KnE Engineering

STARTCON19
STARTCON19 - International Doctorate Students Conference + Lab Workshop in Civil Engineering
Volume 2020

Knowledge E
enriching | engaging | empowering

Conference Paper

Smart Urban Planning at Local Scale: e-Master Plan

Olga Gonçalves[1] and Ana Virtudes[2]

[1]PhD candidate in Civil Engineering, University of Beira Interior, Calçada Fonte do Lameiro Ed. II das Engenharias, 6201-001 Covilhã, Portugal
[2]C-MADE, Centre of Materials and Building Technologies, University of Beira Interior, Calçada Fonte do Lameiro Ed. II das Engenharias, 6201-001 Covilhã, Portugal

Abstract

Local realm, the pivotal level of the spatial planning action regarding the engage of citizens, is following its path regarding the use of Geographic Information Systems (GIS). The literature considers GIS a powerful tool, allowing a better knowledge of cities and countryside, managing them in an integrated and more efficient way. A detailed and embedded territorial knowledge ensures a most effective and successful urban management. In fact, the development of information technologies has been fostered a better interaction between planning authorities and citizens. WebGIS applications are key factors of a wider range of geographic information (GI), considering the diversity of research fields, being a communication tool of planning strategies. This article is focused on WebGIS as a skill to ensuring the effectiveness of planning process, comprising e-Platforms of transferring accurate knowledge about the urbanization and building rules; improving the procedural agility, timescale and equity of planning; and supporting the decision-making process of the urbanization and construction actions by local entities, under a complex set of data, documents, maps and drawings. The conclusion shows that WebGIS at spatial planning, guarantees a bigger satisfaction, boosting the collaboration and exchange between local authorities and citizens.

Corresponding Author:
Olga Gonçalves
virtudes@ubi.pt

Received: 7 January 2020
Accepted: 21 April 2020
Published: 3 May 2020

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the STARTCON19 Conference Committee.

1. Introduction

Portugal is following its path regarding the implementation of Geographic Information Systems (GIS) at local realm, which is the pivotal level of the spatial planning action, considering not only the urban development projects, but also the landscape enhancement. GIS has been considered by the literature a powerful tool with several advantages, allowing to know better the territories (cities and rural areas) and to manage them in an integrated and more efficient way. In fact, only an in-depth and embedded knowledge of the territory ensures the most effective and successful local management. Initially, the use of GIS in spatial planning, was often summarized by local authorities to the existence of databases of Geographic Information (GI) with internal usage purposes. Later on, the novelty of sharing the information to the population outside, was base on

simply static maps, frequently with no graphic quality, promoting doubts of interpretation among the citizens. However, the development of information technologies and the increase of the use of the Web in general, has fostered a better interaction between the spatial planning entities and citizens. For this achievement, WebGIS applications made a great contribution. Consequently, the Internet and the World Wide Web are currently key factors to provide a wider range of GI in an increasing number of research fields, becoming a necessary tool of communication regarding the contents of urban planning instruments.

In this sense, the topic of this article is the WebGIS as a main skill to ensuring the effectiveness of planning process.

On the one hand, it comprises e-platforms of transferring a deeper and more accurate knowledge to the citizens, about the rules of the urbanization and building actions. On the other hand, it improves the procedural agility, timescale and equity of planning instruments and required control by local entities, which is demanded by the analysis of each particular case of urban development project or building construction proposal, under a set of numerous data, documents, maps or drawings, which are in general complex to comprehend for citizens.

2. WebSIG at Local Scale

2.1. Action lines

Local authorities have various spheres of action [1] and are operating at the most detailed scale of spatial planning process, which is the closest to citizen's daily life.

The action lines of local authorities include tasks related to planning, investing, managing, licensing, supervising, permitting, checking or monitoring urban development and building construction processes.

The rules respecting to these action lines, should be organized in geographic databases, accessible to citizens and having an advisory, decisive and management support role.

Actually, local authorities have a broad list of tasks, in several domains which interact with each other, such as in the following [1]:

- Rural and urban equipment;
- Energy;
- Transport and communications;

- Education, vocational education and training;
- Heritage, culture and science;
- Leisure and sports;
- Social action;
- Housing;
- Civil protection;
- Environment and sanitation;
- Consumer defence;
- Development promoting;
- Municipal polices;
- External cooperation and exchange.

The previously mentioned list also includes the domain of land use planning, cities design and urban rehabilitation.

Currently, Portuguese local authorities have already e-platforms for dealing with spatial planning operations, whether new urban developments, building or retrofitting, and to support the control process required at spatial planning operations. These e-platforms are called 'e-platforms for collaborative territorial management' and are under the realm of each one of the 308 municipalities of the country, including the continental territory, plus the Azores and Madeira islands.

However, even recently, such procedures were often manually performed, the territorial information was sometimes not registered, and it was transferred only orally to citizens by local authorities. Consequently, having serious entanglements in procedures, meaning an increasing of time consuming and financial expenses.

There are no doubts about the advantages of having databases available to users, citizens in general, where the necessary geographical information for spatial planning procedures is available, such as the location x and y, or the associated alphanumeric data. The possibility of accessing to this information via web is an added value for society, development and sustainability.

The Portuguese Republic Constitution has enshrined the right for all citizens to participate and to have access to the information spread over by public authorities. This right is also ensured in the Code of Administrative Procedure, as well as at the Public Policy for Lands law, and at the Land Uses and Town Planning law [2, 3]. This spatial planning legal framework refers that local authorities are required '(...) to disseminate

data through the media, and via e-platform for collaborative territorial management, which includes the period of discussion, the way in which the citizens can present their complaints, observations or suggestions' [3].

Under the terms of the Code of Administrative Procedure (CPA) [4], a set of rules are defined to regulate the way how the Public Administration acts in face of citizens regarding the spatial planning process. It imposes a set of principles, which are compulsory for the Public Administration action, with the meaning of guaranteeing the freedom of its action and the citizens rights. It states the following requirements:

1. Principle of pursuing the public interest and protecting the rights and interests of citizens – 'There is the responsibility of the Public Administration to pursue the public interest, while respecting the legally protected rights and interests of citizens' [4];
2. Principle of collaboration with citizens – 'Public administration should work closely with citizens, in particular to provide them the information and clarification they require, supporting and stimulating their initiatives and receiving their suggestions' [4];
3. Principle of participation – 'Public administration shall ensure the participation of citizens and associations, defending their interests in the decision-making processes concerning them' [4];
4. Principle of information right – 'Citizens have the right to be informed by the person in charge at the Public Administration, whenever they request so, on the progress of the procedures that directly concern them, as well as the right to know the definitive resolutions that on them were taken' [4].

The previously referred principles [3] are enshrined in the new CPA, involving stakeholders in the planning process. There is the duty to publicizing, through the media and the 'e-platform for collaborative territorial management', the results of the decisions by local authorities, regarding the processes of elaboration, changing or revision of planning instruments, which are submitted to a public discussion.

The proximity between local institutions and citizens is crucial for citizenship, being a decisive step in the societal evolution process. Using the e-platform for collaborative territorial management, all citizens have access to the contents of spatial planning instruments, being able to 'influence' the decision-making process at local scale. Doing this, they are promoting a smarter planning strategy, in benefit of the local community as a whole.

2.2. Urban Planning Instruments

The bases of the policy for land uses, spatial planning and urbanism were already established [2].

The current legal basis of the urban planning in Portugal states that 'territorial plans are the only instruments capable of determining the classification and qualification of land uses, as well as their programming' [3]. This policy is based on the spatial planning system framework, which comprises four level of action: national, regional, inter-municipal and municipal or local.

All of them are including several planning figures, from the national level, based on the national programme for spatial planning policy, at the country scale, until the detailed local plan at the most detailed zoom of local action.

Among all these planning instruments the most important activities are happening at the local level, comprising the following figures: the Municipal Master Plan, the Urban Development Plan and the Detailed Local Plan. The latter comprises the detailed local plan for rural areas, the detailed local plan for rehabilitation of urban areas and the detailed local plan for heritage safeguarding (Fig. 1).

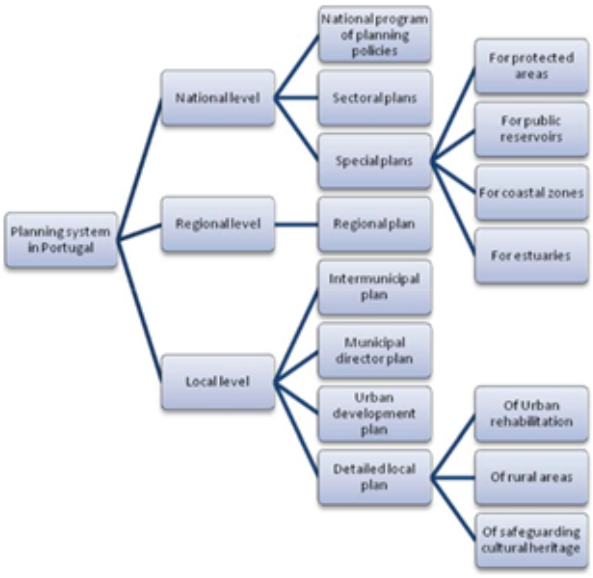

Figure 1: Spatial planning system framework [5]. (Authorship: authors own).

Some planning instruments are compulsory only for public entities. In this case, they are called 'spatial planning programmes'. Other planning instruments are compulsory for both, public entities and private stakeholders. In this case, they are called 'spatial planning plans'. The local instruments are all compulsory figures for both, private and

public entities, as the case of the inter-municipal plan, and local plans (Municipal Master Plan, Urban Development Plan and Detailed Local Plan).

Among other aspects, the contents of planning instruments should identify and programming the following aspect:

- Areas of national defence, security and civil protection;
- Natural resources and values;
- Hazardous and risk areas;
- Agricultural and forestry areas;
- Areas of energy exploration or geological resources;
- Ecological structures;
- Architectural, archaeological and landscape heritage;
- Urban system;
- Location and distribution of economic activities;
- Transport and mobility networks;
- Infrastructures and collective facilities networks.

Territorial plans are the only instruments that can propose the classification and qualification of land uses, as well as their implementation and programming. The Municipal Master Plan, which has been the pivotal figure of urban planning at local scale during about the last 30 years, defines the strategic framework for territorial development of the municipality, being the reference tool for the elaboration of other municipal plans. It establishes the strategic framework for territorial development at the local or sub-regional level.

Considering the legal framework of spatial planning [1, 3], the Municipal authority has the task of defining the contents of the Municipal Master Plan under the decision of the municipal council [3].

According to the same reference, during the elaboration of the municipal plans, the citizen's participation is keeping, imposing that the municipal council has the duty of providing all relevant elements, data and information. Therefore, citizens can make suggestions to the local authority or the advisory commission, which is supporting the plan elaboration.

The Municipal Master Plan is considered to be completed after its approval by the municipal assembly [3]. After this, is mandatory to have the plan contents available, permanently and the updated version, on the web sites of the municipality and of the

National Territorial Information System (SNIT). The local authority must carry out the digital and geo-referenced data and the graphic elements of the plan, making them available online [3].

Thus, in order to comply with the rules [3], the municipal master plan benefits from the use of a GIS, enabling a practical and easy on-line consultation for all citizens. With this data available online, the Municipal Master Plan fully complies with the right of participation and information to all citizens, enshrined in the Portuguese Republic Constitution [6] and the new Code of Administrative Procedure [4].

Local authorities should monitoring the municipal plans, presenting a report to the Municipal Assembly [3], every four years about the state of the territory over the municipal area. This document shows the balance of the the plan implementation, justifying the needs for revision.

2.3. Local Level of Urban Planning

All urban development proposals or building projects are required to get from local authority (the City Council) planning permissions, confirming their feasibility, attaching to the procedure several documents, among which are the following:

- Location plan;
- Topographic survey;
- Proposal of intention.

The request of documents and information, by an urban developer gives rise to a technical administrative process, which is internally registered by local authority and is forwarded to the Urbanism services of Municipalities. Sometimes the citizen or the urban developer are still at the making-decision process, having no interest in having financial charges, just want to be informed. The availability online of planning instruments contents, using WebSIG helps the decision-making process, informing the urban developers about urban rates and the urban perimeters (urban / rural). However, in many cases, such as is the case of Belmonte (Fig. 2 and Fig. 3), the contents of the Municipal Master Plan available online, allow to have an accurate visualization and knowledge.

The analysis of this case study is the starting point of a Doctoral Thesis in Civil Engineering on going, behalf of the Department of Civil Engineering and Architecture at the University of Beira Interior.

This Thesis is focused on the spatial planning figure of the Municipal Master Plan of Belmonte, proposing the creation and implementation of an e-platform using WebSIG that will be called the e-Master Plan of Belmonte.

Belmonte is located in the called Interior Region of Portugal, near to the border with Spain, on the opposite side of the Atlantic sea shore.

Figure 2: Municipality of Belmonte in Portugal [7]. (Authorship: Google Maps).

Figure 3: Municipality of Belmonte [8]. (Authorship: Master Plan of Belmonte, City Council of Belmonte.)

2.4. WebSIG as an Urban Planning Tool

WebGIS technology allows to provide geographical data online typically associated with GIS, such as 'zoom' and 'pan' navigation functions, graphic and alphanumeric search functions [9].

As previously mentioned, this type of technology allows to provide information in vector and raster formats on the WEB, increasing the interactivity, between citizens and local authorities. In this way, the user can have access and manipulate geographic data with no need to have knowledge in GIS. The GI and GIS functionalities are now available to an increasing number of citizens on Web.

Currently, citizens have access to a wider range of data with the contents of the planning instruments at local scale by the WebGIS and to a most diverse framework of 'GIS functionalities', such as maps visualization, associated alphanumeric information. These tools allow the user to carry out searches, both graphical and alphanumeric. Considering all level of the spatial planning system, from national to local, there is access to 'the most diverse GIS with a wide heterogeneous field of application' [10]. These fields of WebSIG can include domains such as safety, environment, construction or business (Fig. 4).

Figure 4: Scope of GIS applicability at local level [10]. (Authorship: authors own).

The publication of GI online allows, among other aspects, the user to have access to the following: to copy geographic database completely or partially requiring experience in GIS to manipulate data; to access to static maps in HTML pages in raster format TIFF or JPEG; to navigate through dynamic maps; to perform queries and analyses (e.g.

calculation of areas, distances and buffers) on the database server; and to have access to digital information once only available in analogue support.

2.5. e-Master Plan

Given that, for the last thirty years the Master Plan at Municipal level has been the pivotal planning instrument in Portugal, is crucial to have an efficient tool to deal with its contents, making its data available for citizens. The proposal is based on the availability online of its contents, using the WebSIG tools, creating an e-platform accessible for citizens as users, named as e-Master Plan (the main goal of the ongoing Doctoral Thesis).

Nowadays, there is an e-platform, available online, supported by the Municipalities Association of 'Cova da Beira', where Belmonte belongs. It is called SIGAMCV and refers to more twelve members: Municipalities of Almeida, Celorico da Beira, Figueira de Castelo Rodrigo, Fornos de Algodres, Fundão, Guarda, Manteigas, Mêda, Penamacor, Pinhel, Sabugal and Trancoso. It allows the access to spatial data related to municipal planning. However, it has still information coming from the 'old times' plans, from the decade of 1990, using the traditional way of preparing planning instruments, in paper support, which at the time were made with no GI tools. This data has a very bad quality of visualization, given that these maps were made using black and white with no other colours (Fig. 5). They are no dynamic maps.

For example, the contents of the Master Plan of Belmonte, made several years ago in paper support, is available at this e-platform. Accessing to it is possible to see the information as picture. The land uses map can be seen. However, the data coming from the old times planning instruments (e.g. before the SIG available), doesn't allow automatic calculations related with urban development indexes, territorial dimensions and surfaces, urbanization and building permissions or land uses restrictions.

Though, there is an effort of improving data quality and the interactivity of the e-platform. For example, the Land uses map of the Master Plan of Belmonte appears coloured, in benefit of its understanding by users (Fig. 6).

Often, the financial constraints are the reason why, some municipalities prefer to deal with free and open source software (OpenSource). The option of this type of software is also the result coming from the desire to extend the use of GIS to the various services of the municipality organization and abroad. Moreover, the legal framework of the territorial management instruments is promoting this praxis, referring the needs

Figure 5: Land uses map, Master Plan of Belmonte [11]. (Authorship: Association of the Municipality of 'Cova da Beira').

Figure 6: Coloured land uses map (Belmonte) [11]. (Authorship: Association of the Municipality of 'Cova da Beira').

of using digital and geo-referenced data regarding the municipal plans, making their contents accessible via Web.

Nowadays, at local authorities there is a clear bet on OpenSource technologies in the WebSIG component, providing GI for free to citizens, moving towards greater transparency and meeting the required open data standard.

In this way, citizens, urban developers and builders, are provided with tools that allow them to be informed in order to have a work to say, to discuss and to give suggestions, regarding the spatial planning rules and permissions. Thus, they can play a most effective role as stakeholders being engaged to planning process.

Some authors [12] are arguing that the exercise of citizenship is only fulfilled when high levels of public participation are reached. The creation and implementation of the e-Master Plan platform using WebSIG will be a way to contributing to the public participation in actions of revision or elaboration of municipal plans at local level, given that data will be accessible to everyone.

In the Central region of Portugal, where the case study belong, there are still several Municipal Master Plans under the revision process. One on them is precisely the

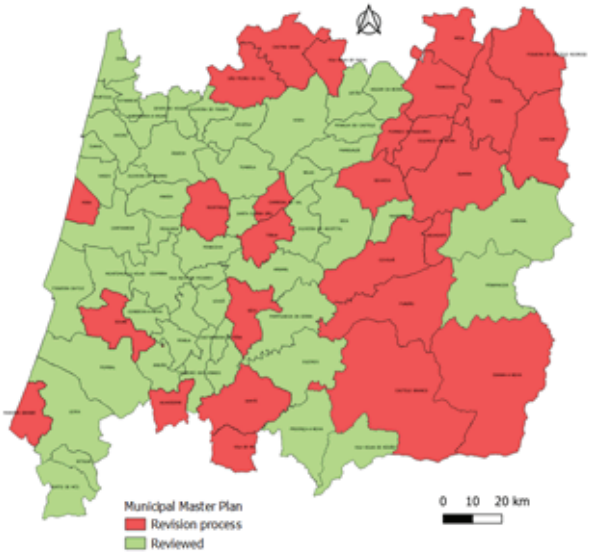

Figure 7: Municipal Master Plan the revision process, central region of Portugal [13]. (Authorship: authors own, adapted from 'Comissão de Coordenação e Desenvolvimento Regional Centro').

Belmonte Master Plan. All of them are using GIS given that is compulsory for the Municipalities to use GIS in all municipal planning instruments, during their elaboration or in their revision process (Fig. 7).

3. Conclusions

The conclusions show that WebGIS guarantees bigger satisfaction at the clarification of the relationship between the local authorities and citizens, regarding the urbanization and construction actions.

GIS appear as powerful decision-making tools capable of storing and managing geographic and alphanumeric information in an interconnected and structured way. They are ways for a higher quality of urban planning instruments, with a better representation of the reality. Consequently, the Municipal Master Plan will reflect the satisfaction for all, inhabitants, urban developers and investors, builders and political power.

City Councils are responsible for organizing and programming the territorial land uses, and the spatial planning rules or urbanization, building or retrofitting. Thus, there is the commitment upon them to promote the management of resources and the careful use of spaces in a sustainable development perspective. Geo-referenced data is a key in the Municipal Master Plan, using GIS.

At the contemporary society, the Internet and mobile communications, have triggered the opening of GIS to the outside world. This evolution and the needs for having high

standards of quality regarding the planning data accessible for citizens are boosting local authorities to develop e-platforms via Web using WebSIG.

At local level of planning action, the use of GIS and WebSIG is an essential tool in land use planning, not only in the elaboration of territorial instruments such as the municipal plans, but also in all the territorial management under the local administration and its dissemination. Local authority is required to transfer data abroad. The e-Master Plan application returns to all, citizens, urban planners, investors, urban developers, builders or political agents, data with no barriers of time nor distance.

Acknowledgment(s)

This work was partially financed by Portuguese national funds through FCT – Foundation for Science and Technology, IP, within the research unit C-MADE, Centre of Materials and Building Technologies (CIVE-Central Covilhã-4082), University of Beira Interior, Portugal.

References

[1] Law nr. 75/2013, 12 of September, Local Authorities Regime.

[2] Law nr. 31/2014, 30 of May, changed by Law nr. 74/2017, of 16 of August

[3] Decree-Law nr. 80/2015, 14 of May, Spatial Planning Framework and Decree-Law nr. 380/99, 22 of September.

[4] Decree-Law nr. 4/2015, 1st of July, CPA.

[5] A. Virtudes, Urban rehabilitation: a glimpse from the spatial planning law, *IOP Conf. Series: Materials Science and Engineering*, 471 (2019) 082032, DOI: 10.1088/1757-899X/471/8/082032.

[6] Portuguese National Constitution – Decree of 10 of April of 1976.

[7] Google Maps, Available at: https://www.google.com/maps/place/Belmonte/@40.3355867,-7.4146022,12z/data=!3m1!4b1!4m5!3m4!1s0xd3d1c235ce0cdb3:0x26944f23acf8557c!8m2!3d40.351063!4d-7.3408535.

[8] Master Plan of Belmonte, City Council of Belmonte.

[9] D. Furtado, Web Visualization Service of Geographic Data, application of Atlas of Portugal using Web Map Service (in Portuguese), Available at: https://run.unl.pt/bitstream/10362/2606/1/TSIG0020.pdf [seen at 28 of November 2018], 50 (2006).

[10] O. Gonçalves, A. Virtudes, e-City Planning: The master plan challenges at local level, *WMCAUS19/4th World Multidisciplinary Civil Engineering, Architecture, Urban*

Planning Symposium, 17-21 June, Prague (2019). In Press.

[11] SIGAMCV, e-platform of the AMCB, Association of the Municipality of 'Cova da Beira', Available at: http://www.sigamcb.pt/visualizador/belmonte.

[12] J.A. Tenedório, C.D. Henriques, J.C. Silva, Municipalities, Spatial Planning and GIS (in Portuguese), [seen at 9 of December 2018], Available at: http://geoinova.fcsh.unl.pt/revistas/files/n7-11.pdf, 203 (2004).

[13] CCDRC - Comissão de Coordenação e Desenvolvimento Regional Centro', Available at: http://www.ccdrc.pt/index.php?option=com_docman&view=download&alias=3173--1347&category_slug=67&Itemid=739; [seen at 9 of December 2019].