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A SPATIAL DECISION SUPPORT SYSTEM FOR PARTICIPATIVE PLANNING

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The fast and disordered urban growth process is the root of many problems faced by cities of several countries, particularly those in developing countries. One of the causes of the problems is certainly the lack of policies for driving the spatial growth of new urban areas. It demands the adoption of new planning methods to ensure a sustainable growth process, meant to improve the overall community quality of life. For this reason, many research teams are nowadays working on the development and adjustment of techniques for getting a stronger community participation in the planning process.

The participation of the community in the planning process can make discussion about urban problems more comprehensive and effective, and also legitimate the decision process. That means that the solutions of urban issues rely not only on politicians and planners, but also on the community affected by the decisions. Participative planning can help to drive the development of a city towards sustainable development and to improve the community quality of life through an organized process. The assessment of possible solutions to actual problems is an input for a development process oriented to the resolution of priorities.

In that context, the combination of Geographical Information Systems and Spatial Decision Support Systems, through an online interface, can provide new perspectives for participatory planning. That is exactly the focus of this paper, in which a spatial decision support model with online community participation is proposed. Its goal is to promote an integrated and sustainable process of urban and transportation planning for Brazilian medium-sized cities by joining together planners, decision makers and the community in the planning process. A case study carried out in the city of Bauru is presented to exemplify the proposed approach.

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Abstract: The fast urban growth process is the root of many problems faced by cities of several countries, particularly those in developing countries. The participation of the community in the planning process can help to drive the development of a city for reaching sustainable development and to improve the community quality of life through an organized process. In that context, the combination of Geographical Information Systems and Spatial Decision Support Systems, through an online interface, can provide new perspectives to participatory planning. That is exactly the focus of this paper, in which a spatial decision support model with online community participation is proposed. Its goal is to promote an integrated and sustainable process of urban and transportation planning for Brazilian medium-sized cities by joining together planners, decision makers and the community in the planning process. A system under development for the city of Bauru is presented to exemplify the proposed approach.

Keywords: public participation, geographic information system, spatial decision support system, urban planning, transportation planning

1 INTRODUCTION

Many of the problems faced by Brazilian medium-sized cities are somehow connected to urban mobility issues. The excessive use of private cars is producing large impacts on traffic flows. In addition, current urban growth and development policies do not emphasize the use of more sustainable transport modes (i.e., cycling and walking, along with urban public transportation). As a consequence, specific areas of the city have their environment affected by negative externalities. Among the consequences of the intense car use in urban areas are: traffic congestion, the steady energy consumption growth in the transportation sector, and the increase of emissions of toxic gases, such as CO_2.

Another problem of urban areas that strongly influences transportation planning is the dispersed pattern of spatial growth currently observed in many Brazilian cities. The location of new houses and services in peripheral areas, distant from the central areas, is affecting the displacement patterns. The cities are often not prepared to serve this new demand as a consequence of missing planning guidelines. Moreover, the sometimes clear dissociation between urban and transportation planning, as in the case of land-use planning, has affected many urban services with direct consequences on urban mobility.

Although the planning processes can differ from country to country or even from city to city due to different rules, regulations, and laws, or even distinct decision-taking processes, they can be based on the same theoretical backgrounds. A recent example of such a common approach is given by some government sectors that have incorporated public participation into the process of discussion and development of municipal Master Plans.

Some cities are actually adopting a more participative and integrated model of urban planning that contrasts with many traditional planning approaches. One of the differences between these two urban planning strategies lies in the level of community engagement with the urban problems. In participative planning, every individual is entitled to bring new ideas for discussion by the group. Given the large diversity of concepts, goals, tasks, abilities, and sectors that can be represented (e.g., universities, labor unions, public and private agencies, etc.), the problems can be analyzed according to different viewpoints, what makes the discussion process more comprehensive and legitimate.

This paper introduces the conceptual framework of an interned-based Spatial Decision Support System, in order to contribute with tools that can increase public participation in urban planning decision-making processes. The objective of the system, which is currently under development, is to increase public participation in the decision-making process of a particular Brazilian medium-sized city. The architecture of the prototype is based on two free software packages that will allow users and decision makers to visualize and to analyze spatial data aiming at urban mobility assessment.

The paper is structured as follows. In the next section we discuss some issues of Participative Planning in Brazil and in some other countries. Next, we expand the traditional definition of Spatial Decision Support System in order to encompass new technologies able to assist in the participative process, including Internet, as an alternative to boost public participation. In the sequence we introduce some relevant aspects of the Spatial Decision Support System being developed; which integrates a

Geographic Information System and a Spatial Decision Support System in the web environment.

2 PARTICIPATIVE PLANNING

The chaotic urban growth of developing country cities can be associated, either as a cause or as a consequence, to many aspects: urban sprawl, extreme use of private cars, lack of urban infrastructure, high levels of environmental pollution, and many other issues that affect the citizens' quality of life. Furthermore, the importance and magnitude of these problems have pushed researchers, decision-makers and decision-takers to discuss and to look for alternatives to reduce them. The traditional planning process, in which every single problem could be independently tackled, is no longer suitable to face the current urban problems, given the strong interconnections of the problems nowadays acknowledged by researchers and managers. Another issue associated to the traditional planning process is the weak public participation, which had just an informative nature.

The participative planning methods, in which community participation is a central issue, appeared as an alternative to the traditional planning approaches still in the 1960's. At that time it was already visible that the traditional planning methods were not able to fully meet the demands of the cities and of their citizens. As a consequence, many cities worldwide are nowadays adopting public participation as a planning strategy to look for alternatives for tackling numerous urban problems.

In the process of participative planning each participant brings contributions to the discussion, in the form of ideas, goals, tasks, abilities and the positions of the sectors of the community they speak for. Therefore, the problems can be analyzed under different viewpoints, what widens the discussion process and makes it more inclusive. Some intrinsic characteristics of the process are: *i*) diversity of participants and interests; *ii*) increase in the involvement of individuals among themselves and with the decision-making tools; and *iii*) changes in the planning process and methods, given that the process is closely related to the political context of the city.

The difference between traditional planning and participative planning becomes clear in the first stage of the process. In the later, community engagement occurs at the beginning of the procedures while in the traditional process the first stage involves only the technical staff. The differences become even more evident during the process (see Figure 1).

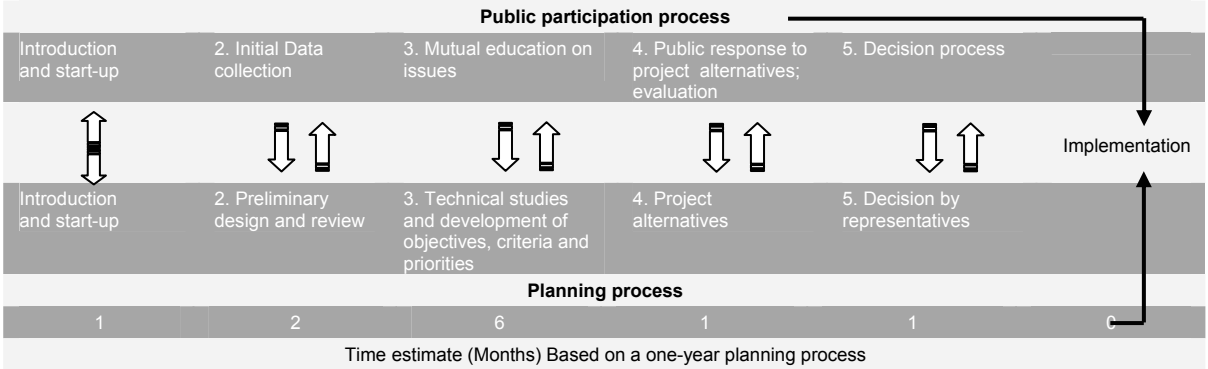

Figure 1 The process of participative planning

Source: Connor (s/d)

The decision of the planning process to be implemented by the municipality is also strongly influenced by the government system, i.e., the level of participation and freedom of the overall community and of those who represent it (see Figures 2 and 3). It ranges from the mere transmission of information (if any) in dictatorships to the full engagement of the community in democratic governments.

Autocracy	Technocracy	Democracy	Citizenship
← To inform	To consult	To discuss	To share →
Manipulation	Information	Delegation	Partnership

Figure 2 The role of public participation in urban planning under distinct political conditions
Source: Laurini (2001)

FORMS OF PARTICIPATION	DESCRIPTION
1. Manipulative Participation	Community participation is limited to the presence of people's representatives, who are unelected and have no power, on official boards
2. Passive Participation	Communities participate by being told what has been decided or already happened by an administration or project management
3. Participation by Consultation	Communities participate by being consulted or by answering questions. Such a consultative process does not concede any share in decision making, and professionals are under no obligation to take on board people's views
4. Participation for material incentives	Communities participate by contributing resources such as labour, in return for material incentives (e.g. food, cash)
5. Functional Participation	Community participation is seen by external agencies as a means to achieve project goals. People may be involved in decision making, but only after major decisions have already been made by external agents
6. Interactive Participation	People participate in joint analysis, development of action plans and formation or strengthening of local institutions. Participation is seen as a right, not just the means to achieve project goals
7. Self-mobilization	People participate by taking initiatives independently of external institutions to change systems

Figure 3 Levels of public participation in the decision making process
Source: Adapted from Alen, Kilvington, and Horn (2002)

The level of public involvement in the decision-making process in Brazil is still weak if compared to other countries. This is probably a result of several years under a non-democratic regime. In that case, the role of the community was only to receive the information provided by the government. However, if we compare what is happening nowadays with the urban planning process in the 1960's and 1970's, when public participation was passive, we clearly identify a significant progress in the decision making process in terms of public involvement.

Even today the participative process occurs mainly at the local level, i.e., it is based on the traditional participation form. In that model, presential meetings are required to group together the planners and the individuals who stand for the several groups involved in the process: different government levels and segments of the community. These meetings may be thematic and/or respecting a geographical division. The

participants may vary depending on the context, what may become a problem. If the meetings are set according to a geographical division, solutions for land-use, transportation, and environment problems of one area may have impacts on other area. All these questions might be discussed and analyzed by the decision makers along with the community, in order to be considered in new plans or projects.

Public participation in the planning process does not always take place in similar fashions in different places and countries. Some places have already intensely adopted new technologies, for example, the use of internet, as a way to increase the number of participants in the decision-making process. On the other hand, the process in Brazil is still essentially in the form of presential meetings. The differences of these approaches will be discussed in the next sections of this paper, when the advantages of using internet in the process will be highlighted.

2.1 The Brazilian Participative Planning

The urban planning process experienced two major shifts in Brazil in the last fifty years. The first phase corresponds to the period when Sectorial Planning was emphasized, during the 1960`s; while the second phase occurred when Participative Planning started to be highlighted, in the late 1980`s. The former was part of a comprehensive policy for urban planning development through SERFHAU (i.e., the National Service for Housing and Urban Planning), which was the central agency in charge of developing Master Plans for most Brazilian cities.

The problem then was that the agency was often working without a specific knowledge of the local reality of the cities. Moreover, the plans were based primarily on functional aspects of the city (e.g., land-use, transportation, health, education, etc). The paradox, however, was in the absence of links connecting many of those sectors where the connections are evident. For example, transportation planning was treated apart from land use planning and from environment planning. Also the planning time horizon was not very realistic. The plans were developed for a period of twenty years ahead without any space for changes in the meantime, notwithstanding the very dynamic nature of the urban environment.

Public participation become visible in the urban context of the country only in the 1980`s as part of the political movement asking for democracy and against the military government. The landmark of participative planning in that decade was the new Federal Constitution, which was passed in 1988. One of the important points of the new Constitution regarding urban issues was that it became mandatory for cities larger than 20,000 inhabitants to have a Master Plan. This requirement was defined as a *basic instrument for an urban development policy*. The big change in relation to the past was the simultaneous treatment of spatial, physical, social, economical and environmental aspects, along with public participation. Community participation was indeed the main characteristic of the discussion of new plans throughout the several planning stages.

Porto Alegre, capital of the Brazilian State of Rio Grande do Sul, was the first city to introduce community participation in the planning process. The first attempt took place in the late 1990`s, when the community was called to discuss the budget of the city. In a second moment, the participative process was expanded to include discussions about the city Master Plan, which was named Environmental Urban Development. This was the first master plan in the country that had the effective participation of the community in the decision making process. The result was a plan

with innovative urban strategies that soon became a reference for other cities. In both instances, the meetings were scheduled by the planning team in predefined times and places in order to promote the discussion of the planning alternatives and strategies.

Another policy tool that has been thought for controlling urban growth and spatial dispersion is the Statute of the City, which is composed by several laws containing essential urban policy instruments for the development of city master plans. The focal point of the urban development policies now set by the federal government is the democratic use of the urban spaces and services. This is a strategy to reduce inequity and to promote sustainable development. The full implementation of these policies, however, will only take place if the community is truly involved in the discussions of the problems of the neighborhood, of the city, of the state, and of the country. It is also important to stress that community participation cannot be limited only to the development of the master plan, but it has to go through afterwards, in a permanent monitoring effort. This is needed to assure that the plan will be constantly evaluated and updated and that its evolution will actually meet the demands of the citizens.

2.2 The Participative Planning and *Internet*

In many countries, the public participation process has been combined with the use of innovative computers tools, as a way to increase the number of participants in the discussion of the urban problems that are part of the decision-making process. *Internet* is certainly one of these tools, whit the advantage that it is already part of the routine of many people. One of the most visible benefits of Internet is certainly the fast and efficient access to information of many different fields and to a large number of users. In addition, the websites and portals now have many distinct features: a new linguistic style; new models for information storage and organization; spatially referenced data and appropriate visualization resources (e.g., hypertext, multimedia, and hypermedia); search engines; and electronic kiosks.

This complex infrastructure facilitates the social, commercial and administrative relationships by reducing the barriers imposed by the physical separation of users. Thus, it narrows the distance between users and the huge amount of information available in the cyberspace that although virtual is now accessible to anyone. According to Kingston *et al* (2003 *apud* Geertman and Stillwell, 2003), Internet can be considered the most democratic tool ever created by our civilization, because it reduces the distance between information and users connected to the global network to just a mouse click. The remaining problem, however, is that not everyone is connected to the web. In many countries, such as Brazil, the number of people that do not have access to the technology is unfortunately still very large.

In the governmental sector, many cities worldwide (and that includes Brazilian cities) are using *Internet* to provide information to the community, what have somehow improved the relationships between the administrative and political instances of distinct government levels and the citizens. Among the different kinds of information available one can frequently find: legislation, geographic data, descriptive information, e-mail contacts and, although not so often, channels for participative planning.

If public involvement in the urban planning process has increased significantly in recent years in Europe and in the United States, Internet has played an important

role as an instrument for community participation and interaction. Although the participative planning process usually demands more time than traditional planning, it allows the involvement of different community segments and sectors in the discussion of the urban planning problems. Although this naturally reveals differences of interest between participants in this process, the final outcome is a more democratic planning practice (Geertman and Stillwell, 2003).

Several international experiences show the public engagement in local decision-making processes through Internet. In those experiences the web is accessed from many different locations: residences, workplaces, schools, and public spaces (e.g., cybercafes). In most cases, the public participation process starts from an *Internet* page where the user can always find, independently from the place and time of the access, general information about the planning subject (e.g., city figures). In that phase, the information search may be interactive, through either direct or indirect processes, or even non-interactive. The most common web page structure in the case of non-interactive information are lists (or links to lists) of geographical data, census data or documents containing local regulations and legislation.

The public participation begins to be interactive when some sort of communication flow is established between the public and the planners or the technical staff. This may happen in many different forms: through questionnaires (e.g., about specific urban problems) submitted to users, through appropriate channels for suggestions and complains, or through information services available by direct contact (for example, by e-mail). The community online participation in the decision process may occur in direct forms (although in virtual space), for example, through a system that provides a visual representation of the spatial interventions suggested by the users in the form of maps and pictures of prospective scenarios. The cases described in the literature confirm that the implementation of public participation processes through *Internet* have indeed increased the number of participants engaged in local decision making processes. In the case of Brazil, however, according to Magagnin *et al.* (2004), the use of *Internet* to promote public participation in decision making processes for municipal planning is still essentially limited to e-mail contacts.

In summary, a current trend of urban and transportation innovative planning initiatives implemented worldwide is the development of web-based Spatial Decision Support Systems (SDSS) that rely on public participation for the decision-making process. However, a common characteristic of many of these projects is the use of commercial software packages in the SDSS, what can in some cases add significant costs to the project. In the case of developing countries, such as Brazil, only the additional costs of software acquisition can make the entire project unfeasible, as discussed in the next section.

3 THE SPATIAL DECISON SUPPORT SYSTEMS IN THE WEB

Several computer tools developed between 1960 and 1970 have improved the planning process. In the case of urban and transportation planning, GIS (*Geographic Information System*) and DSS (*Decision Support System*) were particularly important in that improvement. DSS has been used for data management, modeling, and strategic planning support. Moreover, the 1980's and 1990's witnessed an intense technological development in database management and spatial visualization, which was in both cases immediately associated to the new GIS generations coming up. Also the development of even more sophisticated tools for analysis, simulation and

spatial modeling in the late 1990's was very useful for planners working in urban and transportation planning. Multimedia and virtual reality were included among the latest technological advances that can be incorporated into the planning activity, together with emergent techniques such as artificial neural networks, fuzzy logic, genetic algorithms, etc. (Huxhold, 1991; Brail and Klosterman, 2001; Yigitcanlar, 2001; Geertman and Stillwell, 2003).

The continuous technological development made GIS useful not only for storage and analysis of spatial information, but also a platform for the simulation of urban planning scenarios based on either ground-breaking techniques or models and techniques adapted from traditional planning (Shiffer, 1992). The technological development of hardware and software particularly directed to *Internet* were equally important to urban planning, because they made possible a very efficient exchange of large datasets in distinct formats (e.g., sounds, images, pictures, videos, documents, and maps) and to a large number of users, through multimedia and hypermedia resources (Klosterman, 2001 *apud* Brail and Klosterman, 2001; Yigitcanlar, 2001). Furthermore, it allowed the visualization of alphanumeric and graphic data through web pages in which multiple users are able to search, interact and communicate online. The only thing users are not allowed to do is to change the original data in order to protect the integrity of the databases.

The new environment has encouraged the development of systems with remote access to information, through heterogeneous platforms, with tools for interactive and online participation and with visualization and spatial modeling alternatives (Shiffer, 1992; Yigitcanlar, 2001). Many of these features (particularly the visualization and spatial analyses resources) were built into modules to be added to the most frequently used GIS packages available in the market (Klosterman, 2001 *apud* Brail and Klosterman, 2001).

The *Decision Support Systems (DSS)* and their variations, such as the *Spatial Decision Support Systems (SDSS*) and the *Planning Support Systems (PSS)* can be defined, in the case of urban and transportation planning, as computational systems able to provide support to planners and decision-makers in the analyses and search for solutions to various urban problems. In addition, they can be used to simulate and to evaluate different future scenarios. These systems usually have the following elements: a module to the acquisition of information (that includes metadata and information about the software itself), a module to control the project evolution, models for analyses and simulation, and output alternatives to visualize the results and the steps to be followed for implementation (Turban and Aronson, 1998, *apud* Laurini, 2001).

SDSS are built to provide support to complex spatial problems. They have the essential components of a DSS, such as databases (in the case of SDSS, with spatial and non-spatial data) and analytical and simulation models, in addition to a GIS user interface. The main difference between the DSS and the SDSS, however, lies in the special tools that may be built in the later: resources to the construction of alternative scenarios, and tools for the management of discussion groups and public participation. According to Geertman and Stillwell (2003) they are the perfect environment for planners and decision-makers who want to work with participative techniques.

According to Laurini (2001), an information system for urban planning must have tools that all participants can rely on to discuss or to negotiate the solutions for several urban problems. In addition, the system shall allow a permanent monitoring process. It is also important that users can take into consideration different risk levels in the construction and selection of alternative scenarios. The components of the decision process based on computers systems are: data, decision models, decision environment (in this case, the city) and people. All these elements may have an influence in the selection of alternative scenarios (Yigitcanlar, 2001; Brail and Klosterman, 2001). Furthermore, the way participants interact in the process places different requirements on the system, given that the participatory process can occur in different time and place conditions, as shown in Table 1. For each one of the combinations of time and location described in Table 1 there is a specific computational architecture that better serves it. They vary from single machines to more complex solutions, as the one presented in Figure 4.

Table 1 Arrangement of meetings as a combination of time and place

	SAME TIME	**DIFFERENT TIMES**
SAME PLACE Local area network Local meeting	Conventional meeting Computers connected in a network	Storyboard meeting Computers connected in a network
DIFFERENT PLACES Web environment	Conference call meeting Teleconferencing meeting Interactive desktop audio and video	Distributed meeting E-mail, broadband network, network-resident multimedia tools

Source: Adapted from Jankowski and Nyerges (2001).

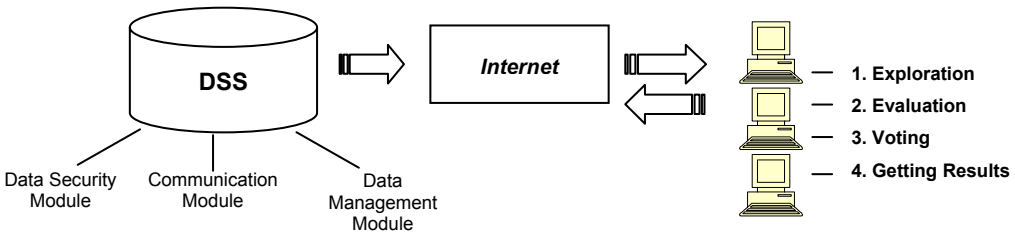

Figure 4 Architecture of SDSS for distributed public participation
Source: Laurini, 2001.

Based on the systems described in the literature we are now working on the development of a system to promote an integrated and sustainable urban and transportation planning process, as discussed in the sequence.

4. PLANUTS - A SDSS FOR SUSTAINABLE AND INTEGRATED URBAN AND TRANSPORTATION PLANNING

The proposed Spatial Decision Support System is meant to be used for evaluating, planning and monitoring urban sustainable mobility in Brazilian medium-sized cities. Therefore, it has to combine traditional techniques with new tools for urban and

transportation planning (in the case of public participation) in order to support integrated and participative decision-making processes. The literature review that showed the alternatives for the development of the system led to the selection of the following freeware GIS packages: Spring and Springweb, developed by the Brazilian Institute of Spatial Research (INPE). The free acquisition of software is a key element for the implementation of such a system in developing country cities, given that most medium-sized municipalities have a limited budget and they still have to invest in hardware to make the system operational. Given that not all GIS packages have good specific tools for urban and transportation planning and that it is not easy to find robust free Decision Support Systems, we decided to combine the freeware GIS packages Spring and Springweb with multimedia and hypermedia resources for building a web-based SDSS. This will be tested in a pilot application Brazilian medium-sized city. A major goal of the project is to promote public participation in planning and decision-making processes.

The base of the system is thus a GIS platform, with some tools running on the web to allow public participation. These tools will be accessed through the homepage of the project portal. In that virtual environment any single user will be able to: browse the GIS database through the Springweb interface; exchange information with the project managers and planners via e-mail, online forums, etc; access the evaluation and voting stages; visualize images (i.e., pictures, photos or videos) of the main city problems; and get additional information required for the decision-making process. The system shall also consider the use of traditional planning techniques (for example, multi-criteria analyses), particularly those that benefit from community interaction.

4.1 The System Framework

The selection of the GIS package to be the foundation of the system was based on the following criteria. It should have spatial analyses tools potentially useful for the decision-making process and tools to make information available to the community through the web. In addition, it should have multi-criteria analyses tools and public communication tools. All these elements have to be combined into a single system, as summarized in Figure 5.

- ***The GIS platform*** has a direct interface with the Project Team. This access is done locally (through the workstation where the software is installed), allowing the insertion, management and manipulation of all data required or produced. Using spatial analysis tools, such as multi-criteria evaluation techniques, it is possible to calculate general criteria weights from the data collected in the criteria evaluation database and, therefore, to generate evaluation scenarios, integrating the data stored in the criteria evaluation database. The results of all the operations are stored in the GIS database, providing a way to produce several outputs, as well as an interface to other platforms, in this case, the web GIS.
- ***The web GIS*** allows the visualization of the local GIS database contents and of maps built to illustrate prospective scenarios. In other words, the web GIS creates a web interface between data stored in the GIS database and the new maps remotely generated.
- ***The project website*** will provide the structuring environment of the system, given that all information flows between the project team and the community will take

place through it. That includes communication channels, such as e-mail and forums, electronic surveys and polls, and access to data to run the analyses tools.

- ***The evaluation module*** is a set of questionnaires and forms designed to collect, through a user-friendly web interface, the data provided by the public in the criteria evaluation phase. It shall be able to obtain the relative importance (weight) that every single user gives to each criterion regarding specific urban mobility issues and subsequently store the results of the evaluations in a database (i.e., the criteria evaluation database).
- **The database** will be managed and accessed by the **GIS platform** for storing all georeferenced information and for generating scenarios, and by the **evaluation module** for storing the results of the evaluations carried out by the community.

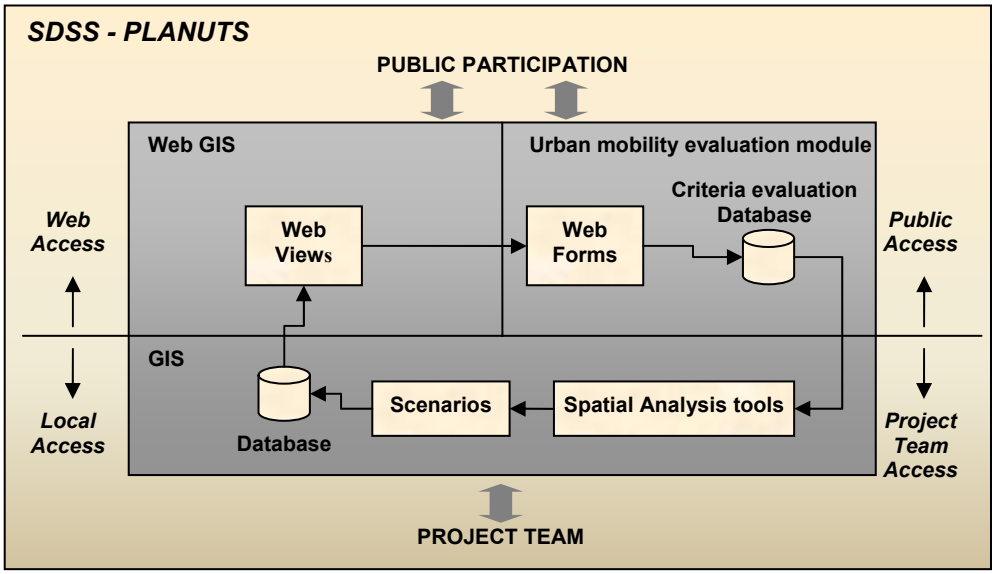

Figure 5 Framework of the proposed SDSS

The Spring GIS, which will be used in the system, has the following characteristics: *i*) its geographic databases do not have any logical boundaries (i.e., it is not limited by scales, projections or Earth zones); *ii*) its database supports very large datasets; *iii*) it works with vector, raster and remote sensing data; *iv*) it allows the insertion of image models, thematic models, cadastral models, networks, and digital terrain models, which are the main elements usually considered in urban and transportation planning; *v*) it has a module for web implementation, named Springweb (Câmara *et al.*, 1996).

The GIS package is the spine of PLANUTS because it is in charge of the alphanumeric and spatial databases, which are the key elements in the decision-making process. All input data (vector maps, tables, photos, etc.) will be first introduced in the Spring database (offline*)* and only subsequently exported to Springweb. The Springweb database will then be online accessed by the public through the project website. Multimedia and hypermedia resources will be incorporated in the process in order to provide more elements for the evaluation phase to be conducted by the community. Springweb will work as the interface element to bring to the users the alphanumeric and spatial data coming from Spring.

The selection of the GIS package had to be associated with the definition of the database management system. The software Access (Microsoft) was chosen

essentially due to the following aspects: *i*) the data handling process (by the team project) is not too complicated, and *ii*) it allows the insertion of new data after the evaluation phase.

The evaluation module of urban mobility is currently under construction. At present, a preliminary version of it is being tested to be later transferred to the web module. The theoretical background for its development comes from the work of Costa (2003), who has selected 115 mobility indicators in the following five categories: Transportation and Environment, Urban Mobility Management, Infrastructure and Technologies, Spatial Planning and Transportation Demand, and Socio-economic Aspects of Transportation. Some of these indicators will have now to be combined because of their similarity and some of them will have to be disregarded because there is no data available (mainly environmental data) in most Brazilian cities for their calculation. Figure 6 shows the process for the definition of urban sustainable mobility indicators implemented in PLANUTS.

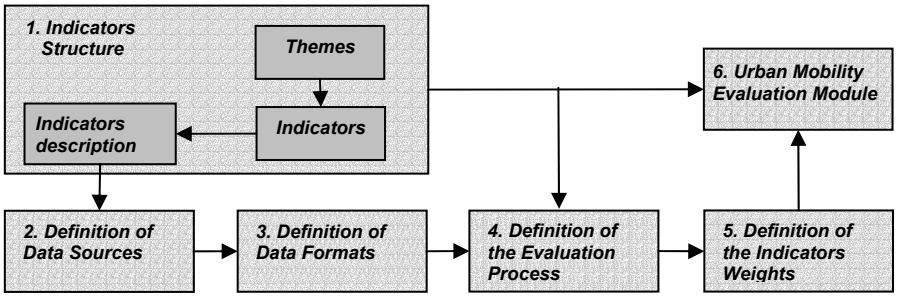

Figure 6 Process for the definition of urban sustainable mobility indicators for PLANUTS

The evaluation process of the urban mobility indicators shall be done in two stages. In the first stage, the community members conduct pairwise comparisons of the following general categories: Environment, Management, Infrastructure, Planning and Socio-Economics Aspects. Only subsequently the indicators associated to each category are appraised. All information has to be stored in the Spring database in order to become input for multi-criteria analyses and to generate thematic maps as outputs.

4.2 Present and Future of PLANUTS

As soon as we defined the GIS platform and the associated database management system, PLANUTS started to be built. The initial works were divided in two stages: *i*) introduction of records in the database, and *ii*) construction of the project website. For the pilot application the database was fed with data of the city of Bauru, which is a medium-sized city located in the State of São Paulo, Brazil. That database shall have all data needed for the evaluation of urban mobility conditions in the city. The construction of the project portal started simultaneously, with the following information: *i*) a *homepage* containing a description of the Spatial Decision Support System for Integrated and Sustainable Urban and Transportation Planning (PLANUTS); *ii*) a page containing descriptive Information about the city of Bauru (i.e., figures and facts); *iii*) a page with a link to the SDSS itself and access to the project databases, through Springweb; and *iv*) a section for users' registration in the system and ways to exchange information with the team project. Additional elements will be later introduced to meet the system needs.

The public participation module, which is built using the Microsoft packages Access and FrontPage, focus on the evaluation of urban mobility and it is about to be ready for tests. The evaluation data to be stored in the system database is remotely obtained from the community participants through their analyses of mobility indicators. The interface for public interaction will be developed only after the public participation module is ready and it is approved in the tests. However, we can see sketches of the future webpages on the right-hand side of Figure 7, along with the PLANUTS homepage, on the left-hand side of the same Figure.

First part of the Evaluation Module

Homepage

Page for the Evaluation of the Environment Category

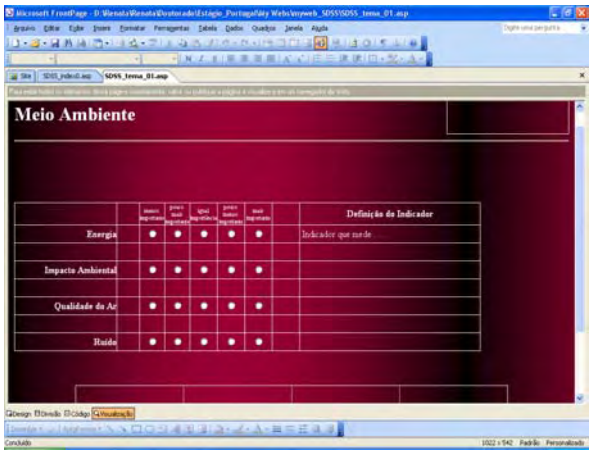

Figure 7 Selected pages of the PLANUTS portal

5. CONCLUSION

The choice of a planning process to be adopted by a municipality has a direct influence on the type of decision support system that better suits the local needs. Once defined the system, the project team has to concentrate on the definition of the indicators that will be part of the evaluation system. That is only possible, however, if the team is sufficiently informed about the existing data in the city, given that the estimation of indicators is highly dependent on the quantity and quality of specific data. Moreover, if a significant share of the required data is not available, the municipality shall look for partnerships (with universities and research institutes, for

example) in order to get it. This problem is quite common in developing country cities, particularly whit regard to environmental aspects, and it can significantly reduce the potential of the system if not appropriately tackled. That is the reason why, more than just a computational solution, PLANUTS intends to be an instrument to stimulate the development of planning practices and to help planners to overcome institutional and sometimes cultural barriers.

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