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# ANALYSIS OF INFORMATION SUPPORT IN THE CONTEXT OF ESTABLISHING A MASS APPRAISAL SYSTEM FOR LAND IN UKRAINE

The aim of this work is to analyze the compliance of the information indicated in existing state registers and databases with the requirements set for automated mass appraisal systems of real estate, according to the standards adopted by the International Association of Assessing Officers (IAAO), and the possibility of applying various methodological approaches to appraisal. To achieve the research objective, the following methods of scientific inquiry were applied: monographic, analysis, and synthesis. The monographic method was used to study scientific works dedicated to the introduction of mass appraisal systems in Ukraine and worldwide. The analysis method was employed to study existing registries, databases, standards, methodologies, and recommendations for the construction of such systems, as well as limitations regarding their application in Ukraine. The synthesis method justified the need for the introduction of a modern cadastral system and highlighted shortcomings in the content and methodology of maintaining existing state registers containing information about real estate objects in Ukraine. As a result of the analysis, it was found that, overall, the aggregate information available in various sources, databases, and registers is sufficient for conducting mass appraisal of non-improved land parcels. At the same time, the authors highlight the issue of the lack of a unified information exchange system, the implementation of which would enable the use of existing information. Additionally, the limited ability to use existing registers for implementing income and cost-based methodological approaches applicable to improved land parcels is emphasized. The scientific novelty and practical significance lie in highlighting the possibilities and feasibility of using the existing State GeoCadastre database as a basis for a future mass appraisal system, as it indirectly affects the values specified in the state register of property rights to real estate.

*Key words:* appraisal information model, mass real estate appraisal system, land administration domain model (LADM), computer-assisted mass appraisal (CAMA), state register of real property rights, cadastre system

### Introduction

The land cadastre, as an important component of the system of public registers, plays a key role in the development of the economy and the stability of the state. The land cadastre is a system of state accounting for land plots and real estate, which contains information about their owners, boundaries, characteristics, and other important data. The main function of the land cadastre is to ensure transparency and legal certainty in ownership, as well as to reduce transaction costs for participants in the real estate market.

A large body of research confirms the land cadastre's positive impact on the state's economic development and the growth of its GDP. For example, in the article [Popov, 2014], the analysis demonstrated a significant positive effect of the introduction of cadastral systems on the GDP per capita through the reduction of transaction costs and the increase in tax revenues.

Thus, the land cadastre serves not only as a tool for ensuring property rights but also as a key factor in economic growth and sustainable development of the state. Understanding the impact of the land cadastre on GDP is of great importance for formulating effective policies in the field of land relations and real estate regulation.

One of the problems in implementing a high-tech cadastral system overall and mass appraisal, in particular, is the input data. Sources of such data, taking into account the requirements imposed by international standards [International Association of Assessing Officers, 2018; https://www.iaao.org] typically include national registries such as registers of property rights, cadastral registries of land plots, buildings, mineral resources, engineering structures, and so on. The implementation of a real estate mass appraisal system is strategically important for the sustainable development of Ukraine, as evidenced by the approval by the Cabinet of Ministers of the Procedure for implementing a pilot project on mass land valuation on October 13, 2023. In this article, the authors analyzed the possibility of implementing

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a mass appraisal system based on information contained in domestic registries, taking into account the requirements for such data.

It is worth noting that the issue of forming a mass land appraisal system in Ukraine has been addressed in the scientific works of Koshelev A. and Kovalenko S. [International Valuation Standards Committee. 2023; Kovalenko, 2022], the foreign experience of mass real estate appraisal is highlighted in the work of Bondar M. and Kulik A. [Bondar, & Kulyk, 2021]. In turn, the research results of Hubar Y. [Hubar, 2017] have proven the expediency of applying GIS technology for mass land valuation. Regarding international experience, the development of an effective property valuation system using the LADM assessment information model is discussed in the work of Hrvoje Tomić, Siniša Mastelić Ivić [Tomić, et al., 2021], while the automated model of the appraisal process for sustainable land resource management has been studied by Jurijs Holms and Irina Arhipova [Holms, et al., 2017].

## **Purpose**

The aim of this study is to analyze the compliance of the information provided in existing state registers and databases with the requirements imposed on automated mass real estate appraisal systems, according to the standards adopted by the International Association of Assessing Officers (IAAO), and to assess the potential for applying various methodological approaches to appraisal. Additionally, the authors aimed to make judgments regarding the possibility of applying various methodological approaches to the assessment of land plots depending on their functional purpose and the presence of land improvements.

### Source data

To achieve the research goal, the following methods of scientific inquiry were employed: monographic, analytical, and summarizing. The monographic method was used to study scientific works dedicated to the implementation of mass appraisal systems in Ukraine and worldwide. The analytical method involved studying existing registers, databases, standards, methodologies, and recommendations for constructing such systems, as well as limitations regarding their application in

Ukraine. The method of summarizing was utilized to justify the need for implementing a modern cadastral system and to highlight the shortcomings in the content and methodology of maintaining existing state registers containing information about real estate objects in Ukraine. Additionally, attempts were made to assess the meteorological situation for the entire territory of Ukraine, and by calculating the values of tropospheric delay and its components, graphs of their variation for this territory were constructed.

#### Research results

As of the beginning of 2024, Ukraine operates two current registries containing information about real estate objects and their owners: the State Land Cadastre and the State Register of Property Rights to Real Estate. The study took into account the fact that as of today, Ukraine has not yet implemented either the Unified State Address Register (USAR) or the Register of Buildings and Structures (RBS) [https://jurliga.ligazakon.net/news/213438 v-ukranstvoryat-diniy-derzhavniy-restr-adres--restr-budvel-tasporud]. The authors also considered the orientation of state programs, including those mentioned in the strategic plan of the State Service of Ukraine for Geodesy, Cartography, and Cadastre for 2023-2025. [https://zakon.rada.gov.ua/laws/show/1205-2023π#Text] and in accordance with the Land Relations Development Strategy in Ukraine [https://kse.ua/wpcontent/uploads/2021/05/Land-strategy.pdf].

Therefore, it has been deemed appropriate to focus on analyzing the content of existing registries from the perspective of the information necessary for conducting mass appraisal of land plots.

Before analyzing the existing registries for the presence of information, it is important to determine what specific data is required. An indicative list of information necessary for conducting mass appraisal of land plots is defined in the mass appraisal standard [https://www.iaao.org], and includes the following: land area, availability of engineering utilities, location, recreational potential, and external inconveniences (such as traffic, noise, proximity to industrial areas).

At the same time, the Standard for Verification and Adjustment of Sales [https://www.iaao.org] specifies the number of factors for maintaining the database. They involve a type of use, most efficient

use, transaction date, legal property description, seller and buyer information, transaction type, physical characteristics, and location.

According to the authors, the aforementioned list of factors is comprehensive and can serve as a guideline for maintaining a unified database of land transactions.

In Ukraine, the automated exchange of information regarding land plots is conducted using the following information systems: the State Register of Rights and the State Land Cadastre, managed by the Ministry of Justice of Ukraine and the State Service of Ukraine for Geodesy, Cartography, and Cadastre respectively.

The authority responsible for maintaining the State Land Cadastre also provides the authority for state registration of rights with information about registered land plots contained in the State Land Cadastre. This information includes the state registration of the land plot (registration date, the name of the registering authority), cadastral number, area, location of the land plot, and the cadastral plan of the registered land plot in electronic (digital) form.

Given the purpose of this research, it is proposed to analyze the Unified Database of Appraisal Reports [https://www.spfu.gov.ua/ua/content/spfestimate-basereport-dani-z-edinoi-bazi.html] and data from the State Cartographic and Geodetic Fund

of Ukraine. The use of these datasets may be relevant to develop a mass appraisal system.

When creating a comparative table, the authors deemed it necessary to analyze the adequacy of available information for implementing a specific methodological approach. This division, as indicated in Table 1, is based on international appraisal standards [International Association of Assessing Officers, 2023] and the mass appraisal standard. So, a corresponding methodological approach should be applied for each type of real estate, which best suits the given type of property.

It is worth noting that the possibility of implementing a particular methodological approach depends on the type of value being determined. In section 2 of the European Valuation Standards [EVS, 2020], it is clear that this standard does not specifically address the requirements for the type of value to be used for tax purposes. It indicates that the value for tax purposes should adhere to the relevant national or local legislation or rules.

At the same time, following international valuation standards and national standards of Ukraine, when determining the value for taxation, the market value should be the tax base. In the future, the authors analyzed the availability of relevant information in terms of the possibility of determining the market value.

 ${\it Table~1}$  The comparative analysis of the available information in state registries

The approach used / information required within the approach	State Register of Real Estate Rights	State land cadastre	Database of reports of the State Property Fund of Ukraine
Land area	+	+	+*
Purpose of the land	+	+	+*
Location	+	+	+*
Land improvements area	+	-	+*
Type of land improvements	+	-	+*
Structural elements of land improvements	-	-	+*
Technical condition of land improvements	-	-	+*
Existing engineering networks	-	-	+*
Construction volume of land improvements	-	-	-
Category of land improvements	-	-	+*

Analyzing the table above, certain conclusions can be drawn. Firstly, based on the information available in the State Register of Real Rights, even with the exchange of information with the State Land Cadastre, it is sufficient only for the implementation of a comparative methodological approach in the Computer-Assisted Mass Appraisal (CAMA) system, provided that recent property transactions have taken place regarding most land plots in the quarter. The relative recency of transactions is important in appraising land. This is because such transactions provide clear value indicators for most land plots, as they have a cadastral number and a clear purpose according to the classifier. This helps in forming the land plot.

It is also worth noting that the absence of information on existing engineering communications, restrictions, and favorable factors such as recreational facilities can hinder the implementation of the comparative methodological approach, since information is only available for plots subject to regulatory monetary valuation. The authors also emphasize on the information regarding land contamination because of military actions in Ukraine. This factor is important to considerwhen collecting taxes from a particular land plot. Such information is included in the regulatory monetary valuation. The authors also want to highlight that information about land contamination in Ukraine is an important factor to consider when assessing taxes for a specific piece of land. This information is included in the regulatory monetary valuation.

When comparing the information needed to use income and expense methods for assessing improved land plots with what is available in state registries, it is clear that most of the required data is in the reports from the State Property Fund of Ukraine. However, this is only for land plots that have received expert monetary valuation since the unified database of appraisal reports was established. It is also important to acknowledge that significant changes may have occurred since the date of the last property transaction of a land plot and its improvements .So why, despite having the majority of all necessary data for assessment in the State Register of Property Rights, which also includes the value of the latest usage agreement, does it still seem inadequate in its current form? The answer lies on the surface - it is about the value specified during the sale-purchase agreement. Let us delve deeper into this issue.

According to the authors, there are two problems associated with the values recorded in the State Register of Property Rights. The first problem arises from people's desire to save on taxes by indicating not the actual sum of money for the sale-purchase agreement but the minimum value allowed for registration by the State Property Fund of Ukraine database. The second problem concerns the algorithm for determining value based on the State Property Fund of Ukraine database. While the first issue is more about individual responsibility and potential risks, both legally and in terms of fraud, the second has been a subject of debate for years.

It is worth noting that representatives of the State Property Fund of Ukraine acknowledge during numerous conferences that the database module's performance is far from perfect. However, despite time passing, the results produced by the database continue to surprise, as evidenced not only by publications in the mass media [https://fakty.com.ua/ua/ukraine/ekonomika/20180801-na-hreshhatyku-zakinchylysya-kvartyry-po-6000], but also by feed back from the State Geocadastre [Leshchenko, 2022].

Unfortunately, open sources lack information regarding the algorithm of operation of the unified reporting database module, making it difficult to provide comments or suggestions for improvement. However, the proposal for its modernization by involving specialists from various fields (mass appraisal, CAMA software programming, appraisers, representatives of the State Geocadastre and the State Property Fund of Ukraine, tax authorities, notaries, and other potential users and developers) seems more attractive than developing an external software resource.

As mentioned earlier, in the event of disclosing the data extraction and processing mechanism for the State Property Fund of Ukraine database, it would be possible to compare it with international practices in this area and verify its compliance with mass appraisal standards. The State Property Fund of Ukraine database effectively serves as a mass appraisal system, since its combination of characteristics allows for such classification.

It is also worth noting that the State Property Fund of Ukraine database of reports is the only register, as of the date of writing this article, that contains information about the structural elements of land improvements, their technical condition, actual use, and available engineering infrastructure. The information provided can be valuable for assessing the value of upgraded land plots. This assessment is primarily conducted within the framework of income and cost-based methodological approaches, under mass appraisal standards and international appraisal standards.

Another question arises, regardless of whether a mass appraisal system is built from scratch or the existing State Property Fund of Ukraine (FDU) database is modified: the potential system's completeness. If the system is implemented only for land plots and solely for mass appraisal purposes, its completeness may be significantly lower compared to implementing a unified LADM (Land Administration Domain Model) system. The LADM system would integrate all existing and prospective databases, enabling not only value calculations but also the provision of administrative services to

individuals, government agencies, and businesses. Implementing a modern LADM system would allow for comprehensive verification of real estate objects various parameters. based on They include transaction history, burden, parametric tax characteristics, engineering infrastructure, and the ability to conduct real estate transactions, similar to recent implementations with vehicles using digital signatures.

Therefore, it seems quite appropriate to argue for the feasibility of developing a mass appraisal system that conforms to LADM standards, considering that it will be used for Computer-Assisted Mass Appraisal (CAMA) [International Association of Assessing Officers, 2018]. Hence, it should include the necessary data for model building. Fig. 1. illustrates an example database configuration, considering the existing state registers and the requirements for mass appraisal systems.

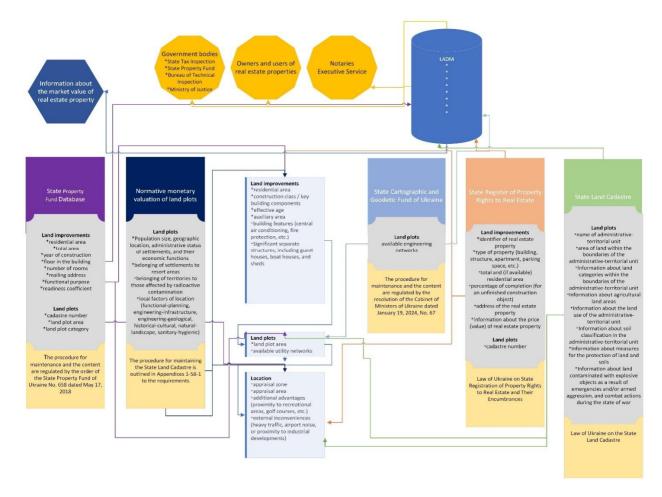


Fig. 1. Proposed database configuration considering existing state registers

The next question is related to determining the most significant factor influencing the value of real estate, namely the location. As mentioned earlier, according to the standard, information about the location of the property must be determined in a standardized manner. In the register of property rights, information about the land plot is usually displayed in the format of region, city, street, and number. However, in practice, this method of presenting the location is not always efficient and informative. Firstly, the absence of the full address or address as a whole is quite common. Secondly, this method of presenting information is poorly suited for its application in mass appraisal models. It is worth noting that the issue of standardized presentation of location information is not unique to the territory of Ukraine. The most common solutions to this problem include:

- Transformation of the conventional address format into numerical coordinates - forming coordinates from addresses. This method has become widespread in areas where statistical data for mass appraisal systems are taken not only from state registers but also from open sources of information. It is worth noting that there are special libraries for this method in programming languages such as Selenium for Python, which help determine coordinates with relatively high accuracy based on the location description [https://towardsdatascience. com/using-python-and-selenium-to-get-coordinatesfrom-street-addresses-62706b6ac250]. One advantage of this approach is the ability to supplement and complement statistical information in case of its absence or underdevelopment in state registers. However, a drawback is that addresses in advertisements are not always accurate, especially in the Ukrainian real estate market, which is associated with the specifics of realtors' work in Ukraine. Additionally, precise location determination is often challenging in rural and less populated areas due to low quality.
- Utilizing unique identifiers for land parcels and land improvements in conjunction with highquality cartographic data. This method has seen the most usage as it combines accuracy, reliability, and ease of use. However, one drawback of this method is its resource intensiveness. This is because the process requires accurate mapping information for

the entire country and the unique identification of each land parcel, followed by assigning a unique number to it. [International Association of Assessing Officers, 2023].

The authors suggest that it is important to emphasize that global standards require the establishment of criteria for the development of automated evaluation models [RICS, 2022]. These models should adhere to general requirements. Therefore, a collegial body should be formed to certify the developed mass evaluation systems. Additionally, national evaluation standards for each country should align with internationally accepted norms and standards. Only in this case, potential users such as government agencies, legal entities or individuals (including non-residents), who consider investment in another country's real estate market, can be confident that the system operates fairly. Also, in the case of standardization of systems, it becomes much easier to train relevant specialists and modernize the systems themselves.

### Scientific novelty and practical significance

The scientific novelty of the conducted research lies in identifying discrepancies between the information available in state registers and the criteria required for mass appraisal systems. Additionally, it has been confirmed that the available information in the registers does not allow for the utilization of methodological approaches other than comparative, except for parcels for which information on land improvements is entered into the unified reporting database of the State Property Fund of Ukraine. The obtained results can be used to create a unified cadastral system, which would serve as the basis for establishing a mass appraisal system for land parcels and improvements in Ukraine.

### **Conclusions**

After reviewing the information in state registries, it is clear that in order to implement a high-quality mass appraisal system that meets international standards, which is necessary for cooperation with the International Bank, we need to address the issue of collecting the necessary information to build the required database. If the state institutions responsible for implementing the mass appraisal system decide to proceed with location

identification based on a unique identifier, such as the cadastral number in Ukraine, it raises questions about the inventory of each land plot in Ukraine. This includes updating necessary data for each plot and eliminating factors such as boundary overlaps. These issues hinder not only the sustainable development of the mass appraisal system but also the property rights system as a whole.

Although the issue of boundary overlaps is not directly related to this topic, it is a cornerstone for the implementation of a modern cadastre system. It is worth noting that the problems and solutions are quite extensively covered in public sources of information. [https://kosivart.if.ua/2023/11/14/12740].

Thus, the authors identified the inadequacy of available information for implementing all appraisal methodological approaches, the inconsistency of existing registry content with the requirements imposed on automated mass appraisal systems, and proposed a conceptual scheme for building a unified cadastre system that would enable more efficient and accurate mass appraisal of land plots.

During the drafting of this article, the authors emphasized that real estate market value should be used as a tax base, in line with international standards. At the same time, according to the analysis, the implementation of the system of mass assessment for taxation will be based on the data specified in the state register of property rights. Therefore, the authors believe it is important to conduct a future comparative analysis of the tax base of real estate properties and their market value. This analysis should also consider the factors that contribute to changes in value over time, which could be used as coefficients for value reduction. This approach would allow for the use of the entire available sample, ultimately improving the accuracy and fairness of the data collected.

The authors conclude that a separate article should address the question of whether to consider the purpose of land in a specific cadastral zone, comparing the tax base and market values, and calculating potential changes in income from real estate taxation if the tax base changes.

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## Роман КУРИЛЬЦІВ<sup>1</sup>, Олександр МИРОНОВ<sup>2</sup>

## АНАЛІЗ ІНФОРМАЦІЙНОГО ЗАБЕЗПЕЧЕННЯ В УМОВАХ СТАНОВЛЕННЯ СИСТЕМИ МАСОВОЇ ОЦІНКИ ЗЕМЕЛЬ В УКРАЇНІ

Метою даної роботи  $\epsilon$  аналіз відповідності інформації зазначеної у наявних державних ре $\epsilon$ страх та базах даних вимогам, що висуваються до автоматизованих систем масової оцінки нерухомого майна, згідно прийнятих Міжнародною асоціацією фахівців оцінки (ІААО) стандартів та можливість застосування різних методичних підходів до оцінки. Для реалізації мети дослідження застосовувалися наступні методи наукового пізнання: монографічний, аналізу, узагальнення. Монографічним методом вивчалися наукові праці, що присвячені запровадженню систем масової оцінки в Україні та світі. Методом аналізу вивчалися існуючі реєстри, бази даних, стандарти, методології та рекомендації щодо побудови таких систем, а також обмеження щодо їх застосування в Україні. Методом узагальнення обгрунтовано необхідність запровадження сучасної кадастрової системи та висвітлено недоліки вмісту та методології ведення наявних державних реєстрів в яких містяться відомості про об'єкти нерухомого майна в Україні. В результаті аналізу, виявлено, що, в цілому, сукупності наявної в різних джерелах, базах даних та реєстрах інформації достатньо для проведення масової оцінки не поліпшених земельних ділянок. В той же час, авторами, висвітлюється проблематика відсутності єдиної системи обміну інформацією, запровадження якої, дало б можливість використовувати наявну інформацію, а також підкреслюється обмежена можливість використання наявних реєстрів для реалізації дохідного та витратного методичних підходів, що застосовуються для поліпшених земельних ділянок. Наукова новизна та практична значущість полягають у висвітлені можливості та доцільності, в якості бази для майбутньої системи масової оцінки, застосувати наявну базу ФДМУ, як таку, що опосередковано впливає на вартості зазначені у державному реєстрі речових прав на нерухоме майно.

Ключові слова: оціночна інформаційна модель, система масової оцінки нерухомого майна, Land Administration Domain Model (LADM), CAMA, державний реєстр речових прав на нерухоме майно, кадастрова система

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