



Article

Ways to Improve The Methodological Foundations of Mass Real Estate Appraisal

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Abstract: This article is devoted to researching the development of real estate valuation methodology in Uzbekistan, highlighting the significant financial losses experienced by local government authorities due to the absence of an updated, relevant, and transparent tax assessment system. The primary hypothesis of the study is that improving the methodological and institutional framework for mass appraisal will lead to the gradual development of real estate market relations in Uzbekistan, as well as the sustainable formation of an effective and fair tax system. The research identifies current issues within the national mass appraisal system and proposes corresponding solutions. The majority of these problems are related to the lack of market data and the use of outdated methodologies. The obtained results support the idea of creating, implementing, and sustainably maintaining a mass appraisal system as a fundamental element in establishing an equitable real estate tax system. This, in turn, stimulates regional development and supports economic activities related to the real estate market.

Keywords: Real estate valuation, real estate taxation, mass real estate appraisal, value modeling, regression.

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1. Introduction

Currently, the real estate market in Uzbekistan is in a state of moderate stagnation, characterized by low transparency, inconsistencies in real estate cadastre data, and insufficient development of the institutional infrastructure. These problems are also clearly evident in a crucial part of valuation activity: the mass real estate appraisal process carried out for taxation purposes. Given that mass appraisal serves a highly specific purpose, the attention of stakeholders to the valuation results is exceptionally high.

On the one hand, the state – through its regional bodies – relies on the results of this process to monitor real estate market dynamics and to formulate local budget indicators necessary for regional administration. On the other hand, civil society – as taxpayers – reacts directly to reforms concerning the real estate tax and the supplementary wealth tax, which are calculated based on the value assessed by the real estate cadastre. A vast majority of the disputes and debates that arise during the fulfillment of civic obligations to pay real estate taxes stem from the valuation methodology and the principles applied in determining property values. Ultimately, all of these issues come down to the tax amounts calculated through mass appraisal.

Despite having experience in the mass appraisal of certain categories of real estate for taxation purposes since the first decade of the current century, tax authorities continue to calculate real estate taxes based on outdated values derived from the results of those initial mass appraisals. The remaining portion of real estate is taxed according to normative

values established using indices from the 1970s, subject to only partial indexation. All of these factors result in massive financial losses for local government budgets, which in turn negatively impacts the socio-economic development dynamics of the regions.

As relations within the real estate market have developed, the level of awareness among real estate taxpayers – namely, the citizens – has also increased. This has led to the emergence of new factors that influence the value of real estate and the conditions surrounding its appraisal. The continued application of outdated models used in previous valuations creates a number of problems; the results obtained through these models fail to reflect current market conditions and fluctuations in real estate values. These issues have created the necessary prerequisites for developing and implementing new methodologies based on modern mathematical and cybernetic modeling methods.

The introduction of a value-based real estate taxation system stands out as the most crucial aspect of tax reform in many countries. Transitioning to this new system is particularly relevant for developing economies, where concepts such as “private property”, “market relations” and “market value” are relatively new. Currently, a comprehensive tax reform is underway in our country, which envisions a transition to calculating the tax assessment of real estate based on market value. The multifunctional real estate cadastre system currently being implemented in the country plays an important role in creating a solid foundation for tax assessment [1].

Real estate tax is one of the most important sources of revenue for local budgets, especially in developing countries. Specifically, in Uzbekistan, property tax accounts for around 11.8-13% of local budget revenues, while central government transfers provide 50%. Therefore, creating an effective real estate taxation system is of great importance in establishing a decentralized model of local governance.

This tax enables local authorities to recapture a portion of the increased real estate value resulting from public expenditures back into the budget. As McCluskey emphasized, real estate serves as a convenient object for taxation because it is “visible, immovable, and an obvious manifestation of wealth” . When properly managed, property tax is even more attractive compared to other sources of local revenue, emerging as a fair and highly effective fiscal instrument.

Following independence and the transition toward creating or reconstructing a market economy, comprehensive reforms of the tax system, including real estate taxation, were initiated. Global experience demonstrates the existence of various approaches to real estate taxation. According to the classification in US appraisal practice, in some countries, tax calculations are based on the area of land plots and buildings, while in others, they are determined by the market value of the land and structures.

Area-based systems are administratively simple, as determining the tax base merely requires ascertaining the size of the property. This approach eliminates the necessity of collecting and analyzing expensive market data or conducting frequent revaluations. Furthermore, measuring area is significantly more objective than determining market value, a process in which appraisers form their conclusions based on comparables. Consequently, area-based approaches generate fewer disputes compared to market value-based appraisals [2].

2. Materials and Methods

Literature Review

Literature Review. The theoretical and conceptual foundations of real estate taxation were shaped by classical and neoclassical economic schools, with the principles of equality, certainty, convenience, and efficiency put forward by A. Smith forming the methodological basis of modern tax systems. These principles were later developed in research by N. Turgenev [3], A. Wagner [4], and M. Friedman [5], substantiating the role of taxes as a mechanism that ensures a balance between fiscal interests and social justice.

In international studies (IMF, World Bank, OECD, IAAO), real estate tax is recognized as a vital source for ensuring the financial independence of local budgets. Aligning cadastral value with market value and implementing mass appraisal models are highlighted as the primary directions for increasing tax efficiency.

In the works of Uzbek economists, these issues are addressed from the perspective of national conditions. In particular, the research of A.V. Vakhobov, A.Jurayev, and A.Altiyev substantiates the fiscal significance of property and land taxes, as well as their role in strengthening regional budgets. Studies by I.Niyazmetov and M.Tuychiyev analyze the problems of tax base formation and the administration of property taxes. Meanwhile, A.Mirkhoshimov and U.Pardayev [6] demonstrate the impact of tax policy on economic activity and the investment climate in their research.

Furthermore, in the scientific research of U. Tulakov, mass appraisal in real estate taxation is substantiated as a vital instrument for aligning cadastral value with market value, expanding the tax base, and ensuring tax justice. The author emphasizes the necessity of integrating mass appraisal with tax administration and the cadastre system [7].

Overall, while Uzbek scholars have established a certain scientific foundation regarding real estate tax, the issues of systematically implementing market-value-based cadastral valuation, institutionally strengthening mass appraisal models, and enhancing the integration between tax and cadastral authorities have not been sufficiently researched in a comprehensive manner. This scientific gap determines the relevance of this dissertation research.

Research Methodology

Research Methodology. The methodological basis of this research consists of studying and systematizing the works of local and foreign scholars on aspects such as real estate appraisal, the current state of the local real estate market, investment analysis focused on real estate efficiency, fiscal policy, mathematical modeling, and real estate management.

During the research process, fiscal legislation and regulatory documents, real estate cadastre data, real estate management and appraisal practices, methodological manuals, internet information sources, and other studied resources were utilized.

By employing scientific methods such as analysis, deduction, induction, grouping, comparison, analogy, scientific abstraction, synthesis, and statistical techniques, the author evaluates the effectiveness of the proposed methodological solutions by comparing the quality indicators of new models based on the proposed methodologies with those of outdated appraisal models.

3. Results and Discussion

Currently, the Republic of Uzbekistan is undergoing a transition process from the previous real estate taxation system – which was based on inventory value considering only construction cost and depreciation – to a system of determining the cadastral value of real estate based on the property's actual market price [8], [9].

The initial legal foundations for this new approach began to be introduced between 2018 and 2020 through the newly revised Tax Code and Presidential Decrees. During the initial stage (2020 - 2022), this system was tested primarily on real estate objects in major cities such as Tashkent and Nukus, as well as provincial centers, by establishing a “conditional cadastral value” (a minimum amount per 1m²) [Error! Reference source not found.0].

By 2023–2024, the process of aligning the tax base with market prices fully expanded to include commercial and industrial properties – namely, non-residential buildings. In particular, it was established that for legal entities, the tax base cannot be lower than the absolute minimum value specified per 1m².

The specific mechanisms and timelines for implementing the new system were established by the Decree of the President of the Republic of Uzbekistan dated March 5,

2025, No. DP-43, "On the implementation of a mass real estate valuation system". According to the decree, starting from 2025, all real estate objects will gradually undergo periodic mass appraisal to determine their value in close alignment with market prices.

The process of transitioning to mass appraisal and the new tax regime, as in international practice, is carried out in the following stages:

The first stage (2025–2026): As a pilot project, only real estate objects located in the city of Tashkent will undergo mass appraisal. This is explained by the high activity of the real estate market in the capital and the relatively well-developed database.

The second stage (2026–2027): the scale of the reform will be expanded to cover the city of Nukus and regional centers. During this period, the cadastral value of residential and non-residential properties in major urbanization centers will be aligned with market prices.

The third stage (2027 and beyond): appraisal work will be carried out in all remaining regions of the republic, including districts and rural areas.

This approach envisages the introduction of the mass real estate registration and appraisal system in Uzbekistan not through "shock therapy", but by adapting the population and businesses to the new conditions over a three-year transition period [11].

The process of mass registration and appraisal of real estate is, in turn, closely linked to the introduction of the new taxation system, both of which are based on real estate cadastral data. Just as the mass registration of real estate is being carried out in stages, the implementation of the new taxation system is also being introduced gradually as an integral part of this process (Table 1).

Table 1. The integration of mass real estate registration and appraisal with the implementation of the new taxation system

Stage and territory	Type of property covered	Number of real estate objects	Valuation period	Year of implementation of the new tax system
Residential and non-residential properties in the city of Tashkent (Experiment)	All residential and non-residential properties	~ 850 000	2025-2026	2027
Real estate properties in the city of Nukus and the regional centers	Multi-storey buildings, offices, retail outlets	~ 2 000 000	2026-2027	2028
Residential properties in other areas (districts and rural settlements)	Residential houses and other structures	~ 5 150 000	2027 and beyond	2029
Land plots (throughout the Republic)	Individual residential properties and non-residential land plots	~ 7 000 000	2026-2028	2029
TOTAL	All real estate properties and land plots	15 000 000+ assets	2025-2028	Phased

In accordance with the financing agreement signed between the Republic of Uzbekistan and the World Bank, the "Modernization of Real Estate Registration and Cadastre Systems" project is being implemented in the country. The strategic objective of the project is to create a digital infrastructure for land resource management, bring the

quality of real estate appraisal systems up to international standards, and establish a transparent and fair taxation base.

Within the framework of the “Real Estate Valuation and Taxation” component of the project, the following key tasks have been defined:

- determining the actual market value as economic assets of more than 8 million residential and non-residential properties and approximately 7 million land plots;

- recording property objects that were previously accounted for only at cost value or were not fully entered into the cadastral database, through the new digital system;

- creating a mechanism to continuously update real estate values (every 3-4 years), taking into account price fluctuations in the property market. This process is intended to be implemented gradually between 2025 and 2028, starting initially in the city of Tashkent and subsequently in the regions;

This process is being developed with the participation of international experts within the framework of the “Modernization of Real Estate Registration and Cadastre Systems” project, supported by the World Bank. Specifically, the introduction of the automated mass appraisal system relies on the advanced experiences of the USA, South Korea, and European countries [12].

The current legal and regulatory framework and the appraisal process are based on precise technological procedures. Accordingly, the determination of the market value of more than 15 million real estate objects and land plots will be carried out gradually using specialized software and geographic information systems, while minimizing the human factor [13].

According to experts in the field, developing countries using a value-based real estate taxation system face two main challenges:

- the first is the lack of a complete registry of real estate properties subject to taxation;

- the second is the lack of sufficient information regarding transaction prices. Although these problems can be overcome if sufficient resources are allocated, and despite their positive impact, many governments are not showing active determination in this direction [14].

The formation of a complete real estate registry in Uzbekistan is ensured through the real estate register of the Cadastre Agency under the Ministry of Economy and Finance of the Republic of Uzbekistan and the implementation of relevant regulatory legal acts. The execution of mass registration programs and the continuous monitoring of real estate object transactions allow the state to create a comprehensive database of real estate objects and the rights associated with them.

As for transaction data, government agencies currently lack complete information that reflects real market prices [15]. This is due to the actions of transaction participants aimed at artificially undervaluing prices. Additionally, there are several problems relevant to the mass appraisal system that are also linked to other sectors of Uzbekistan's economy. For example, illegal constructions and unregistered structures. If taxpayers feel that others are evading taxes because their property is not government-registered, the public acceptance of real estate tax is significantly weakened. The informal use of land and buildings complicates the maintenance of tax registries and undermines the universality of the real estate tax [16].

In the legal and regulatory framework of the Republic of Uzbekistan, it is stipulated that the mass appraisal of real estate for taxation purposes shall be carried out using automated market value determination models based on international standards, relying on methods of econometric analysis and mathematical modeling. These methods calculate the actual market value of real estate by taking into account factors (hedonic characteristics) such as location, infrastructure, age, and building materials [17].

Currently, in Uzbekistan, the form of real estate appraisal models for taxation purposes depends on the valuation method being applied. For standard objects such as apartments, residential buildings, and land plots, the sales comparison method is used if sufficient data on sales transactions are available.

In accordance with Order No. 269 of the Minister of Economy and Finance of the Republic of Uzbekistan dated July 7, 2025, and pursuant to the Decree of the President of

the Republic of Uzbekistan No. DP-43 dated March 5, 2025, "On the implementation of a mass real estate valuation system" the "The methodology for public valuation of real estate" was officially put into effect. According to the methodology, it confirms that in determining the value of real estate objects, one of the comparative, cost, or income approaches shall be applied, depending on the object's location, descriptions, and characteristics [18].

1. The comparative approach is used in areas where there is sufficient market data. Its essence is based on hedonic modeling, and the value of the object is determined by adding the calculated values of the building and the land plot:

$$OQ = (BN \times BM \times K_1 \times K_2 \times \dots \times K_n) + (YEN \times YEM \times K_1 \times K_2 \times \dots \times K_n) \quad (1)$$

The formula is based on applying multiplicative adjustments through price-forming coefficients (K_n) to the base value obtained by multiplying the building price per 1 m² (BN) by the building area (BM), that is, $BN \times BM$. This is considered the fairest calculation, as it reflects precisely the market component of the property. The value of the land plot ($YEN \times YEM$) is also adjusted by the same coefficients, which reflects the fact that land prices are likewise influenced by social, infrastructure, and environmental factors [19].

2. The cost approach is applied in areas where market data are limited or for new properties that have no comparable analogues. It is aimed at determining the value of the property by taking into account the cost of its reproduction or replacement and its depreciation:

$$OQ = QX \times (1 + TF) \times (1 - JE) + YEQ \quad (2)$$

QX – the total costs required to construct the property.

TF – the amount of the entrepreneur's expected profit is taken into account.

JE – the amount of depreciation is deducted, which takes into account the property's physical, functional, and economic depreciation.

YEQ – the value of the land plot is also taken into account in this approach as a separate component [20].

3. The income approach can be used to determine the value of non-residential properties. This method is based on converting the income stream that the asset is expected to generate in the future into its present value.

$$OQ = SOD / KS \quad (3)$$

SOD – the annual net income generated from the property.

KS – the rate used to convert income into value.

Unique properties are assessed separately when they cannot be valued using any of the approaches established in this methodology, including properties that have no comparable analogues or possess distinctive characteristics.

The current problems inherent in the mass appraisal system of the Republic of Uzbekistan, as well as the inconsistencies that, to some extent, are encountered by all countries introducing a property taxation system based on market value, continuously give rise to the following issues at the stages of system development:

- identification of taxable objects and taxpayers;
- the quality and transparency of market data;
- methodological problems in determining the tax base;
- organizational issues in the infrastructure of the mass appraisal system;
- identification of taxable objects and taxpayers.

The issues related to identifying the appraisal object concern unregistered and unauthorized real estate properties, as well as the differing classifications of taxable real estate objects [21].

In Uzbekistan, real estate properties that are under construction, unregistered, or unauthorized have a negative impact on the effectiveness of the property taxation system. Since the current tax mechanism is strictly tied to the cadastral register, properties whose construction remains incomplete for a long period or that have not been legally formalized are excluded from the tax base. This situation limits the formation of a stable revenue base for local budgets and hinders the full realization of the fiscal and regulatory functions of property tax.

Data collected from various sources are subjected to statistical analysis and serve as the basis for developing mathematical models to assess the taxable value of real estate. From this perspective, the quality of the data and the degree of accuracy of the information sources used become decisive factors in achieving the performance indicators of the resulting models [22].

The quality of appraisal results is determined by the level of accuracy, the logic and management of the initial stages of data collection and analysis, as well as the ability to manage information effectively. Bringing the initial “raw” data into compliance with established quality standards is one of the most important tasks in mass appraisal, forming an entire field known as “preprocessing.” The main problems that lead to a decline in data quality are the absence of a continuous system for data collection and analysis, as well as the low level of data transparency. While the absence of a continuous data collection and analysis system is linked to the institutional structure of the real estate cadastre, the low level of data transparency is more closely related to the fiscal policy of the state [23].

Due to the rapid pace of development of modern methodologies, the mass appraisal models currently used in Uzbekistan to calculate the tax base have become overly simplified. This is due to the limited number of factors used in determining property value and the simplicity of the methods applied to reflect the complex relationships involved in the formation of market value. These established models do not adequately reflect the full range of value factors affecting the market value of property and, as a result, are frequently revised. Therefore, it is necessary to modify property valuation methodologies in compliance with the principles governing the contribution of various factors and with due regard to the specific nature of the real estate market, including the fact that the market value of the appraisal object does not represent the arithmetic sum of the values of its component parts (land and all improvements located on it) [24].

The expert-analytical method is aimed at formalizing expert opinions on the dependence of land market value on combinations of influencing factors. This method is widely recognized in individual valuation for determining adjustment coefficients for value factors. However, its application in large cities with non-standard urban planning characteristics, as well as in small and medium-sized cities, may lead to significant distortions of results in relation to the actual price of certain parts of the urban area. To address this, such cities should first be divided into territorial zones that are more homogeneous in terms of price characteristics as valuation objects, and then further subdivided into appropriate subzones based on their functional purpose [25].

Value factors are represented in linear models and do not provide flexibility for factors that operate through nonlinear functions. In particular, the area factor, which is interpreted linearly in relation to value, is affected by the phenomenon of the “law of diminishing returns.” It is also observed that, within the interaction of two or more factors, their combined effect may be significantly less than the simple sum of their individual effects [26].

Another drawback is observed in the use of multipliers for value adjustment, which has been addressed through the segmentation of quantitative variables by means of grouping and clustering. This led to the formation of a value scale, as a result of which the fair value between two adjacent quantities is lost.

The phenomenon of diminishing returns reflects the distortion of mass appraisal results. It becomes evident when the sum of the values of the structural elements of the appraisal object is calculated by simple arithmetic addition, without making adjustments for the specific nature of the complex property [27]. The market value of real estate is not equal to the sum of the values of its separately appraised components. This effect exists in the formation of real estate value both at the level of value factors and at the level of the elements of the appraisal object – its component parts. For example, the added value of buildings, together with the average value of vacant land, does not equal the market value of that property under free market conditions.

Existing models for valuing complex categories of real estate that include land and buildings as components of total value are based on the principle of equally distributing

the weight between these elements across all territorial regions of the country. This approach leads to inaccurate results because the levels of development of real estate markets for land plots and buildings differ from one region of the country to another [28].

Some of the problems noted above hinder the functioning of analytical models and algorithms, such as missing values and systematic distortions. At the same time, others – such as duplicates, inconsistencies, and noise – may not disrupt the algorithms themselves, but can still lead to incorrect analytical results. Regardless of what distortion factors are present in the data, they must be addressed. This is carried out in two stages:

1. studying the data in order to identify problems and develop a strategy for resolving them;
2. applying various methods to eliminate the identified problems.

Introducing an adjustment coefficient for the development of the local market of individual residential houses relative to the development of the construction market segment. The application of an integrated model of mass real estate appraisal across different regions of the country creates certain difficulties in the perception and acceptance of results for local real estate market segments. The proposed inclusion of a construction market development coefficient in the model serves as a catalyst for eliminating distortions in assessed values for areas where real estate markets are developed to different degrees [29]. The model's elasticity with respect to changes in land and construction prices in different locations improves the quality of the results obtained.

The development of the methodological and institutional foundations of the mass appraisal process for real estate, as well as ensuring that the appraisal system is supplied with transparent and reliable market data, contributes to the gradual advancement of the real estate market and to the creation of effective and equitable fiscal systems. The author compared the quality indicators of rate studies based on the old models with those of the new models developed on the basis of the methodology proposed in this article. The comparison results and their analysis are presented in Table 2.

Table 2. Comparison of the quality indicators of the old and new models (for example, multi-storey apartment buildings and individual urban residential houses)

Indicator	Recommended	Apartments			Individual houses		
		Old	New	Variation	Old	New	Variation
Median (Appraisal Accuracy, RM)	0.9-1.10	0.41	1.03	↑ 56.0%	0.24	1.03	↑ 73.0%
Coefficient of Dispersion (COD)	5-20%	108.3 %	37.3%	↓ 70.9%	128.32 %	42.45%	↓ 85.8%
Price-Related Differential (PRD)	1.0	1.78	1.19	↓ 59.0%	1.69	1.28	↓ 41.0%

The comparison of the indicators presented in Table 2 confirms, on the basis of scientific metrics, the main objective of the newly introduced mass appraisal system in Uzbekistan – namely, to significantly improve appraisal quality and ensure fairness in the tax burden. Compared with the old models, the new median ratio (RM) for the studied samples improved by 56.0% in the apartment category (changing from 0.41 under the old system to 1.03 under the new system), and by 73.0% for urban houses (individual residential houses) (changing from 0.24 to 1.03), indicating that the assessed value of property has become closer to its actual market value. The higher increase in the median value for individual houses (73.0%) suggests that they had been most undervalued in the old system due to the exclusion of land plot value, and that the new system has produced the sharpest increase in the tax base for this category [30]. The coefficient of dispersion (COD), which measures the spread (or inconsistency) of appraisals, improved by 70.9% for apartments (decreasing from 108.3% to 37.3%) and by 85.8% for individual houses (decreasing from 128.32% to 42.45%). This indicates a substantial increase in the accuracy

and objectivity of the appraisal system due to the automated multiplicative model. The price-related differential (PRD) measures how fairly the tax burden is distributed across properties of different values, with a value centered around 1.0 being considered ideal. Although the PRD still reflects regressive inequality (that is, more expensive properties continue to bear a relatively lower tax burden), the level of optimization is expressed at 59.0% for apartments and 41.0% for individual houses. This represents an important step toward eliminating the imbalance between high-value and low-value properties that existed under the previous system.

4. Conclusion

In our country, the mass appraisal system used for real estate taxation purposes is neither stable nor rigid. This conclusion is confirmed by a number of indicators highlighted in various sections of the study.

Many of the current problems faced by the mass appraisal system can be resolved in the short term and with existing resources.

The shortcomings identified in the mass appraisal system for real estate taxation purposes should be eliminated without delay by improving the methodological framework used to calculate the cadastral values of properties.

In addition to purely legislative decisions in this field, optimizing mass appraisal procedures requires the establishment of real estate market indicators. These indicators should serve as guidelines for revising cadastral values when significant changes occur in the real estate market.

Implementing the proposals resulting from the research presented in this article will improve the quality of market data, the methodology applied in mass appraisal practice, and the accuracy of the results. The improvement in quality indicators for the models developed on the basis of the proposed methodology demonstrates a potential objective pathway for advancing the field of mass real estate appraisal.

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