Project for the management of the Municipal Development Plan of Venice

P. Barbieri & S. Mazzariol,
City of Venice, Italy

M. Rumor
IUAV University of Venice, Italy

A. Scottà
Geodan IT BV, Holland

ABSTRACT: Following the innovations introduced by Urbanistic Regional Law no.11/2004 the Veneto Region has also defined, through specific guidelines, the structure and content of the data necessary to form the design documents and the interdisciplinary datasets to support the preparation of the city planning, now divided into a Urban Structure Plan (PAT: "Piano di Assetto del Territorio") and an Operational Plan (PI: "Piano degli Interventi"). These regional guide specifications are strongly oriented towards the implementation of geographic information systems (GIS) finalized to the land planning and management. Within this context, the City of Venice has initiated the design and development of its geoDBMS and related software for the management of the new planning instruments, in compliance with the GIS standards adopted by the city. The aim of this paper is to illustrate the main characteristics of the project and development prospects from the conceptual , organizational and technical point of view.

INTRODUCTION: VENETO'S URBAN PLANNING LAW AND NEW PLANNING INSTRUMENTS

In the last few years, the regulations concerning urban planning in Veneto, like in other Italian regions, have been radically innovated through Regional Law no. 11 introduced on the 23rd of April 2004 (Barel 2004). The law aims to achieve "sustainable land development" through the simplification of the procedures, the involvement of citizens and stakeholders, by enhancing participation and agreements between the public and private sectors, and the adoption and use of an "unified and accessible geographical information system." A specific chapter of the law is devoted to this last issue – the main focus of this paper – which concerns "Information Coordination and Integration" and focuses on the interdisciplinary spatial datasets in order to support the planning instruments. The fundamental idea is that these interdisciplinary spatial datasets "are part of the geographical information systems of the city, province, and region, as well as of the private and public subjects" who contribute to the management and update of the land and environment information. Specific "guidelines" issued by the Regional Council describe in detail the structure and content of the (geo)datasets that are necessary to set up the design documents and the information bases used for the analyses. The region guidelines form a sort of manual for the preparation of the planning instruments. Another important aspect is represented by the definition of parameters used to assess the interdisciplinary spatial datasets through technical and statistical procedures aimed at monitoring the information quality.

The innovative nature of the Urban Planning Law of the Veneto region – aside from the technical-methodological, as well as regulatory perspective point of view, with legal institutions such as the system for the distribution of building rights to landowners (planning equalization), "building credit", and the Strategic Environmental Impact Assessment (VAS: "Valutazione Ambientale Strategica") implementing European Directive 2001/42/EC – is especially evident in terms of city's planning instruments. The traditional General Development Plan (PRG: "Piano Regolatore Generale"), now designated as the Municipal Development Plan (PRC:

"Piano Regolatore Comunale"), has been modified so as to be divided into structural provisions, included in the Urban Structure Plan (PAT: "Piano di Assetto del Territorio") and operational provisions that are included in the Operational Plan (PI: "Piano degli Interventi"). The PAT "is the planning instrument which outlines the strategic choices concerning the structure and development governing the City's land. It points out the specific vocations and invariants – geological, geo-morphological, hydro-geological, landscape, environmental, historic-monumental, and architectural – according to the targets and guidelines set out in the land planning at a higher level, as well as based on the needs of the local community." The PI is the planning instrument which, while respecting and implementing the PAT, singles out and governs all actions aimed at protecting and transforming the land, by planning – at the same time – the creation and/or reorganization of human settlements and related building activities (network and transit services and infrastructures). In other words, from the perspective of their content, the PAT is a "structure plan;" whereas, the PI centres on homogeneous areas like the old PRG's; however, significantly, it also includes a time planning horizon.

On the basis of this regulatory and technical-conceptual framework, the Veneto region is witnessing the development of a new urban planning season, which thoroughly effects the over 500 municipalities in the region. These municipalities are all required to prepare their new planning instruments, starting from the PAT.

INFORMATION BASES FOR THE PREPARATION OF THE URBAN STRUCTURE PLAN (PAT)

As mentioned in the introduction, the guidelines issued by the Regional Council define in a comprehensive way the structure and content of the information bases necessary to prepare the PAT, and, subsequently, the PI. The information is divided into three main groups:
a – Basic Cartography: containing basic maps of the region, carried out by each municipality, and the survey of the municipal boundaries;
b – The Project: including the PAT design documents (national heritage map, invariants map, fragility map, transformation map);
c – The Interdisciplinary Spatial Datasets (QC: "Quadro Conoscitivo"): including all the information (found in other official sources or produced by the City itself) necessary to systematically understand the area under examination, and useful for the preparation of the project.

Within each group, the information is further divided hierarchically into matrixes, themes and classes. Overall there are sixteen matrixes. We list them here, in order to provide an idea of the interdisciplinary contents of the information bases:

1. Basic Land Information (group a)
2. Restrictions and Land Planning (group b)
3. Invariants (group b)
4. Fragility (group b)
5. Transformability (group b)
6. Basic Land Information (group c)
7. Air (group c)
8. Climate (group c)
9. Water (group c)
10. Soil and Subsoil (group c)
11. Biodiversity (group c)
12. Landscape (group c)
13. Cultural and Architectural Heritage (group c)
14. Physical Pollutants (group c)
15. Economy and Society (group c)
16. Planning and Restrictions (group c)

Overall, there are 99 themes and 377 classes (approximate number, as it is possible to both omit classes, stating the reason, and add new ones for special needs). Each class represents a

different information level which corresponds to files featuring a different nature and format. The classes in Group “a”/Cartography are shapefiles; the classes in Group “b”/Project include shapefiles and pdf files; the Group “c”/Interdisciplinary Spatial Datasets can include several file formats (shape, raster, database, spreadsheet, etc.). The main classes (approx. 100) are accompanied by detailed datasheets reporting information as the file name, the geometry type, the data type and structure, eventually the symbology, and references to regulations, as well as other information useful to the construction of the dataset. Furthermore, in compliance with the ISO standards, specific metadata are to be compiled for each class according to the provisions set out in the guidelines published by the National Centre for the Information Technology within Public Administration (CNIPA).

THE PROJECT IN CONTEXT – THE CITY OF VENICE

It is clear that the new planning instruments (PAT and PI) of the City require the design and development of a specific GIS to organize and manage the spatial information. In the case of the City of Venice, an essentially file-based approach, no matter how advanced, is likely to be inadequate and limited. This is due to the complexity and peculiarity of the area, especially in regard to the management of the PAT, the PI, and the supporting Interdisciplinary Spatial Datasets. This complexity (the historic city, the lagoon environment, the industrial park in Marghera, Mestre’s conurbation), together with the considerable size of the area (41,316 hectares overall, of which 16,014 represented by dry land and 25,302 by lagoon water; with a resident population amounting to 276,000 inhabitants, but, in fact, corresponding to 300,000 steady city users, excluding the tourists) translates into an equally complex urban planning history. After the first development plan in 1962, the City witnessed a proliferation of variations in the General Development Plan and implementation plans. Only from the mid-1990s these interventions found a common reference framework in the Preliminary Draft of the new General Development Plan (Benevolo 1996) and, more recently, in the municipal Strategic Plan. The documents currently in force or under approval (pursuant to the previous regional urban planning law) include 11 major Variations (indicated by different colours in Figure 1), tens of minor ones (linked to isolated settlements or roads), as well as about 300 implementation plans carried out by subjects in both the private and public sector.

It should be kept in mind that, in the preparation of the PAT (Venice City Council 2007), being it an element of the Interdisciplinary Spatial Datasets, as well as, operatively, during the programming and management of the PI, it is a matter of placing all these Variations and implementation plans into a “mosaic” whose data structure must be homogeneous. This situation gives rise to the need to prepare a new technological and organizational framework centred on a common geoDBMS (Zlatanova & Stoter 2006). Consequently, we will have at our disposal an instrument that is suitable for the management and variation processes of the new Municipal Development Plan, and able to guarantee the essential conditions of data security and integrity. The chosen platform (ESRI/Oracle Spatial) maintains a continuity with the software environment used so far by the City’s Urban Planning Department and fits to the standards adopted by the just in use City’s Spatial Data Infrastructure and by the Municipal GIS Project currently under implementation. The first part of the project, which is described below, refers to the PAT. Instead, during the second part, the system will be completed to include also the creation and the management of the PI.

It’s suitable to notice that the Spatial Data Infrastructure of the City of Venice (Rumor et al. 2004), includes the cartographic geoDB (according to the specifications set out by the national working group called “Agreement between State, Regions and Local Authorities on Geographical Information Systems”), the digital orthophoto map and the cadastral maps. The cartographic geoDB performs the role of basic cartography in the Group “a”of the Interdisciplinary Spatial Datasets (see above, previous section).

Figure 1. Major Variations of the Venice General Development Plan.

THE PROJECT FOR THE MANAGEMENT OF THE PAT (AND, SUBSEQUENTLY, THE PI) OF THE CITY OF VENICE

The project has been started in April 2008 and conducted by the company entrusted with the task – Geodan IT BV, Amsterdam, Holland – together with the City's staff.

The system architecture, illustrated in Figure 2, consists of the following components:

1. ESRI Desktop ArcGIS 9.2: for the display and management of the Municipal Development Plan (PRC) geodatabase;
2. PRC Extension in ArcMap includes non-standard geodatabase management functions required by version management and the upgrading of the City's planning instruments;
3. ESRI ArcSDE 9.2: the interface between the Desktop ArcGIS and the Oracle Spatial database;
4. GDB PRC: the geodatabase developed in Oracle Spatial 10.2, including spatial data not related to Group "b"/Project, and the classes of Group "c"/ Interdisciplinary Spatial Datasets;
5. ArcGIS Server 9.2: used to publish data through services in an architecture which is directed towards services based on standards such as W3C, OGC, ISO, OASIS.

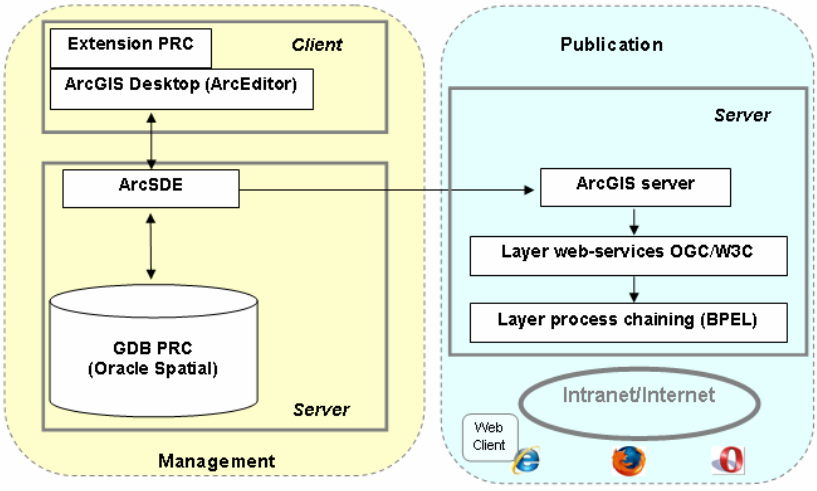

Figure 2. The system architecture.

The database model is implemented on the basis of regional specifications, but in compliance with the standardizations rules.in order to avoid redundancy and inconsistency related problems. The database is filled and managed by means of the PRC Extension implemented and integrated with Desktop ArcGIS. The extension includes functions developed ad-hoc for the municipality of Venice, including a generic import module (with structure, geometric and topological checks), an export module to export data according to the specifications imposed by the region and a set of management tools to facilitate the edit process for the spatial planners of the municipality in charge to modify the datasets according to the new urban plans of the city. Figure 3 shows the PRC extension integrated with the desktop of ArcGIS.

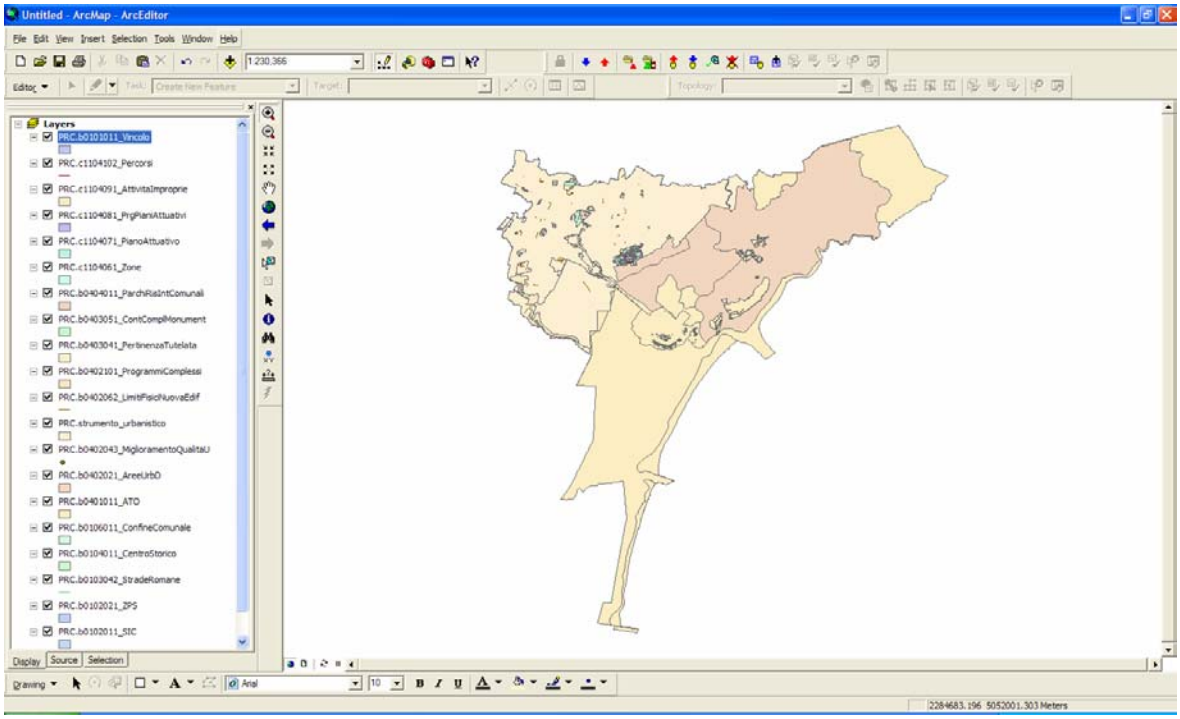

Figure 3. The PRC extension integrated with the ArcGIS Desktop

Users with different profiles and privileges can access the data through the extension, then display, extract and edit them, following a check-in/check-out mechanism which is part of the extension. The user selects geographically the data to be exported (check-out), edits the exported objects, and updates the geodatabase through a check-in operation. The objects which have been exported by a user, during a check-out operation, cannot be exported by other users (check-out module implementing pessimistic locking). This mechanism makes it possible to edit the data without requiring a connection to the central database. The software facilitates management of the life cycle of a planning instrument. It is assumed, in fact, that the planning instruments can take on different versions (or statuses), depending on their life cycle: proposal, adoption, approval, and, if necessary, withdrawal (historical archiving). The life cycle of a planning instrument is represented graphically, in a simplified way, by the diagram in Figure 4.

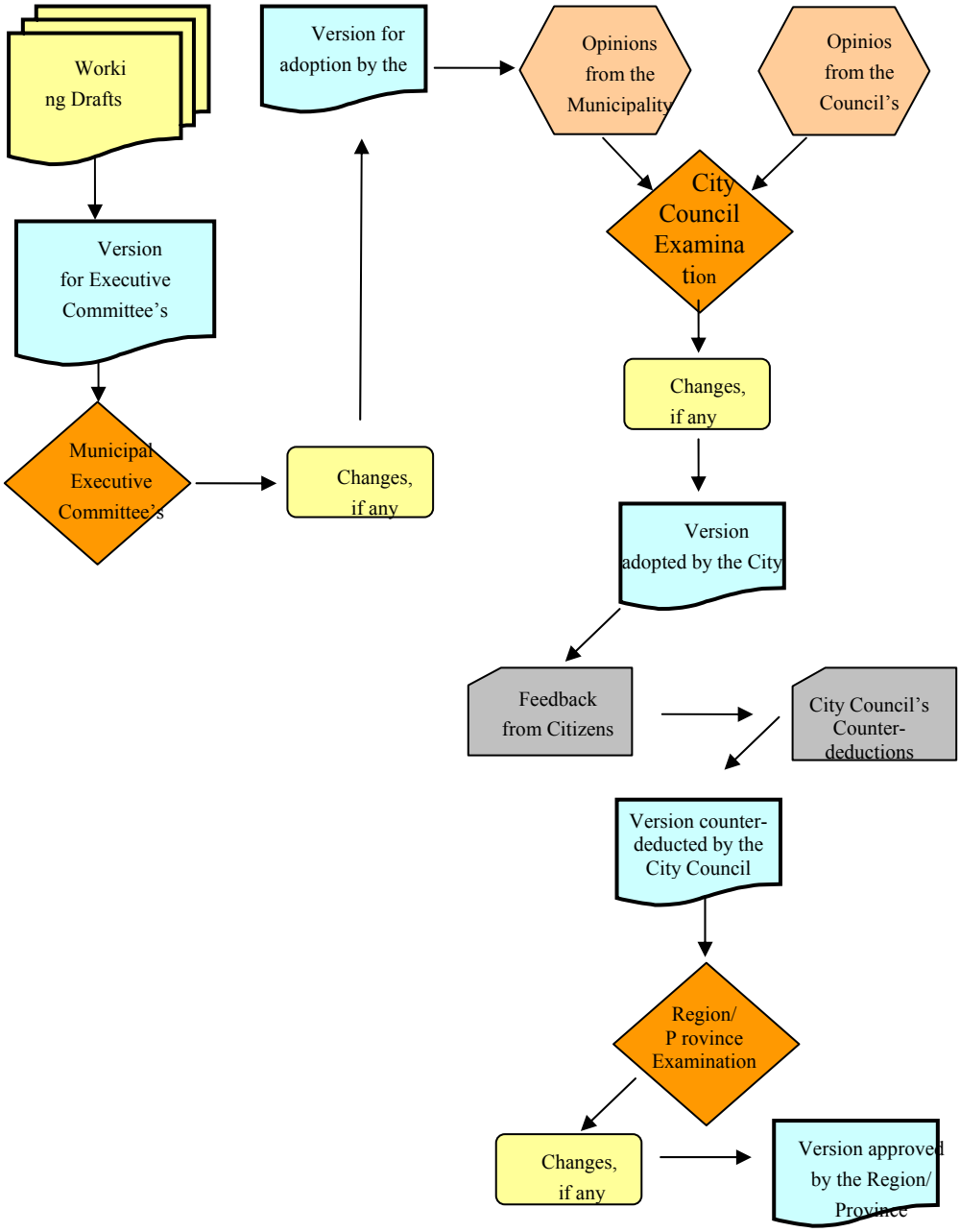

Fig. 4. The life cycle of a planning instrument

FURTHER DEVELOPMENTS

A future development of the project will be the possibility to access data through the Internet. We plan to configure an architecture based on Internet services and centred on aspects such as standardization, distribution, and interoperability. Concepts such as service-oriented architectures (SOA), and internet services based on standards (e.g., ISO, OGC, W3C, OASIS) are topical issues in the fields of information technology and communication, as well as in the world of geo-information, as they represent the right solutions in an infrastructure that needs to be interoperable and flexible in case of modification.

The data of the Municipal Development Plan database, both spatial and administrative, are published using internet services developed and managed with ArcGIS Server ("internet services" layer in Figure 2). These services, which can also be accessed using the SOAP

standard protocol (Simple Object Access Protocol), can eventually be concatenated (Service Chains, Gehlot & Verbree 2006), for instance, by using the BPEL standard language (Business Process Execution Language, "service chain" layer in Figure 2). Then they can be published according to the standards, and be ready for use in an internet client (or another type of client). The development of an internet application program based on ArcGIS Server services (or service chains) and on a client specifically created or integrated in pre-existing clients, such as Google or VirtualEarth, represents a further interesting development of the project.

CONCLUSIONS

Through the new urban planning at a municipal level introduced by the Veneto Region, which includes a clear definition of data structure and content, the City of Venice, continuing the path already started for basic cartographic data (Barbieri et al. 2005), has initiated a project whose aim is the organization of the PAT and PI data in an Oracle geoDBMS managed using ESRI software. The aim is to contribute to the creation of a geographic data infrastructure (GDI) which benefits from the significant advantages offered by geoDBMS (Rumor & Scottà 2005), is arranged according to concepts such as standardization, distribution and interoperability, and is based on new technologies. We are confident in the success of this project, and hope that the introduction of an innovative GDI for the City of Venice can make a relevant contribution in facing, with adequate tools, the difficult challenge of governing a territory which is as unique as frail and complex.

REFERENCES

Barel B. (ed.) 2004. *La legge urbanistica della Regione Veneto*. *Commentario alla L.R. del Veneto 23 aprile 2004 n.11*. Padova: Edizioni Corriere del Veneto.

Barbieri P., De Gennaro M., Rumor M. 2005. Strutturazione e gestione di informazione cartografica di base a grande scala: l'esperienza di Comune di Venezia e Regione del Veneto. *Atti della 9° Conferenza Nazionale ASITA. Catania, November 2005*.

Benevolo L. (ed.) 1996. *Venezia Il nuovo Piano Urbanistico*. Bari: Laterza.

Comune di Venezia 2007. *Piano di Assetto del Territorio – Documento Preliminare*. *Allegato alla Deliberazione della Giunta Municipale n. 533 del 05.10.2007*.

Rumor M. & Scottà A. 2005. Un'introduzione ai geoDBMS. *Almanacco della Geomatica.*

Rumor M., Barbieri P., Bresciani M., Mazzariol S. 2004. The design and the implementation of the spatial data infrastructure of the City of Venice, *24th UDMS Proceedings.*

Zlatanova S. & Stoter J. 2006. The role of DBMS in the new generation GIS architecture, In S. Rana, J. Sharma (Eds.); *Frontiers of Geographic Information Technology, pages. 155-180.*

Gehlot S. & Verbree E. 2006. Web-based sharing of a Geo-processing chain: combination and dissemination of data and services, *ISPRS IV Geospatial databases for sustainable development, Goa, September 2006, 6 p.*