

**FORMATION OF VALUATION INFORMATION MODEL
IN THE LAND ADMINISTRATION SYSTEM**

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Abstract. *The article examines the feasibility of developing a valuation information model for use in Ukraine's land administration system. The Land Administration Domain Model (LADM) standard, intended to standardize cadastre models of different countries, is considered. The conceptual principles of the valuation information model and its conformity to the Land Administration Domain Model (LADM) are revealed. Features of the basic valuation information model structure are presented, including identifying information needs and establishing relationships between classes of objects and their filling. This approach automates the data collection and analysis process and reduces the number of errors during evaluation. The article examines the implementation of the valuation information model based on LADM in Ukraine, which will require a comprehensive study of the legal and regulatory framework related to the land administration system in Ukraine. For the successful implementation of the valuation information system in Ukraine, the authors propose defining types of ownership in the model, spatial-territorial distribution, and types of tax payments administered in the system. Thus, a well-developed and implemented model of land administration can provide effective management of land resources, an increase in investments, and the generation of incomes.*

Keywords: *valuation information model, land administration system, land administration domain model (LADM), real estate taxation*

Formulation of the problem. The understanding of the necessity of introducing modern land administration systems has been in society for a long time. So back in 1980, The National Research Council (NRC) published a survey on the need for a multi-assessment inventory, according to which a developed cadastre system is a driving force for economic development.

The theory of land administration covers different processes used to realize three types of tasks: Land identification, land interest determination, and information organization. In market economies, these tasks are related to the basic functions of ownership, use, evaluation, and development.

Land administration, whether formal or informal, includes a wide range of systems and processes of administration. Land administration processes include the transfer of land rights from one person to another through sale, lease, loan, inheritance and inheritance, regulation of land and property relations, use and protection of land, collection of income from the land through sale, leasing, and taxation and settlement of conflicts relating to land ownership and use. Addressing these issues will require comprehensive reform of the land administration system and, in particular, a search for an approach to determining real estate value based on the modern valuation information model.

Analysis of the latest scientific research and publications. The issues of implementation of the modern model of land administration in Ukraine are devoted to the scientific works of scientists such as Shipulin V. Shipulin. E. [16], Tikhenko O. C. [14], Kozlova T. C. [12]. In their studies, they note that the introduction of a system of land administration will allow the consolidation of existing state registers on real estate objects, information on taxpayers, urban planning and environmental records, as well as cartographic data. In its turn, Tretyak A.M. and Kuryltsiv R.M. [15], in their scientific research, focus on forming a new infrastructure of information support for the land

administration system in Ukraine, capable of ensuring the use of geospatial knowledge for decision-making in the space-oriented environment.

In recent studies of such foreign scientists as F. Muhammad Khan [2], A. Kara [5], V. [1], H. Tomić [4], and M. A. Ad [7], the main attention is paid to the development of valuation information models within the framework of the LADM standard. At the same time, in domestic publications, the LADM standard mainly concerns the registration function of the land administration system [10,11,13].

Therefore, there is a need for a more comprehensive study of the evaluation component in the land administration system and to determine the directions for implementing the valuation information model in Ukraine based on LADM.

The purpose of the research. To study conceptual principles of formation of evaluation information models based on LADM abroad, as well as to define directions of development of this model in Ukraine.

Materials and methods of scientific research. The following scientific knowledge methods were used to realize the research goal: Monographic, analysis, and generalization. The monographic method studied scientific works devoted to the creation of LADM and evaluation information models for them. The analysis method examined existing standards, methodologies and recommendations for the construction of such models, as well as limitations on their application in Ukraine. The method of generalization is based on the necessity of the introduction of a modern system of land administration, which will be based on the standard LADM with a developed evaluation information model.

Research results and discussion. In land administration, land relations are established due to four main functions: Land ownership, land valuation, land use, and land development [9]. Four functions of land administration are distinguished by their professional orientation and generally carried out by combining the work of experts in the field of cadastre, land management, geodesy, geoinformatics, and urban planning.

In modern land administration, it is determined that the function of "land assessment" is interrelated and interacts with three other functions: land ownership, land use and land development.

The modern theory of land administration establishes the following definition of "land valuation" function: "Land valuation is the processes and institutions related to the valuation of land and land ownership; calculation and collection of revenues through taxation; management and judicial review of disputes concerning land valuation and tax disputes" [9].

Therefore, land administration systems seek to ensure stability [8] by providing accessible, accurate, authoritative, reliable, and unambiguous [3] information about who owns the land where it is located, its value, as it is used, and how it could or should be used. Thus, a well-functioning model of land administration will facilitate the collection of taxes and fees related to land use and land ownership.

In 2012, the ISO 19152:2012 Geographic information — Land Administration Domain Model (LADM) [6] was approved to standardize cadastre models of different countries by:

- definition of LADM, covering the main information components concerning land plots (both above and below the land surface);
- provision of an abstract, conceptual model with four packages (three basic packages and one subpackage):
 1. Party Package – package of parties (people and organizations);
 2. Administrative Package – a package of basic administrative units, rights, duties, and limitations (ownership rights);
 3. Spatial Unit Package (land plots, legal space of buildings, and engineering networks);
 4. Surveying and Spatial representation Package – a package of spatial information sources (filming) and spatial display (geometry and topology);
- providing terminology based on different national and international systems, as simplified as possible to be useful in practice. Terminology allows

describe different formal or informal practices and procedures in different jurisdictions;

- providing a basis for national and regional registers;
- agreement on merging information on land plots from different sources [1].

It is worth noting that among the main functions of LADM is very little attention paid to the evaluation. In our opinion, none of the above functions is secondary, but the valuation issue needs to be more widely disclosed, as real estate taxation depends on it.

Conceptual principles of the evaluation information model based on the ISO 19152:2012 standard LADM were offered by the author's team headed by V. Çağdaş. In particular, the authors argue that applying the LADM standard allows for an effective estimate of the value of a property, reduces bureaucracy, and ensures greater transparency in the process of valuation and taxation [1]. Their research presents the characteristics of the basic evaluation information model structure, including the identification of information needs, creation of the relevant information model, and establishment of the process of interaction between the assessment system, taxation, and the database (Fig. 1).

The developed expansion module offers a parent class FM_FiscalUnit, and FM_Parcel, FM_AbstractBuilding, subclasses FM_CondominiumUnit to represent sites, buildings and condominiums, and their physical and fiscal characteristics, necessary authorities, conducting assessment and taxation (Table. 1).

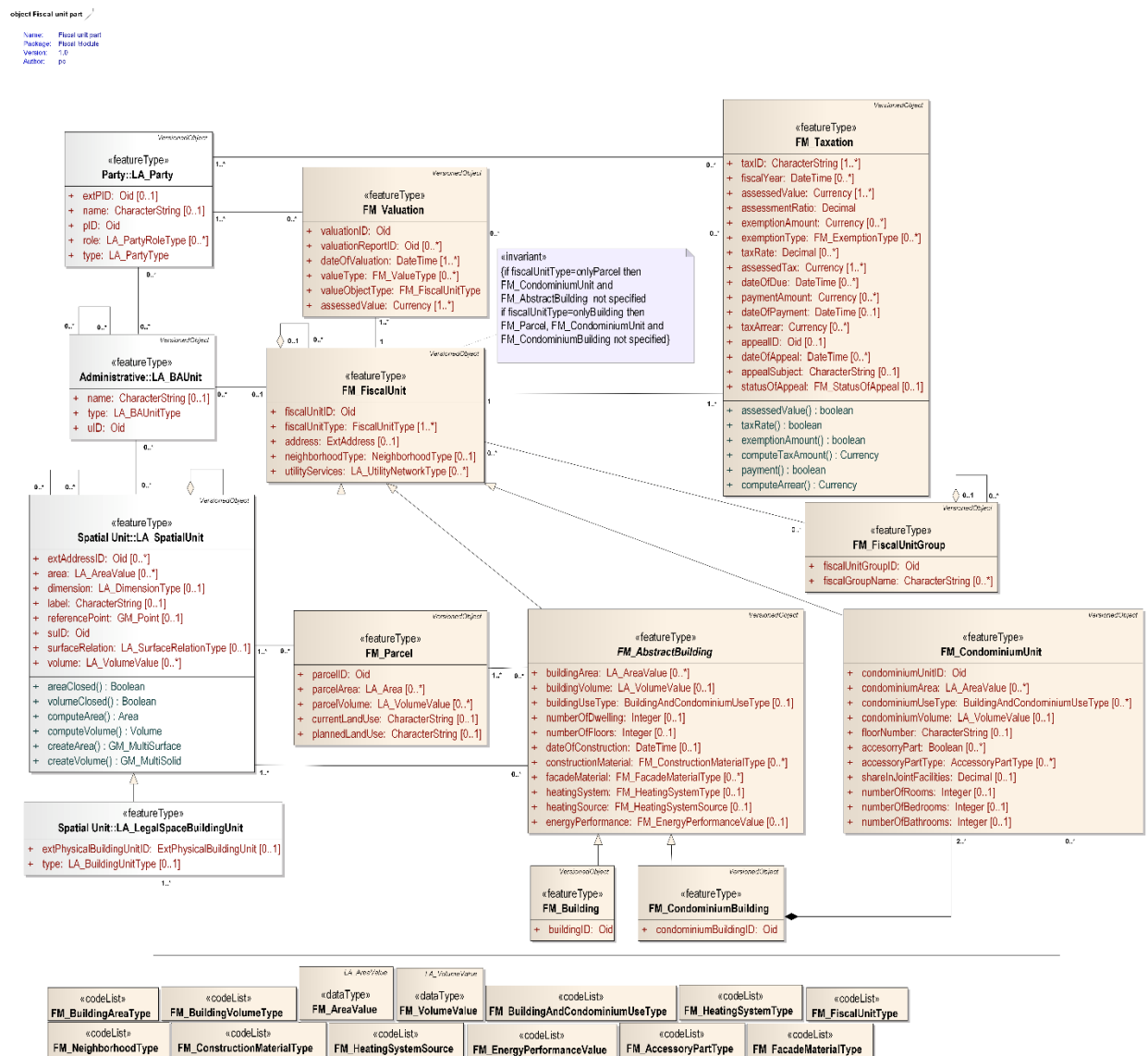


Fig. 1. Basic evaluation information model structure [1]

Table 1. Description of classes of the evaluation information model of the system of land administration

Model classes	Characteristics of the classes of the evaluation information model
FM_FiscalUnit	Represents the base unit of the fiscal register record, which marks the base unit of the cadastral systems. The expansion module allows you to record data only for selected fiscal units according to the tax base chosen (i.e., only areas or buildings, areas and buildings together, or condominiums).

Model classes	Characteristics of the classes of the evaluation information model
FM_Parcel	Represents plots or their parts based on land use for tax purposes. In addition to the inherited attributes from FM_FissalUnit, it must be attributed to site identifiers recorded in the cadastre information system, including current and planned land use.
FM_AbstractBuilding	Contains two classes such as FM_Building and FM_CondominiumBuilding. The first represents buildings that are considered as part of the land use but can be taxed or assessed separately from the areas in which they are located. FM_CondominiumBuilding is based on the OGC LandInfra/InfraGML standard and reflects buildings-condominiums.
FM_CondominiumUnit	Serves to record the basic characteristics of the condominium unit required for evaluation procedures, such as area and volume, type of use, type of condominium, floor, number of bathrooms and bedrooms. The assessment and taxation of the Condominium apply not only to the features mentioned above but also to related facilities and improvements.

The author's development is based on [1]

The following two classes of FM_Validation and FM_Taxation are similar to the external classes of ExtValuation and ExtTaxation in LADM and are created to determine the estimated and tax information.

The FM_Valuation class focuses on input and output data used in single or mass valuation processes for property tax assessment. FM_Taxation focuses on a record of specific tax information such as the name or ID of the real estate tax, fiscal year, estimated value, type and amount of tax benefits, cost/tax ratio applicable, and payment details (e.g., amount of payment, date of payment, identification of the application, subject of the application, and the status of appeal).

As you can see from the above, the evaluation information model in the LADM structure is intended to record the following information:

- on the property subject to valuation, as well as their characteristics,

- on properties through single- or mass valuation procedures,
- on transaction prices, generation and presentation of sales statistics.

Therefore, the evaluation information model is considered as the basis for organizing and ensuring the process of real estate evaluation, including land, which ensures the collection, processing, and analysis of structured data on valuation objects.

The evaluation information model includes the following elements:

- sources of data on assessed real estate, especially land;
- classification of real estate, providing a standardized approach to all objects of assessment;
- real estate valuation methods based on legal, economic, financial, and technical aspects;
- algorithms for processing and analyzing data necessary for real estate valuation;
- organizational and technical means for implementing the evaluation process.

The evaluation information model based on the LADM standard is a crucial tool for ensuring the effective functioning of the land administration system. It enables the integration of databases on valuation objects, primarily land plots, with the geospatial database of the state land cadaster. It also provides access to its data to all interested parties, including state and local authorities. In our opinion, this will automate the process of determining the value of real estate, ensure the adoption of more objective decisions in the field of valuation and taxation, and increase confidence in the assessment results.

Conclusions and prospects. The creation of a valuation information model based on LADM in Ukraine will require a comprehensive study of the legal and regulatory framework related to the system of land administration in Ukraine. Before starting to design the model, it is necessary to define the area of its application, namely the type of ownership, spatial-territorial distribution (territory of United territorial communities, territory of administrative-territorial units or their parts, territory of estimation areas and zones, land plots or their parts or the totality of land plots and rights on them, including

land shares, within the territory of Ukraine), and types of tax payments (state and local), which will be administered.

Once the model has been defined, it is necessary to collect data including property, land use, boundaries, and other relevant information. In this situation, it is expedient to use the geographic databases of the National cadastral system, the data stored in the register of real estate rights and the basis of unified registration of reports, information from notaries on the value of transactions, and from open sources on the value of proposals of a certain type of property. Only based on the collected data we can begin to design an evaluation information model of the data, which will determine the relationships between different data elements. Once the data model is developed, it must be implemented using the appropriate software tools. It can be an approach using commercial software, such as ArcGIS, the national land cadastre system is based on, or the development of specialized software.

In general, a qualitatively developed and implemented valuation information model in the land administration system can bring many advantages for our state, namely to ensure effective land resource management, increase investments and income generation.

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ФОРМУВАННЯ ОЦІНОЧНОЇ ІНФОРМАЦІЙНОЇ МОДЕЛІ В СИСТЕМІ ЗЕМЕЛЬНОГО АДМІНІСТРУВАННЯ

***Анотація:** У статті досліджується перспективи розробки оціночної інформаційної моделі для використання в системі земельного адміністрування в Україні. Розглянуто стандарт Land Administration Domain Model (LADM), що покликаний стандартизувати кадастрові моделі різних країн світу. Розкрито концептуальні засади побудови оціночної інформаційної моделі та відповідність цієї моделі стандарту Land Administration Domain Model (LADM). Представлено особливості структури базової оціночної інформаційної моделі, включаючи визначення потреб в інформації, встановлення взаємозв'язків між класами об'єктів та їх наповнення. З'ясовано, що такий підхід забезпечує автоматизацію процесу збору і аналізу даних, а також зменшення кількості помилок під час проведення оцінки. У статті обґрунтовано, що впровадження оціночної інформаційної моделі на базі LADM в Україні вимагатиме всебічного вивчення правової та регуляторної бази. Для успішної реалізації оціночної інформаційної системи в Україні авторами пропонується визначити типи власності, просторово-територіальне поширення та види податкових платежів, що будуть заадмініструватися в системі. Доведено, що якісно розроблена та впроваджена оціночна інформаційна модель земельного адміністрування дозволить забезпечити ефективне управління земельними ресурсами, збільшення інвестицій та генерацію доходів.*

***Ключові слова:** оціночна інформаційна модель, система земельного адміністрування, Land Administration Domain Model (LADM), оподаткування нерухомості.*