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## From Decision Support System to Urban Land Readjustment

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### Abstract

The paper discusses the importance of effective and efficient decision support system in urban planning, based on the principles of geomarketing. Geomarketing, as an integration of geographical intelligence and marketing, is used to include and value various aspects of spatial resources. The core base of geomarketing system in spatial planning is land administration data, which is stored and maintained by many different administrative bodies. Development in the field of the spatial technologies is making possible integration of all land administration and other available data, and with that an establishment of the decision support system, which could make urban planning more sustainable, economically approved and ecologically controlled. Decision support system with those data included can be used also to enable the planning of raising the real estate value by the procedures of land readjustment. Raising the transparency level by mass valuation in the planning process makes possible to facilitate and accelerate the subsequent procedure of spatial plans implementation.

**Key words:** decision support system, land readjustment, mass valuation, geomarketing

## 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. The fragmentation significantly disables efficient agricultural production in rural, and the implementation of spatial plans in urban areas. The fragmented parcels are inappropriate in urban space use, so urban land readjustment is needed in order to make buildable land parcels.

This paper emphasizes the importance of effective and efficient decision support system (DSS) in urban planning, based on the principles of geomarketing. Geomarketing, as an integration of geographical intelligence and marketing, is used to include and value various aspects of spatial resources. The core base of geomarketing system in spatial planning is land administration data, which is stored and maintained by many different administrative bodies.

Geomarketing comprises a wide range of components and services. The geomarketing software, market data, digital maps and specialised consultancy services offer a multiple approach to answering queries related to location in sales, marketing and controlling.

## 2 PLANNING, DECISION MAKING AND DSS

There are different phases of the decision making process. Decision support systems (DSS) are interactive, computer-based systems that aid users in judgment and choice activities. Decision support systems aim mainly at this broadest type of decision making, and in addition to supporting choice, they aid in modelling and analysing systems (such as complex organizations), identifying decision opportunities, and structuring decision problems (Marek, 2002).

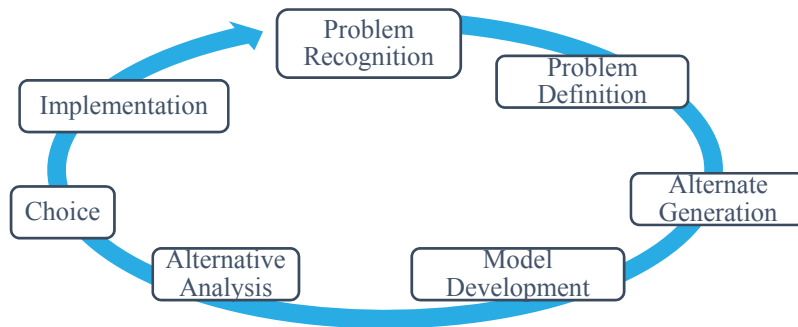


Figure 1 DSS decision-making process (Shim et al. 2002)

Combining of DSS with a Geographic Information System – GIS lead to development of Spatial Decision Support System – SDSS. SDSS has an explicit spatial component, and it is designed to assist in decision making while solving semi-structured spatial problem. The difference between the SDSS and classic GIS with generic spatial functions is a higher level of analytical and statistical modelling capabilities.

There are three main components of SDSSs (Sage 1991):

- Spatial Data Base Management System (SDBMS):
  - A DBMS serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures.
- Analytical model:
  - The purpose of an analytical model is to transform data from the SDBMS into information that is useful in decision making.
- User interface – Dialog Generation and Management System (DGMS):
  - The primary responsibility to give a user interface and enhance the ability of the system user to utilize and benefit from the use of DSS.

SDSS capable to assist in a process of urban planning and land readjustment have to be capable of multi-criteria and multi-objective decision analysis, based on relatively large quantities of spatial and non-spatial data.

## 3 URBAN PLANNING AND LAND READJUSTMENT

Rural land consolidation is the most complete and the most complex agricultural option, whose main purpose is consolidation of scattered property (Cetl 2001). Along with hydro melioration work, the consolidation gives exceptional results in agricultural land development.

Urban land readjustment, or urban consolidation – as named and defined in Croatian Law on Physical Planning and Building (Official Gazette 76/2007), is recognized as an quality instrument in the process of spatial plans implementation. Procedure of land readjustment is described as merging buildable land parcels into one whole and its division on building and other parcels in accordance with the detailed urban plan – DUP. 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 areas.

Urban land readjustment, as described in the mentioned Law, had very poor and inadequate definition of land valuation: in the procedure of land valuation definition of urban consolidation did 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 urban plan. That is the reason why, according to the available literature, land readjustment procedure was not ever performed.

Since the 1<sup>st</sup> of January 2014, there are new regulation on physical planning and construction in Croatia (Law on Physical Planning and the Law on Building – Official Gazette 153/2013). None of these Acts regulate the institute of urban land readjustment anymore. By this, current legal framework on land consolidation is based on Law on Land Consolidation which dates from 1979, and it is unenforceable. The new Law on Land Consolidation, which is in preparation for a long time, will have to cover and define this important procedures, as it is recognized and emphasized in many international recommendations and studies, and also in the Croatian Strategy of Spatial Development.

Besides inadequate land valuation in former regulation on land readjustment, mentioned procedure required already finished and completed detailed urban plan of land readjustment area. In this way the owners know in advance in which new purpose zone their parcel belongs, and they aren't interested in land readjustment procedure. As defined in legislation concerning land readjustment in Western European Countries, detail urban plan is formed according to the land readjustment and parallel with the land readjustment procedure, as a multi-criteria and multi-objective decision task (Figure 2)

### **3.1 USE OF SDSS IN LAND READJUSTMENT**

Following criteria's can be useful as a support for decision making in the process of land readjustment:

- Parcel market value/relative value ratio, zoning and planning data (floor/area ratio, subdivision block), micro and macro location, availability of services, topography, cultural and archaeological preservation data, environmental report, etc...

Together with mentioned criteria's, accurate and complete land administration system spatial data must be modelled and stored with connected criteria's. Based on suggested criteria's and accordingly to defined objectives, SDSS would help to have better insights in the process of weighting between multiple given objectives and choosing among different alternatives.

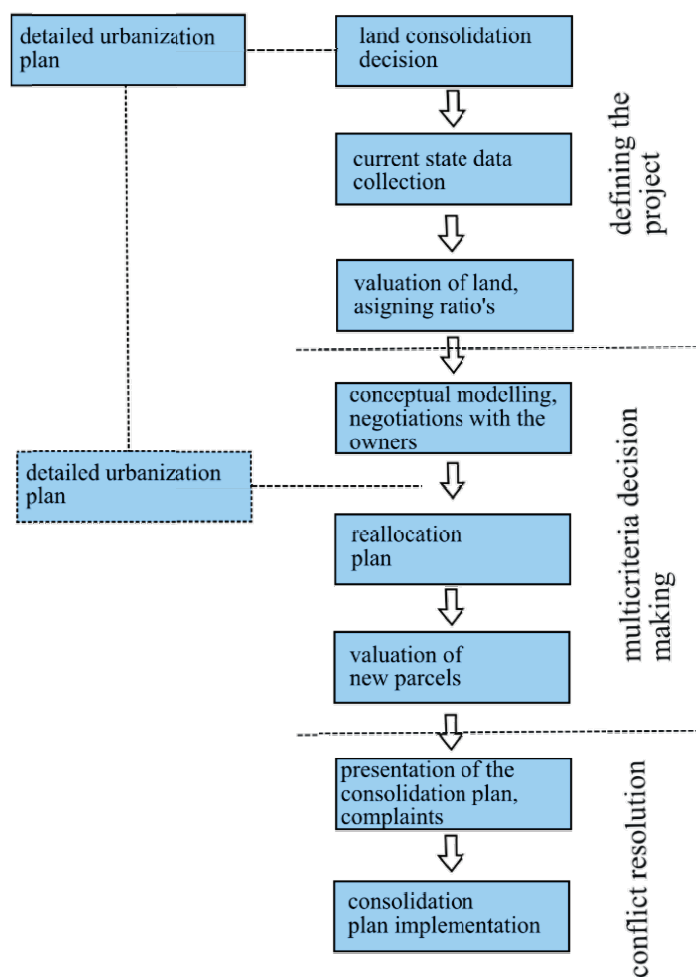


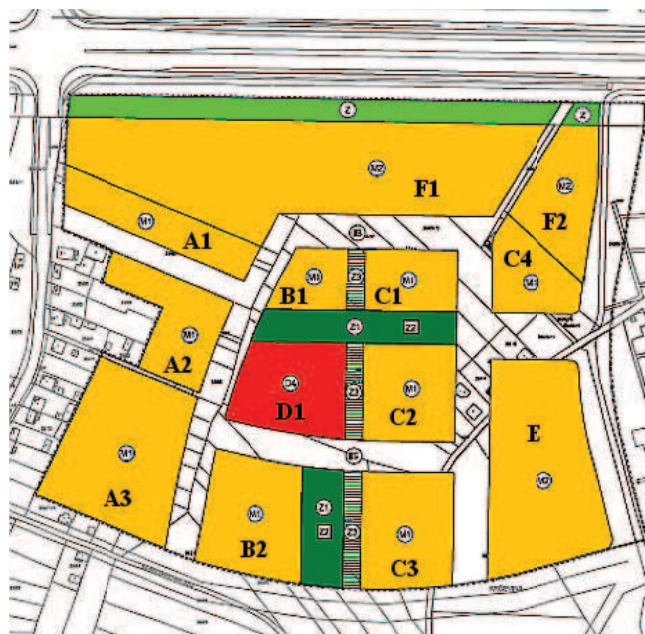
Figure 2 Decision-making process in urban land readjustment procedure

#### 4 VALUATION IN URBAN LAND READJUSTMENT PROCEDURE

When valuing land parcels, it is possible to determine many factors and influences which can significantly affect the value of a land. The development of GIS technologies enables a relatively easy and transparent application of automatic procedures of mass land valuation in land readjustment procedures (Tomić 2014, Matijević 2006), which increases the perception of fairness and enables simpler and fairer allocation of land parcels.

A good mass valuation system would be of great significance in the urban readjustment 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 needed when estimating a relative values of parcels before readjustment and new buildable parcels after completed urban readjustment procedure, which would allow, together with fairer allocation of building parcels, planned raising the real estate value by the procedure itself.

On the basis of different parameters that affect the value of the land, it is possible to calculate relative values of newly-formed buildable parcels (Figure 3). This shows that taking only a few parameters (block area and floor area ratio) into account dramatically changes relative values of new parcels (Tomić et al. 2014). Inclusion of these and the adding of more valuation factors in the future legislation will made the procedure of urban readjustment more transparent and fairer.



Subdivision block	Zone	Block area [m <sup>2</sup> ]	Floor area ratio	Relative value
A1	M1	3214	1.2	3857
A2	M1	3489	1.2	4187
A3	M1	7919	1.2	9503
B1	M1	1218	2.2	2680
B2	M1	4768	2.2	10490
C1	M1	2400	2.5	6000
C3	M1	4489	2.5	11223
C4	M1	2589	2.5	6473
E	M2	7242	3.0	21726
F1	M2	17243	2.5	43108
F2	M2	3627	2.0	7254
<b>Σ</b>		<b>58198</b>		<b>126498</b>

Figure 3 DUP "Savska Opatovina" valuation ratio's (Tomić et al. 2014)

## 5 CONCLUSION

In the Republic of Croatia, no enforceable land readjustment/consolidation regulation, both rural and urban, does exist at the moment. More appropriate legal definition of land readjustment, land consolidation and connected procedures – especially land and property valuation procedure, would allow to raise the transparency level and through that change the perception of procedure fairness.

The Spatial Decision Support System – SDSS could be used in all phases of land readjustment, connected physical planning and implementation. Use of SDSS would allow to include all spatial and non-spatial criteria's and objectives – and, with help of experts and professionals, enable weighting of them in order to make decisions which would help to finalize land readjustment plan and detailed urban plan.

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