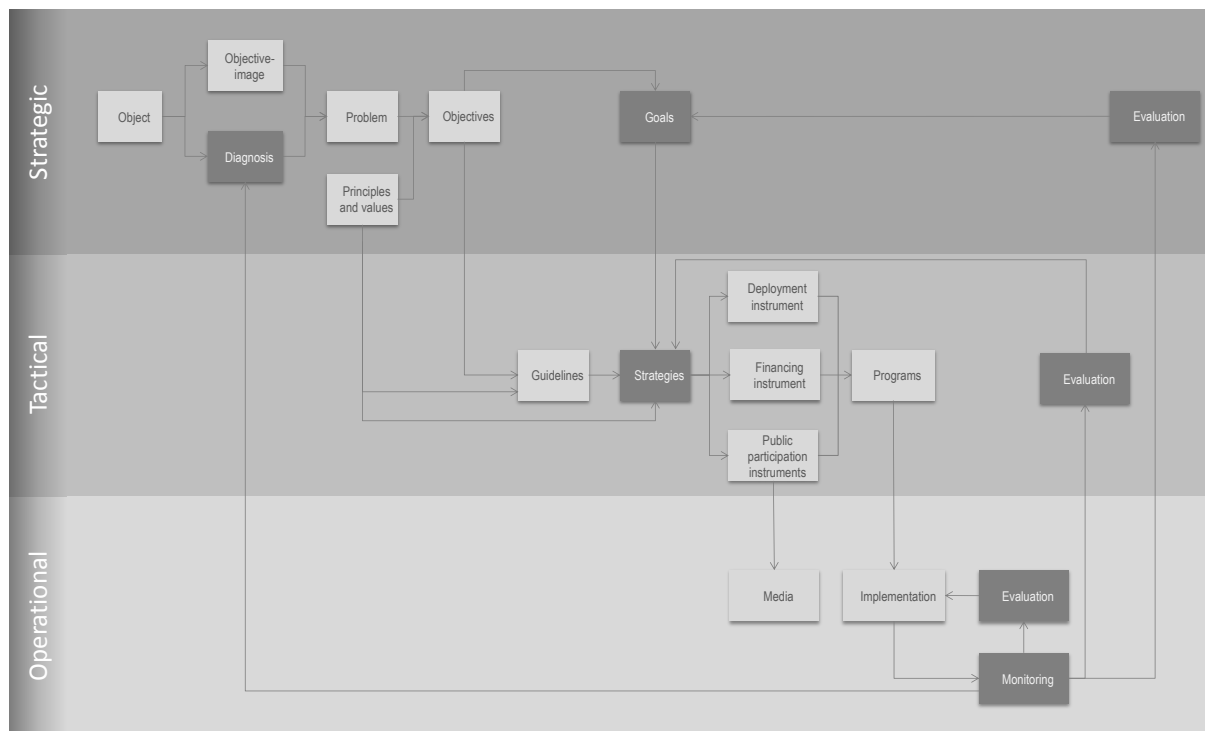


Figure 3: Integrated planning process (Magalhães and Yamashita, 2009)

UMS PLANNING AND ASSESSMENT PROCESS: A METHODOLOGICAL PROPOSAL

Considering the advantages and disadvantages identified in the process described previously and the discussion about the main paradigms shifts in the mobility field, an improved methodology is proposed where the role of assessment is highlighted. The structure of the planning and assessment process proposed is presented in Figure 4 and is based also in a hierarchical STO framework, but in which is possible to identify the main decision-making (DM) functions, the planning and assessment steps and its respectively support activities.

Unlike in the other structures analyzed, the assessment activities in this methodology are more clearly identified, taking place at all decision-making levels (STO) and in two different moments of the process: before and after the implementation of the alternatives/actions/measures. In the first moment the assessment occurs both in strategic and tactical levels and refers to the diagnosis of the current situation and the appraisal of the alternatives. After the alternatives implementation the assessment tasks occur in the three levels and refers to the monitoring of the system (operational) and to the evaluation of the alternatives implemented and verification of the objectives achievement (tactical/strategic).

The first phase in the process is related with the **problem set diagnosis** and occurs at the strategic level of the process which has a strong political focus. It refers to the assessment/diagnosis of the current situation and the definition of the objectives to guide the

formulation of alternatives. It comprises the follow assessment, planning and support activities:

- **Diagnosis of the current situation:** refers to the assessment of the present state of the system and help to identify the set of problems it has faced. It should start by a consultation with stakeholders (users, service providers, planners, politicians, etc.) in order to identify their perception about the problems related to the system. These identified problems should then be characterized through indicators that will allow verify whether the problems really exist and if so to analyze their intensity and magnitude as well as identify the causes and effects relationship of them. The development of this first *ex-ante* analysis of the process should be filled by **the values and principles** established to guide the process. Such values in turn should be reflected in the definition of a set of **indicators** that will support not only the diagnosis, but all the subsequent activities in the process making it more responsive, economical and timely. These indicators are organized under a STO framework presenting different levels of specification according to the phase it is related. The diagnosis step is the first moment where the concerns about the configuration of the network should be considered through the development of indicators that represents its characteristics and at the same time the values chosen to guide the process.
- **Definition of strategic objectives:** consists in the formulation of comprehensive statements that reflect the expected results for the system and whose purpose is to guide the development of the proposed actions to achieve them. These objectives should be restricted by the **values and principles**, associated with an **indicator** and reflect the problems identified as well as the **city vision** when it exists. In case there is a vision for the city, which ideally should be defined through a participatory process and reflect principles such as sustainability and equity, the strategic objectives should be formulated as broad statements of what is necessary regarding the UMS to achieve such a vision. These objectives can be further translated into more detailed objectives that will conduct the development of the tactical and operational activities. The detailed structure of these objectives is largely dependent on the maturity of the stakeholders involved in the planning.

The second phase in the process has a more technical approach and refers to the **analysis and choice** of the alternatives developed to attend the objectives defined at strategic level. It is related to the tactical level of process and consists in the follow assessment, planning and support activities:

- **Definition of tactical objectives:** corresponds to the specification of the tactical objectives and can be considered as commitments that represent the political and technical priorities in space and time. The tactical objectives can be seen by the technical and organizations responsible for its deployment as guidelines that will help them to conduct the development of the alternatives by restricting the scope of the solutions to what is considered politically desirable and sustainable;
- **Formulation of alternatives:** consists in develop alternative solutions guided by the tactical objectives to solve the problems identified. These alternatives solutions or

projects are developed in a context of limited resources, capacity control and power pressure and should comprise not only the actions proposed to solve the problems, but also the establishment of the role of each actor/institution involved, the alternative of financial resources provision and the means of dissemination and public debate of the alternatives proposed ;

- **Ex ante assessment of alternatives:** refers to the scanning of alternatives in order to identify the ones that give the best answers for the systems problems. This activity consists in quantify the alternatives results and impacts by the application of models and considering the same set of indicators used in the diagnosis; and in qualify the alternative through assessment criteria that should reflect the preferences of all stakeholders involved (Tarko, 2004). This *ex ante* analysis is perhaps the most applied form of assessment for which many methods such as cost-benefit analysis, multi-criteria analysis, descriptive methods, etc. have been already developed with the objective of support the choice of alternatives by the decision makers;
- **Development of programs:** comprises a set of articulated actions or measures focused on a defined tactical objective and must include the specification of the funding sources, the actors/agents responsible for each action, the mechanisms for monitoring, the communication plan and the schedule of implementation.

The third phase is related to the **implementation of the alternatives** proposed and refers to the operational level of process. It consists in the execution of the actions established at the strategic and tactical levels and comprises the following activities:

- **Definition of operational objectives:** corresponds to the detailing of tactical objectives taking into account the specifications of the action proposed in the programs. They can also be seen by the technical/institutions responsible for its deployment as guidelines for the implementation of the actions proposed;
- **Execution of actions:** refers to the definition and execution of all procedures necessary for the implementation of the proposed actions and for the spreading of the information regarding the plan. The responsibility for these procedures is shared by the different entities as discussed in the tactical level;

The final phase is the **assessment and feedback** of the process. It refers to a set of *ex-post* analysis related to all planning levels that helps to verify if the operation, alternatives and objectives are doing well. It consists in the following activities:

- **Monitoring of the system:** refers to an operational activity and consist in a permanent data collection about the system operation to support the development of the **indicators** used during the process. The monitoring has two purposes: support the control and supervision by the regulatory entities of the alternatives implemented and the verification of the results of the process by the entities responsible for the planning and implementation.
- **Ex post assessment of alternatives:** correspond to the analysis of the results and impacts obtained after the alternatives implementation considering the same set of

indicators used in the diagnosis and *ex ante* assessment steps. This activity allows assessing the effects of alternatives on the indicators associated with both tactical and strategic objectives and thereby determines whether they are being met. Besides it also help to assess if the problems identified in the diagnosis phase are being overcome or even if new ones are emerging.

By the description of the proposed structure is possible to see the clear recognition of the role of assessment activities throughout the process, especially regarding the importance of diagnosis step which denotes the problem-oriented character of this methodology. As discussed at the beginning of this paper, only through the identification of problems and its proper characterization is that become possible defining the most adequate solutions to different urban realities. Therefore, the alignment between the activities of diagnosis and assessment of alternatives through the use of indicators related to objectives and not alternatives can be seen as a more appropriate way to carry out the urban mobility planning system.

Nonetheless, it should be noted that the *ex-post* assessment activity proposed in these process is much more difficult to apply in practice due to the lack of effective monitoring mechanism to ensure constant and adequate collection system data (Weiner and Riklin, 2005). In many practical cases although there are procedures implemented for data collection, they are not adequately systematized and neither is the development of indicators that make information useful for both decision makers and users.

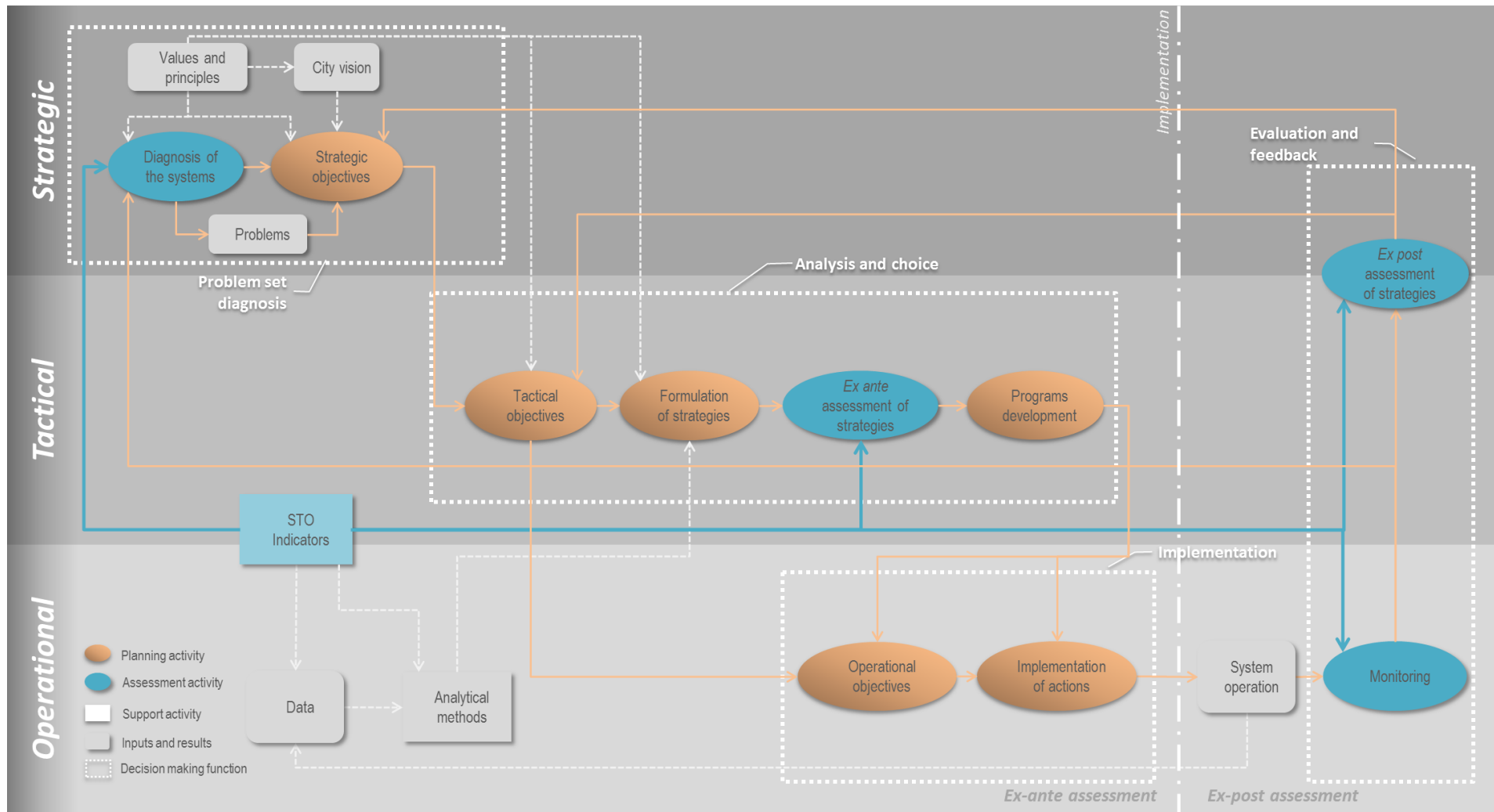


Figure 5: UMS Planning and Assessment Process - Methodological Proposal

CONCLUSIONS

Throughout time many paradigm shifts have been claimed in the field of urban mobility. Some of them have been widely explored in the literature and implemented at least in the development of studies, such as the focus change from mobility to accessibility, the integrated planning and the incorporation of principles like equity and sustainability in the development of planning process. However, there are still some values changes, as the recognition of the concept of urban mobility network and its strategic role for the system, which has yet to be formally recognized and adequately incorporated into the planning process.

Probably one of the main difficulties in considering such a change is related to a lack of strategic approach for the system and methodological procedures that emphasize the role of assessment in planning and decision making processes. The majority of the traditional methodological procedures fail to consider these issues together. Some methodologies do not emphasize the role of assessment, in spite of recognizing the importance of considering the city vision and incorporating sustainability and equity principles. Others have even moved to a joint consideration of these two issues, but still fail to stress the role of assessment as a fundamental activity to the process. Furthermore none of these procedures recognizes the strategic role of the urban mobility network.

The proposal of an assessment-based planning methodology comes out as a way to tackle these issues. First by recognizing the importance of a strategic approach for the system, where the mobility network appears as a central element, and second by emphasizing the role of assessment as a transversal task of the process. This revised methodology allows the alignment of the alternatives to develop the mobility network according to the city's vision while providing a framework for both *ex-ante* and *ex-post* assessments of impacts caused by decisions that change the network. It also represents a valuable tool as it provides planners and decision makers with useful information allowing them to assess the consequences of a decision and to identify the system's deficiencies and opportunities for its improvement.

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