

Transparent Valuation as a Planning Support for Just Land Management System (LMS)

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Key words: land consolidation, land readjustment, mass valuation, multi criteria decision analysis

SUMMARY

Effective spatial resources management is one of the main features of healthy economic growth of a region. Although traditionally divided among several administrative bodies, the technological progress enables the integration of all space-related attributes, creating spatial information support that can service all more complex social communities. The paper considers the possibilities of the mass valuation application in the procedures of land management in the Republic of Croatia, views all legal frameworks and gives an overview of information of land administration, and especially cadastre, on which every mass valuation system is based. Through the overview of the existing state of information and the descriptions of abandoned mass valuation systems, the paper explains the problems of rural and urban land valuation. It explains the choice of Multi Criteria Decision Analysis helped by Rule-based Expert System methodology with the purpose of developing functional, practical, consistent and adaptable mass valuation system on a national level, applicable on the area of the Republic of Croatia and states with similar LAS.

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1. INTRODUCTION

Land information management is impossible without its physical organization as well as organized land registers. Land fragmentation is visible in many areas of the world, and the reasons for that are numerous. It is generally accepted that there are four main factors that influence the land fragmentation (Demetriou et al. 2013): inheritance, population growth, land markets and historical perspectives. The fragmentation significantly disables efficient agricultural production in rural, and the implementation of spatial plans in urban areas.

Although the fundamental reason for the establishment of the majority of cadastral systems is real estate taxation, in Croatia the determination of the amount of the real estate tax based on the cadastral income was abandoned in 1997. **The abolition** of the system and the methods of cadastral classification signified the **abolition** of the only system of agricultural land valuation on a national level.

This paper emphasizes the importance and explains the connection of a good system of land administration **and the indication of value of non-built and** built parcels. It gives the overview of Croatian land administration systems (LAS) and legal framework connected to land management. It views the possibility of an application of advanced GIS analysis for mass real estate valuation in the consolidation procedures for agricultural land, and urban consolidation. Every day, consciously or not, even in the most simple life decisions we make decisions based on multi criteria optimization, and the problem of mass real estate valuation can be reduced to the selection and transparent calculation of the most influential factors that influence the value of a real estate in certain areas. The paper emphasizes the importance of transparent real estate valuation and gives basic guidelines for integration of valuation within legal frameworks.

In previous papers on Chair for Spatial Information Management at the Faculty of Geodesy, University of Zagreb, the factors of real estate valuation have been modelled and considered, certain functions that automatically calculate the influence of certain factors have been made (Matijević et al. 2006, Roić et al. 2007, Tomić et al. 2010, Tomić 2010). The application on mass valuation of the based methods and the implementation of these in the legal framework would change the perception of fairness and cost-effectiveness of the consolidation, urban consolidation and other procedures for the implementation of spatial plans. That is necessary in Croatia, as well as in other transition countries, where for a number of years, due to the lack of care about private property, the opinion prevails that these procedures as unjust and forced procedures of land management.

2. BACKGROUND AND METHODS: THE IMPACT OF LAND ADMINISTRATION ON LAND VALUE

The basic goal of a good land administration system is ensuring sustainable development through which economical balance, economic security and social fairness can be achieved. The land is the fundamental limited natural resource for ensuring sustainable development, necessary for the existence of all eco-systems and life on Earth in general (UN-ECE 1998). For that reason, well organized spatial information systems must be developed. Technological progress enables the integration of all these spatial information which created support for more complex social communities and thus makes the space use sustainable, economically profitable and ecologically controlled.

2.1 The relationship between good land administration and sustainable development

Quality sustainable growth needs to be based on two opposed concepts of care about space: static (land register and cadastre) which needs to guarantee existence, invariance of geometry and owner rights, and dynamic (spatial planning) which is conditioned by economic development program with urban or agrarian project. Dynamic concept needs to increase the value of all real estate included in the procedure in a controlled way through quality programs of land development. Implementation of these documents on the field is achieved through the procedures of land consolidation (relocation, consolidation for agrarian formed projects and urban consolidation (readjustment) for urban development projects.

In order to ensure the much needed fairness and transparency in these processes, all procedures and space and land market need to be based on (Dale and McLaughlin 1999):

- Land Registration and Cadastre, legal framework which guarantees the ownership and owner rights administration
- Land valuation, transparent estimate of real estate value with good quality of market information
- Financial Services, which can be used by the real estate as a financial security and capital for investments and which guarantees the stable taxation regime.

2.2 Valuation as a support in land management procedures

Real estate valuation is an essential part of the support system for land development. Real estate valuation assessment is the prediction of the real estate value based on experience, and the valuation of its spatial and other features. It inevitably includes dependence on market factors. **In this paper, definition of valuation fairness rely on transparency of valuation rules together with guarantee of invariability of rules during the consolidation.**

In most European countries there is a certain model of mass real estate valuation that evaluates some of the physical characteristics of real estates, i.e. cadastral parcels with accompanying building and other constructions. The mentioned systems evaluate the real estate value by dividing them into agricultural and buildable cadastral parcels (built or non-

built), which are mostly taxed jointly with one tax on a real estate. The evaluation of agricultural land takes into consideration agricultural abilities of the land: the quality of the soil, the water regime, the elevation and climate influence and economic conditions for production – infrastructure and alike.

2.2.1 Single property valuation versus mass valuation methods

There are three most used methods of real estate assessment: cost approach, sales comparison approach and income capitalization approach. However these methods are used mainly for assessing the value of particular built or non-built developable land, and inevitably include the appraiser, which greatly lengthens the process and makes it more expensive.

Mass valuation is the procedure which, based on valuation factors and by using statistical methods, assesses value of many real estates. In order for this assessment to be fair and correct, it is necessary to acquire sufficient amounts of data on each parcel of real estate. In that way, by using statistical methods, it would be possible, with a degree of certainty, to predict the value of a certain factor further used in the procedure of calculation of final value (UN-ECE 2001, Barańska 2004). Mass real estate valuation systems, which have already been implemented and are functioning in most modern countries, are one of the services for insuring more effective use of land (UN-ECE 2001).

Those multipurpose systems are used for several purposes; fair taxation of ownership on real estate, helping real estate market, helping rural and urban land management. Geospatial information always makes the base of every real estate valuation system, due to the fact that the real estate is significantly determined by their spatial features (Yomralioglu and Nisanci 2004). The universal model of mass real estate valuation on the territory of a country has to be functional, practically applicable, consistent and adaptable to real conditions and trends on the real estate market (Kuburić et al. 2012).

3. CROATIAN LAND ADMINISTRATION, AN OVERVIEW

The Land Administration System in the Republic of Croatia is based on two basic registers: Cadastre under the responsibility of State Geodetic Administration and Land Book which is under the responsibility of Local Courts. According to law, the real estate consists of a land parcel including everything that is relatively permanently connected to it above its surface or under it. Real estate is registered in land and real estate cadastre, and the rights on them are realized by registering in the land book. Basic registration unit in cadastre is cadastral parcel – data about cadastral parcel is registered in cadastre on cadastral map and in possession sheet.

In the Land Book, property units are registered in the land book sheet – there is recorded information about the associated rights, responsibilities and restrictions. A property unit can consist of several cadastral parcels, registered in same land book sheet.

3.1 Current state of Croatian Land Administration System

The development of land information in the area of Croatia is conditioned by different countries, which were, throughout history, part of the same country as the Republic of Croatia. Due to that, the land information has originated in different dynamics and in different conditions, depending on the social organization of these countries. Cadastral surveys in the eighteenth and nineteenth centuries were graphic (using geodetic planetable). After WWI, numerical methods started to be applied – orthogonal and polar, later photogrammetric and recently the Satellite positioning - GNSS RTK method (Figure 1).

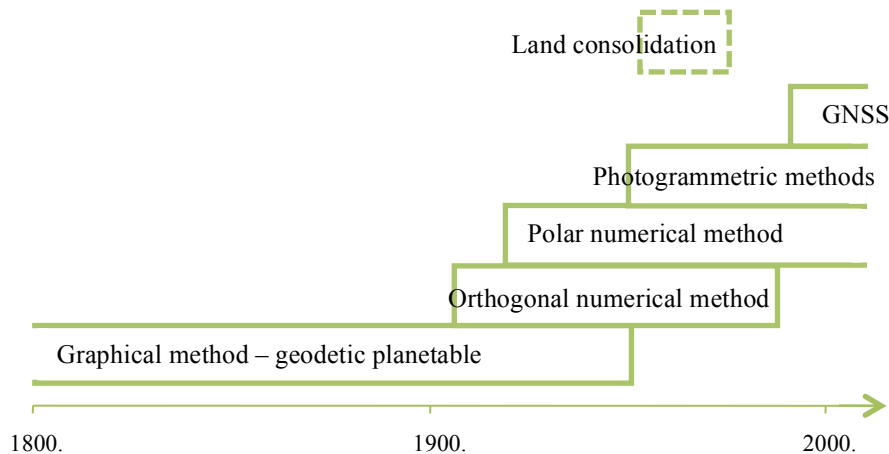


Figure 1. Used methods of cadastral surveys in Croatian area (Roić 2012)

Unfortunately, the fact that around 70% of the cadastral maps, in official use today, were made by graphic survey along with the information that is relatively inhomogeneous, significantly aggravates the transition from a “Land Cadastre” to a “Real Estate Cadastre”, a project which is being achieved with the help of international organizations, International Bank for Reconstruction and Development, the European Union and a number of donor countries. With inhomogeneous information, there is a great problem of mismatch of information between the cadastre and Land Book as well as the outdated information – so that there is a major risk that the situation in the registers does not correspond to the actual situation in the field.

All this significantly slows down the project of establishing a joint information system (JIS) and makes it more difficult. A JIS would unite the information in real estate cadastre and land books and establish them on a joint Land DataBase (LDB), which was started in 2006. What is included in the project is the making of the system for storing spatial and nonspatial information, management system and maintaining information, and the move of existing information in a JIS. It is necessary to achieve consistency for most of the information in order to move them. Homogenization of the cadastral map is a method for improving quality of the vectorised cadastral data regarding their homogeneity (Cetl et al. 2012). It is also used to obtain data in the state coordinate system. This method has been used in many countries before entering the data into electronic land information systems.

3.1.1 Cadastral Land Valuation in Croatia

Mass land valuation for taxation purposes in the Croatian cadastre was done in the time of Franciscan Cadastre (Roic 2012), to which that was the basic purpose. Implementing additional functions of the cadastre draws further signs for the real world objects, but the cadastral land valuation, i.e. cadastral classification with the purpose of determining cadastral income of agricultural production, always remains an important part of a cadastral system.

Cadastral classification of land was used to determine for each land the way it was used, and its production ability for agricultural production or for forestry. The territorial unit for cadastral classification of land is cadastral county. The area of cadastral county is made of territorially connected cadastral municipalities that have approximately the same natural and economic conditions for agricultural production. Land classification is done after the finished cadastral survey in one cadastral municipality or in a part of its area – and it is done by an agriculture expert. The regulation on cadastral classification of land determined nine cadastral cultures which consist of cadastral parcels of fertile land, and defines visual presentation of classifications which result in documentation for marking the parcels under the mentioned cultures on cadastral maps.

In 2001, based on the current Law on State Survey and Real Estate Cadastre at that time, registering information on cadastral income was abolished and along with it the only valuation system of agricultural land on state level.

3.1.2 Rural Land Consolidation as a Cadastral Survey Method?

Rural Land Consolidation comes from a Latin word “commassare”, which means collecting in a pile. That expression is used in Poland, Czech Republic and Hungary.

Rural land consolidation is the most complete and the most complex agricultural option (Figure 2), whose main purpose is consolidation of scattered property. Along with hydro melioration work, the consolidation gives exceptional results in agricultural land development. What is achieved by land consolidation is the following:

- more rational and more economic agricultural production
- creating better conditions of life, work and life in the countryside
- maximal use of countryside space
- preserving rural environment and scenery.



Figure 2. Example of Land consolidation result in Croatia

It was usual to implement consolidation for the majority or for the whole cadastral municipality, and the result was quality cadastral information. Thus, it can be said that consolidation achieved the survey of a part or the whole cadastral municipality.

According to the data of Croatian State Geodetic Administration – SGA, between 1956 and 1959 more than 650 000 hectares were consolidated, which makes around 20% of arable land. The main part of consolidation work encompassed area of Slavonija and Baranja.

3.2 Administrative units in the Republic of Croatia

Mass valuation is a process which most often includes the use of the existing spatial sets of data, as well as statistical data, and the use of boundaries between units of local and municipality self-government, and regional self-government – taken from the spatial unites registers, is the only solution which fulfils the practicality condition.

The regional self-government units in the Republic of Croatia are counties, and there are 20 of them plus the City of Zagreb (Figure 2). These spatial units coincide with the NUTS-3 (Nomenclature of Units for Territorial Statistics – standard developed and regulated by European Union) division of statistical spatial units for the Croatian area. In Croatia there are total of 429 municipalities and 127 towns.



Figure 3. Croatian administrative boundaries

4. Use of Multi Criteria Decision Analysis – MCDA and Rule-Based Expert System – ES in mass valuation

In the previous research, various factors of valuation were modelled and analysed (Roić et al. 2007, Tomić et al. 2010, Tomić 2010), and particular functions which automatically calculate the influence of specific factors were created (Kuburić 2012).

All these models are based on the existing information of land administration systems which are modelled and stored in a database. Based on these test information it is possible to draw conclusions on the applicability of mass valuation in real conditions and by applying various tools, spatial databases and by applying various valuation techniques.

The issue with the real estate market in Croatia is the following – it is not possible, for the need of valuation, to get the information on real estate transactions, nor is that information systematically gathered for the purpose of mass real estate valuation. So it is necessary, based on the limited “knowledge” on the state of the market and existing data to try establish the valuation model.

In all our previous papers, the problem of mass assessment is divided on two sub-systems:

- Spatial units valuation model: a model which, within the each assessed real estate, should include all external factors and joint spatial features within a certain spatial unit, or the settlement in which it is located.
- Model of real estate valuation within the framework of a spatial unit: in which it is (valuation of internal factors based on relevant characteristics which influence its value).

Integration of these two sub-systems could create a model of mass real estate assessment valuation which could recognize all the important characteristics of each individual real estate

within the spatial unit, and which would result in a universally applicable and consistent mass assessment model.

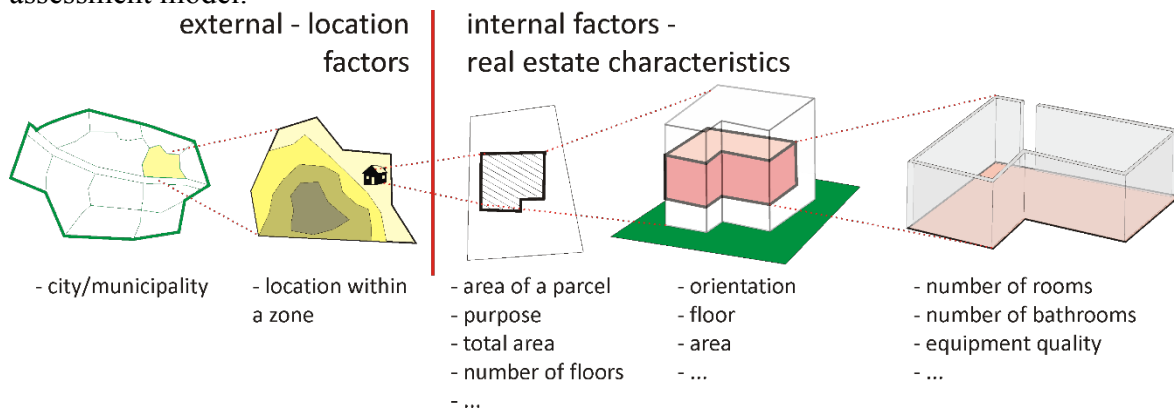


Figure 4. Division of real estate external/internal characteristics (Tomić 2010)

The market unmistakably defines the value by jointly using all the characteristics which can influence the market value in any way. It is hard to accomplish that by a computer model because it is difficult or almost impossible to model certain factors, that is, to reliably determine their influence without sufficient number of information from the real estate market. Rule-based Expert System (ES) has been chosen for multi-criteria factor valuation in mass valuation procedure. The mentioned method tries to stimulate the expertise for each real estate, integrating in the system rules determined by one or more experts which deal with individual real estate assessments for a certain area. The calculation of values by these valuation systems is mainly based on Rough Set Theory – RST, formal mathematical method for reducing dimensionality of information sets or Fuzzy Set Theory (McCluskey 1999, Kauko and d'Amato 2008).

4.1 Valuation in rural land consolidation procedures

The development of GIS technologies enables a relatively easy and transparent application of automatic procedures of land valuation in rural land consolidation procedures, which increases the perception of fairness and enables simpler and fairer allocation of land parcels.

When valuing land parcels, along with assessed units as the element for reducing all properties under the same joint denominator - depending on the land and culture capability, it is possible to determine many other influences which can significantly affect the value of a land. In the quality land assessment it is possible to build in the influence of various factors, which has a long tradition in scientific articles. It is accepted that the form of the parcel greatly influences the potential for agricultural production and with compactness - as one measure of form, i.e. the resemblance of the parcel to the circle, it is possible to join the information on the length of parcel sides, angle values between certain sides and the number of boundaries points to the automatic procedures (Demetrious 2012) as valuation elements which need to be built in the total measure of land parcel form valuation.

4.2 Valuation in urban land readjustment procedures

Modelled on the countries of Western Europe, where urban consolidation is recognized as an instrument of quality implementation of spatial plans, in Croatia the urban consolidation procedure is implemented in 2007 with the Law on Spatial Planning and Building. In the Law, it is described as a procedure of merging building land parcels in one whole and its division on building and other parcels in accordance with the detailed urban plan. In the same time it deals with ownership and other real rights with the goal of dividing buildable parcels to land owners and units of local self-government for the need of public area surfaces.

On the basis of different parameters that affect the value of the land, it is possible to calculate relative values of newly-formed parcels (Figure 5). Calculation of the relative values, given in the Figure below shows that taking only a few parameters (block area and floor area ratio) into account dramatically changes relative values of new parcels. Inclusion of these and the adding of more valuation factors would greatly improve the current practice of not applying legally prescribed urban consolidation procedures.

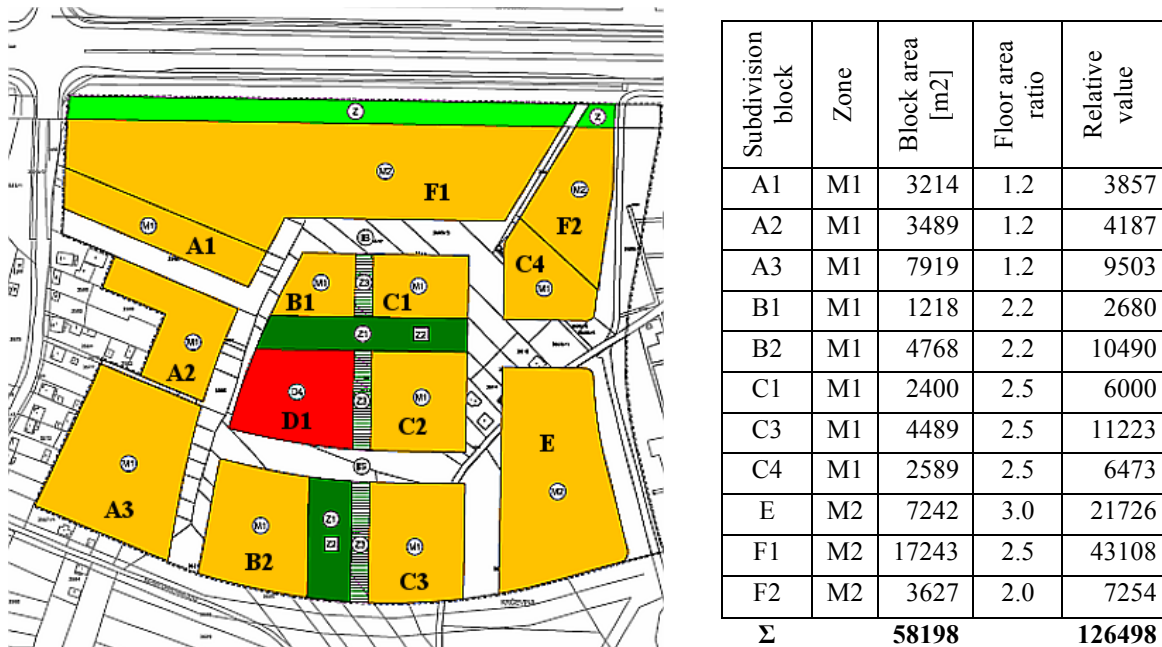


Figure 5. Detailed Urban Plan "Savska Opatovina" relative value estimation

A good mass valuation system would be of great significance in the urban consolidation procedure, since it is necessary for the implementation of the procedure itself to determine the market values of all real estate which are in the area of urban consolidation.

A mass valuation system would be more important when estimating the relative values of parcels before readjustment and new building parcels after completed urban readjustment procedure, which would allow, together with a fairer allocation of building parcels (which is not in the existing law), the planning of raising the real estate value by the procedure itself.

5. CONCLUSION

The use of land administration information and other related registers for the need of the mass valuation system management based on the official and updated land information enables the establishment of transparent valuation methodologies as the guarantee of valuation fairness. **In this paper, valuation fairness consider the transparency of valuation rules together with guarantee of invariability of rules during the consolidation.** A system based on that could be effectively used in many cases, out of which the land management processes are considered in this paper, in rural – in the land consolidation procedures or in urban areas – urban land readjustment.

Although modern GIS and **Spatial Database Management System – SDBMS** technologies allow the use of mass real estate valuation in all the mentioned procedures, the existing legal framework does not have clear valuation rules. As previously mentioned, the legal framework is partly unenforceable (the current Law on Land Consolidation dates from 1979) and incomplete (urban land readjustment, defined in Law on Spatial Organization and Building), despite the fact that the importance of these procedures is recognized and emphasized in the majority of international recommendations and studies, the strategy of spatial development of the Republic of Croatia and the strategy of development of geodesy.

In such a way, the legal definition of urban consolidation does not predict the valuation of new building parcels that are allocated to the owners according to squares, nor does it take into consideration various values of building parcels depending on the purpose zone and the use of space, according to the detailed management plans. To achieve a more efficient implementation, it is necessary to change and adapt the legal framework by including more parameters into valuation in order to raise the transparency level as the guarantee of the system fairness.

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BIOGRAPHICAL NOTES

Hrvoje Tomić works as a university assistant at the Chair of Spatial Information at the Faculty of Geodesy in Zagreb. In 2010 he defended his Ph.D. thesis at same University, with thesis: “Geospatial Data Analysis in Purpose of Real Estate Valuation in Urban Areas”. His main research interests are GIS and DBMS technology in spatial data handling. Hrvoje Tomić has participated on several projects and has published several papers.

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