

## **The Use of Mass Property Valuation in Spatial Planning: An LADM Approach**

**Josip ŠIŠKO, Hrvoje TOMIĆ, Sanja GAŠPAROVIĆ and Darko ŠIŠKO, Croatia**

**Key words:** Spatial planning, Mass Valuation of property, LADM, Values-led planning approach.

### **SUMMARY**

Spatial planning is at the core of every economic and social development of city. Key element in the process of spatial planning is information, that is traditionally a cadastre and land book. The change in property values has been considered as the result of the planning process, but in the last decade researches have seen a huge importance of using property values data in the first step of spatial planning as additional input information. Property values data are stored and collected in the process of mass valuation. The use of these data in the process of spatial planning will enable planner to get in touch with current state of property market in the area of interest, that will contribute to a balanced spatial development. This paper takes a new look in spatial planning process using a PSS that will be based on model as mathematical background for calculating correlation of spatial plan and property values and their mutual influence. Researched system will be connected to national LADM profile using Valuation Package and Spatial Planning Information Package extensions, which will enable international context of system.

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## **1. INTRODUCTION**

Land is a limited and important resource for the economic and social development of a given area. The key element of spatial planning is information that describes, in the first step of planning, land use defined by the existing spatial plan (Laurini R., 2001). The basic idea of spatial planning is to enable uniform spatial development and to optimize infrastructure costs (Marinović - Uzelac, 1989). Good and effective spatial planning requires not only the official authoritative spatial datasets, but also additional spatial and other datasets to obtain more complete information about land. Mass property valuation collects and processes information about existing property that can be used to analyze and predict changes in property values due to different planning and land use conditions.

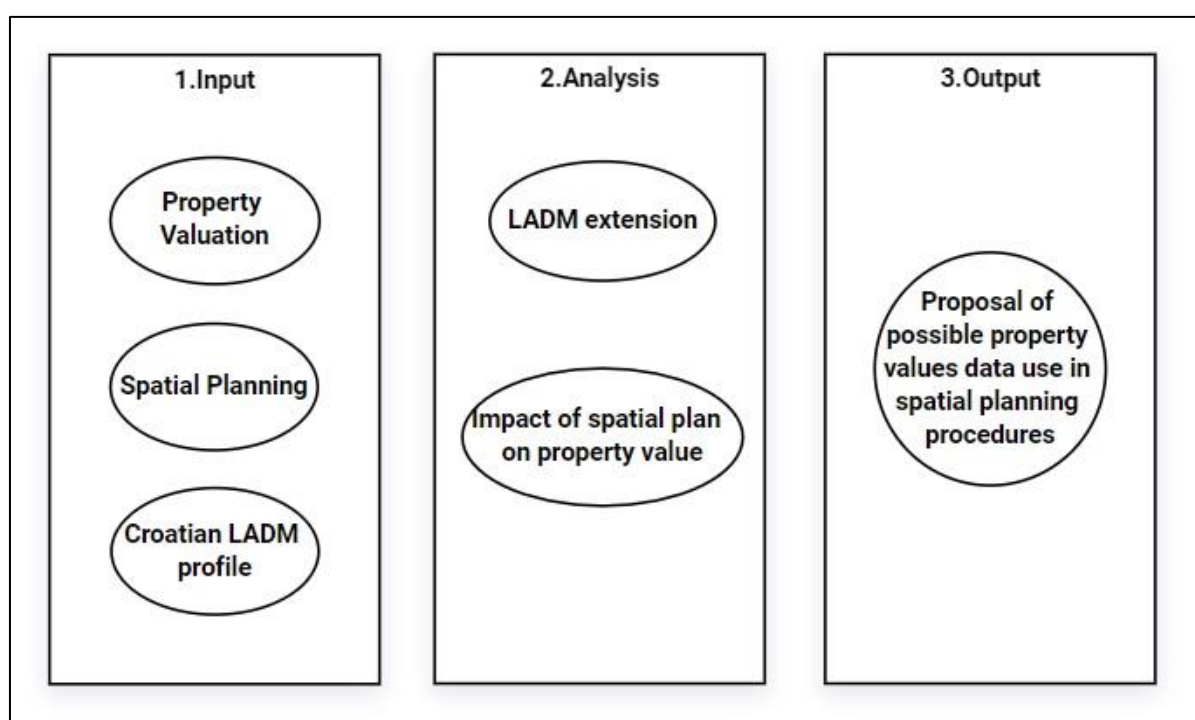
The impact of urbanization on property values has been studied in Australia, where the impact of urban growth on property values in the outskirts of Melbourne was analyzed using various forecasting models (Ball et al., 2014). The change in property values depending on different planning conditions is also described in Krajewska (2008), and Szmatoch (2015) presents in his paper the impact of changing spatial plans in correlation with mass property valuation and shows methods of property valuation due to different spatial planning conditions using the example of the city Krakow in Poland. Most studies focus only on the analysis of the impact of spatial plans on property values, but in the last decade the importance of values has been considered as the core of any planning and decision-making process.

Although there are some studies that value various aspects of space for spatial planning, there are no works that address the use of property economic values as a result of the influence of all individual valuation factors for the spatial planning. . Property valuation is an important component of an efficient Land Administration System (LAS). The data of Spatial management and LAS system are complex and distributed across several responsible agencies and institutions. Interoperability is achieved by using the national spatial data infrastructure defined by INSPIRE. In order to develop different cases of data use and integration, it is necessary to model them carefully by using relevant conceptual models from the field of land management systems. Information Model Package and the Spatial Planning Information Package were proposed and implemented as extensions to the existing Land Administration Domain Model (LADM) using Unified Modeling Language (UML) use case and class diagrams. These extensions were used for a prototype of the Croatian system for mass valuation property system with basic assumption that an effective mass valuation information system can be based on existing relevant land administration data and other public data stored in distributed databases and shared through agreements between different government agencies. Establishing a link

between the planning process and mass valuation data would enable development of a planning support system that would lead to better spatial planning.

## 2. METHODOLOGY

The main purpose of this paper is to present an overview of previous research showing that a spatial planning not only affects property values, but can also be based on assessed property values to support spatial planning (Figure 1). The value of property is the result of the impact of all individual valuation factors on property, e.g. land use defined by local plan, green zones, distance to nearest school etc. Establishing a correlation between the factors that affect the value of property and the final value of property, and using the values spatial planning process as input data that will represent current state of property market in that area will enable better spatial planning. The literature review was used to explore the existing knowledge on property mass valuation, spatial planning and to place the case study research in an international context using the Land Administration Domain Model.



**Figure 1.** Research plan

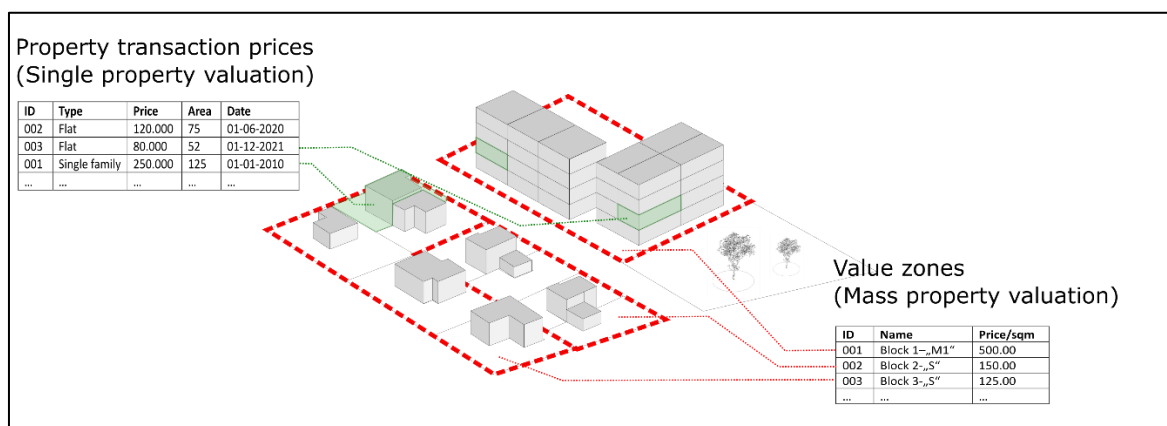
International best practices (Jaeger, 2006; Jasiolek, 2013; Śleszyński et al., 2021) were used as a starting point for analyzing the correlation between property values and planning/land use conditions. The Croatian LADM profile (Tomić et al., 2021; Vučić, 2013; Vučić et al., 2013) and the national spatial planning system (Kranjčević, 2005; Poropat et al., 2006) were analyzed to establish connections with mass valuation data using UML diagrams. The first Croatian LADM profile was developed in 2013 and the created profile confirmed the high level of compliance of Croatian LAS with LADM (Vučić et al., 2013). The created profile included all main packages and classes: party, administrative units and spatial unit, along with the matching

attributes from the Croatian LAS registers. The LADM profile will enable the standardization of individual and property mass valuation procedures as well as spatial planning procedures. This will enable better interoperability of data in both procedures.

### 3. PROPERTY VALUATION IN CROATIA

#### 3.1 Individual Valuation

Individual property appraisal is a multidisciplinary process for the market valuation, that determines the social, economic, governmental and political impact, as well as the influence of the environment on the value of property. The best known methods of individual property valuation are: Cost Approach, Sales Comparison Approach and Income Capitalization Approach (Tomić, 2010). Individual property valuation is prescribed by the Property Valuation Act (Official Gazette of the Republic of Croatia, 2015). Property valuation may be performed only by authorised persons. Property purchase prices are collected and maintained by the Tax Authority of the Ministry of Finance. The records are stored in the Property Market Information System (eProperty). These data are used by authorised parties (court appraisers, agents in property transactions and local and regional self-government units) and their intended use is individual property valuation. Currently, no public organisation/authority uses these data for the assessment of property for public purposes (Tomić et al., 2021).

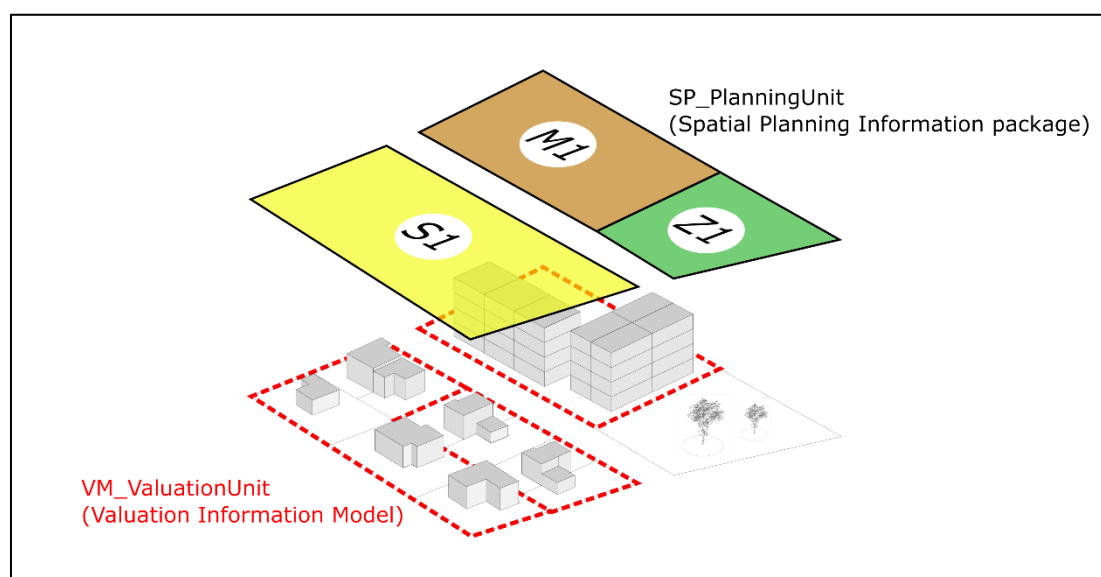


**Figure 2.** Single and mass property valuation

#### 3.2 Mass Valuation

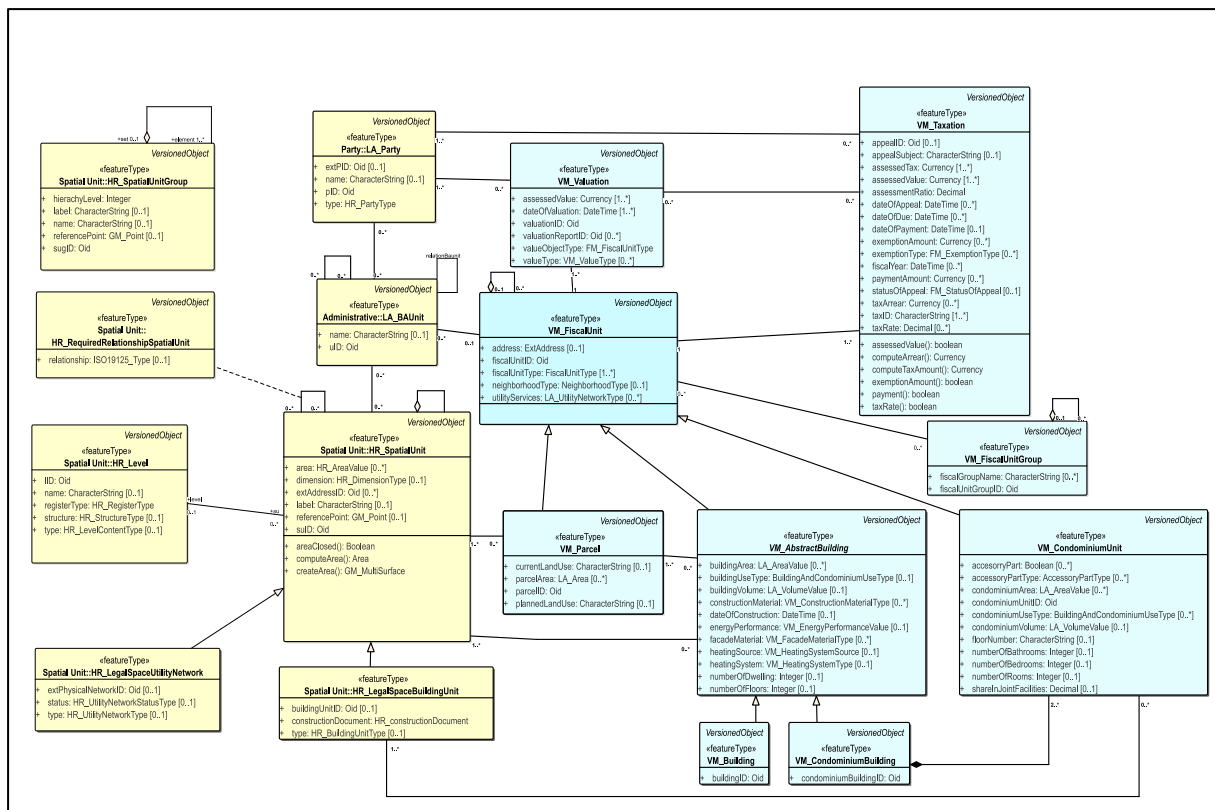
In addition to individual property appraisal, an important segment in effective space management is the appraisal of a large number of property in a certain area, i.e. the property mass appraisal. The data collected through mass property valuation were originally used for tax purposes (Ročić, 2012), and in modern space management systems their use is widespread. Property mass valuation is defined as a valuation method in which, group of properties in a wider area is valued using standardized procedures and methods, as opposed to individual valuation (Figure 2). The best known methods of mass property valuation are: the Multiple Regression Analysis (MRA) method (Benjamin et al., 2004), the Artificial Neural Network (ANN) method (Wang & Li, 2019) and GIS method (Geographic Information System - GIS)

(Kauko & d'Amato, 2008). The decree on Mass Property Valuation presented the method, model development and required data for mass property valuation in the Republic of Croatia. The Decree defines the method of Multiple Regression Analysis (MRA) as the official method, and the data from the land administration system are established as the basis for the property official identification in the process of property mass valuation. In the Republic of Croatia, property data transactions are collected in the eProperty, Property Information System application maintained by the Ministry of Construction and Physical Planning, which consists of Purchase Prices Collection which contains data on property collection and the Approximate Value Plan for viewing through the geoportal of the Spatial Planning Information System (ISPU) which contains a cartographic representation of price blocks associated with the associated attributes (Figure 3).



**Figure 3.** Land use and mass appraisal zones

Due to high collection costs, the procedure for determining the amount of the property tax in the Republic of Croatia was abandoned in 2001. Although it was planned to introduce it in 2017, there is still no property tax. The taxation of real property is done by taxing income from certain types of real property, the acquisition of real property and the ownership, but only for some types of real property (Tomić et al., 2021). The LADM is a conceptual model and standard (ISO) that defines data models and a standardised global vocabulary for land administration. The LADM is primarily concerned with the registration of rights, restrictions, and responsibilities (RRRs) to the land and considers other aspects of land administration as external (Lemmen et al., 2015). In order to make prototype of mass property valuation system, the Valuation Information Model Package was proposed as an extension of the Croatian LADM profile. In the proposed extension, the valuation object can be a cadastral parcel (land) with or without improvements (buildings) or land and improvements on a condominium property (Figure 4). The basic unit of the proposed extension is the ValuationUnitGroup, which corresponds to a single zone in the mass valuation zoning system.

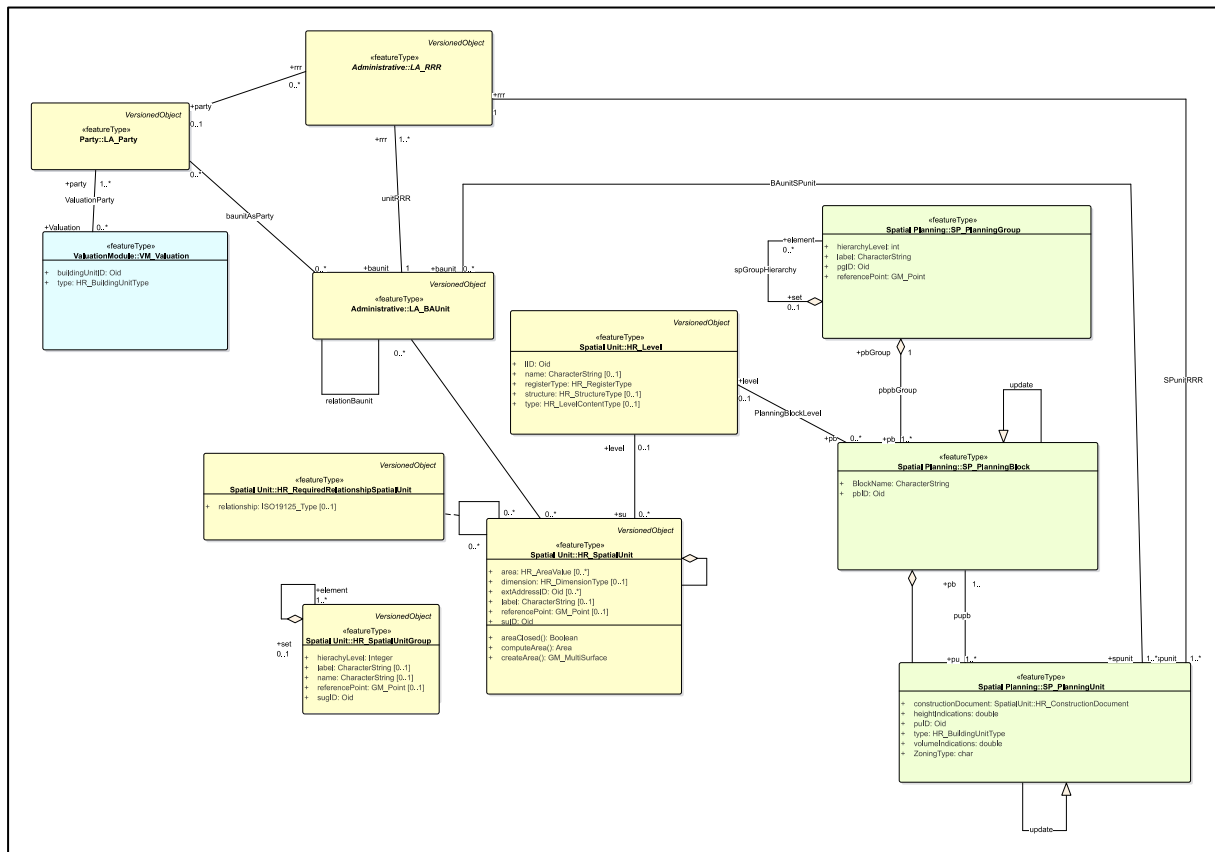


**Figure 4.** Croatian LADM (yellow) and its relations with Valuation Information Model classes (blue) (Tomić et al., 2021)

## 4 SPATIAL PLANNING IN CROATIA

Space is a valuable, limited and important resource shared by a variety of users and therefore requires high-quality management. Spatial planning is all methods that create conditions for the use, protection and management of space, which creates conditions for social and economic development (Official Gazzette of the Republic of Croatia, 2019). Urban planning is the process of using space and shaping the urban environment with the aim of ensuring controlled development of settlements and communities. In order for the space to be well planned/managed, it is necessary that it is defined in the spatial plans. In the Republic of Croatia, the spatial planning system is defined at several levels, depending on who issues the spatial plan, and the hierarchy of spatial plans has been established accordingly. At the top of the hierarchy are the spatial plans of the state level, which are adopted by the Ministry of Construction and Spatial Planning, followed by the spatial plans of the regional self-government, for which the counties are responsible and at the bottom of the hierarchy are the local governments, which adopt spatial, urban and detailed development plans. In the process of mass property valuation, urban development plans are used, which are divided into zones (zoning) in order to create price blocks that are a cartographic representation of grouped properties with homogeneous characteristics. The two basic criteria that affect the creation of price blocks are: the approximate value of the land, that can be determined based on recorded individual appraisals and characteristics that affect property value, of which location is the most important. Due to the importance of location as a key characteristic of property, price blocks

are created according to defined representations of the land use and urban planning rules (Majčica, 2018).



**Figure 5.** Croatian LADM (yellow) and its relation with Spatial Planning Information Package (green) (Tomić et al., 2021)

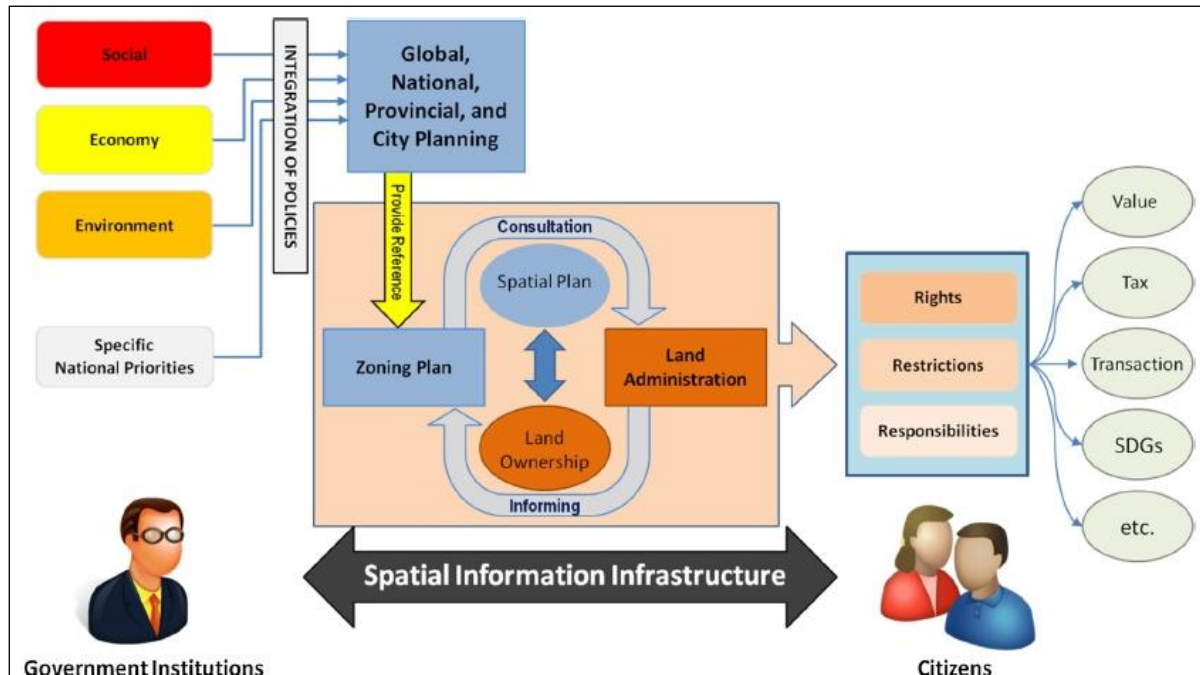
To support the proposed Valuation Information Model Package, the LADM Spatial Planning Information Package should be able to store zoning regulations that can be used as land rights restrictions. To enable this, Spatial Planning Information Package was proposed as an integration of the RRRs information from the spatial planning into the LADM (Figure 5). In the proposed package, the basic unit is SP\_PlanningUnit, which contains zoning plans and this unit corresponds to a zone in mass valuation zoning system (Indrajit et al., 2020).

#### 4.1 The Impact of Spatial Plans on Property Value

Local land use plans are among the most valuable legal acts for investors, owners and entrepreneurs, because they contain some of the most important property informations (Szmatoch, 2015). Property value is a fundamental indicator of the attractiveness and economic value of a particular location and of the amenities available at that location. These amenities include a variety of attributes ranging from the agricultural productivity of a site to the quality of an urban neighborhood around a particular site. In urban areas, variations in property values depend on the location and geographic advantages of a particular site, as well as local externalities and government policies regulating its use. Land use regulations in urban areas are



critical determinants of the shape of cities, their spatial patterns of physical development and use, the housing and transportation costs of residents, and their economic prosperity. Land use regulations can thus directly affect property values through the types of uses allowed, but also indirectly through the creation of neighborhoods and cities with a particular character (Kok et al., 2014).



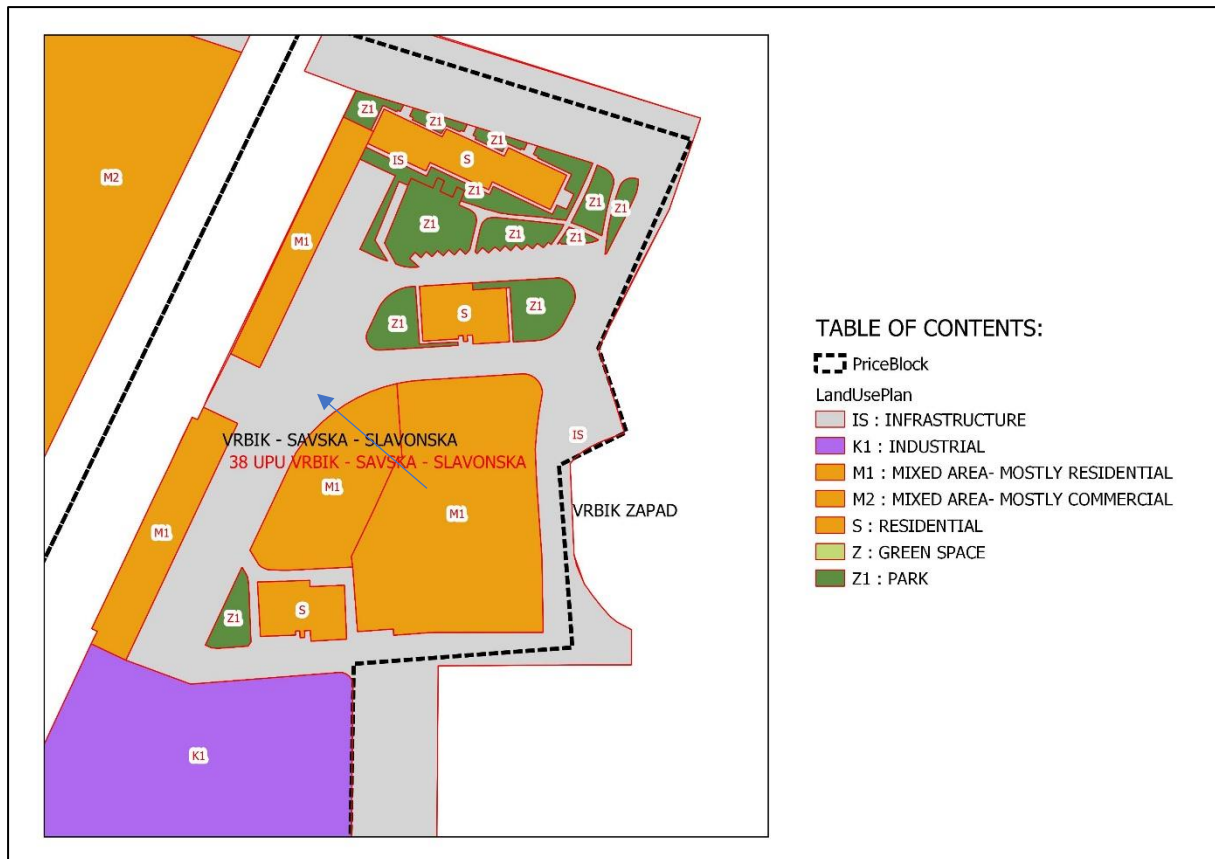
**Figure 6.** Correlation of spatial planning and property value (Indrajit et al., 2020)

Figure 6 shows how spatial planning and numerous other factors (social, socio-logical, economic...) influence the property value when integrating the LADM for sustainable development with the RRR of land management (Indrajit et al., 2020). It is also possible to establish a relationship in the opposite direction, i.e., using values in the process of spatial planning process as input data representing the current state of the property market in the area.

## 5 CASE STUDY CITY OF ZAGREB

Since 2012, 690 price blocks have been built on the territory of the City of Zagreb using a hybrid model of land use and urban rules. The available data on price blocks are: name of price block, land use, construction coefficient, etc. Public use areas are also divided into price blocks, although there is no data on transactions within these blocks as sales are not allowed in these areas. Constructing price blocks based only on the basis of land use would result in a high degree of homogeneity within the block, but would also result in an excessive number of price blocks, which would reduce visibility. By using a hybrid model of land use and urban design rules, acceptable homogeneity was achieved with a relatively lower number of price blocks, but also allowed areas within the same land use zone to belong to different price blocks (Figure 7). In the figure, the boundary of the price block is marked with a black line and the boundaries of the land use plan are marked with red line.

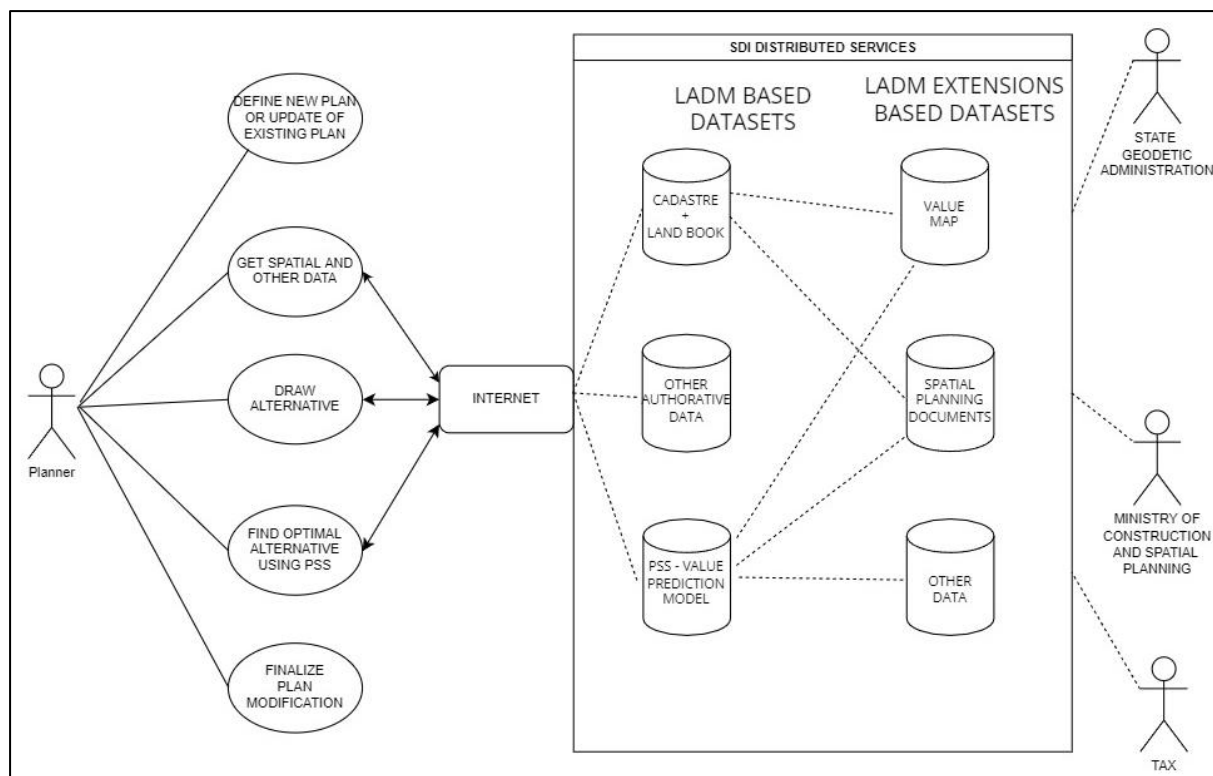




**Figure 7.** Visualization of price block and land use boundary

## 6 DISCUSSION

The analysis of previous research shows that in spatial planning values are not used as input information about the current state of the property market. The use of property values in the process of spatial planning as additional information to the traditionally used cadastre and land book information would enable balanced spatial development. The current state of technology and the development of distributed databases shared through web services provide access to data that united with official registers could form the basis of a planning support system (PSS) (Figure 8). The utility of PSS is illustrated by the prediction changes in property values as a result of updating or creating a new spatial plan. To accomplish this, it is necessary in future research when creating new or updating existing plan to make several variants that will be evaluated and then test the correlation of changes to the plans to property values. This correlation will be first step to the balanced spatial development. To make this possible, it is necessary to create a model that will be a mathematical background for calculating the specified correlation. This model will be tested and implemented in addition to the proposed Spatial Planning Information Package in Croatian LADM profile.



**Figure 8.** Possible use of property value in spatial planning

## 7 CONCLUSION

This paper analyses the possibility of using property values data as additional information to official registers that will form the basis of a future PSS. Although our investigations into this area are still in progress this paper has highlighted the importance of using property values data in the process of spatial planning. Despite the fact that our work has some limitations, we believe it could be a starting point for further analysis and research. The current study was limited by the availability of property values data, which are stored by Ministry of Construction and Spatial Planning and can only be shared only to authorised individuals. Further work will focus on creating a mathematical model to calculate the proposed correlation between property values and spatial planning.

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