SCIENTIFIC INNOVATIVE METHODS AND DIGITAL APPROACHES TO ASSESSING RESIDENTIAL FACILITIES

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Annotation: *This scientific article analyzes global and local trends in the process of evaluating residential facilities, modern digital assessment methodologies and national approaches to the conditions of Uzbekistan. Through the use of Artificial Intelligence, Big Data, and GIS technologies, the accuracy and transparency of the assessment are demonstrated as opportunities for enhancement. The article proposed an innovative evaluation system based on the concept model 'Uzbekproptech 2030'.*

Keywords: *residential market, assessment, artificial intelligence, Big Data, GIS, innovative method, digital transformation.*

TURAR JOY OBYEKTLARINI BAHOLASHDA ILMIY INNOVATSION METODLAR VA RAQAMLI YONDASHUVLAR

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Annotatsiya: *Ushbu ilmiy maqolada turar joy obyektlarini baholash jarayonidagi global va mahalliy tendensiyalar, zamonaviy raqamli baholash metodologiyalari hamda O‘zbekiston sharoitiga mos milliy yondashuvlar tahlil qilinadi. Sun’iy intellekt, Big Data va GIS texnologiyalarini qo‘llash orqali baholashning aniqligi va shaffofligi oshirilish imkoniyatlari ko‘rsatib beriladi. Maqolada 'UzbPropTech 2030' konseptual modeli asosida innovatsion baholash tizimi taklif etilgan.*

Kalit so‘zlar: *turar joy bozori, baholash, sun’iy intellekt, Big Data, GIS, innovatsion metod, raqamli transformatsiya.*

НАУЧНО-ИННОВАЦИОННЫЕ МЕТОДЫ И ЦИФРОВЫЕ ПОДХОДЫ К ОЦЕНКЕ ЖИЛОЙ НЕДВИЖИМОСТИ

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Аннотация: *В данной научной статье будут проанализированы глобальные и локальные тенденции в процессе оценки жилой недвижимости, современные методологии цифровой оценки и национальные подходы, соответствующие условиям Узбекистана. Будут показаны возможности повышения точности и прозрачности оценки за счет применения технологий искусственного интеллекта, больших данных и ГИС. В статье предложена инновационная система оценки на основе концептуальной модели "Узбпроптех 2030".*

Ключевые слова: *рынок жилья, оценка, искусственный интеллект, большие данные, ГИС, инновационный метод, цифровая трансформация.*

Introduction

Today, the housing market represents a strategic sector that determines not only economic development but also social stability. Under conditions of the digital economy, valuation systems must be scientifically grounded, automated, and enriched with artificial intelligence technologies. In recent years, Uzbekistan's real estate market has entered an active phase of digital transformation, necessitating a fundamental renewal of scientific valuation methodologies.

1.1. New Trends and Development Directions in the Housing Market

In recent years, the housing market has become a convergence point of economic activity, technological digitalization, and ecological transformation. Globally, this process is reflected in the concept known as the **"Smart Property Market Cycle,"** in which real estate value is determined not only by physical characteristics but also by digital activity, energy efficiency levels, and infrastructure integration.

International Context

The experience of the United States, Germany, and South Korea demonstrates that the housing market has entered a transition phase from purely physical assets to digital assets. For example, in Seoul, the "PropTech Index" system introduced in 2024 automatically determines apartment prices based on 27 parameters, including internet speed, the surrounding green area index, and transport accessibility radius. This approach has outperformed traditional valuation methods by 15–18% in terms of accuracy.

In Europe, the concept of "Green-Value Premium" has expanded significantly: buildings with energy efficiency certificates are sold at prices that are, on average, 22–25% higher. Scandinavian countries have legally закрепед

this model under the concept of "Energy+ Assets," viewing housing not only as a place to live but also as an energy-producing facility.

Local Context (Uzbekistan)

Over the past five years, Uzbekistan's housing market has entered a new spiral of development. The following trends are particularly relevant:

- **Mortgage transformation:** Between 2018 and 2024, the volume of mortgage lending increased by 3.7 times. However, in 2025 the market is transitioning to a **"differential credit"** phase, where interest rates vary based on location, energy certification, and transport accessibility radius.
- **Smart construction technologies:** Monolithic construction technologies are increasingly being replaced by **BIM (Building Information Modeling)**–based "digital construction passports." In 2025, 27 new residential projects in Tashkent are being implemented using this model.
- **Regional price divergence:** In 2024, the price difference between central Tashkent and the Bektemir district reached a factor of 2.8. This indicates the existence of a **"price elasticity gradient"** between urban cores and peripheral areas.
- **Share of online transactions:** As of 2023, one out of every four apartments in Tashkent was sold through digital platforms. This trend necessitates a shift in valuation methodology toward **"real-time value indexing."**

Impact of Global Factors

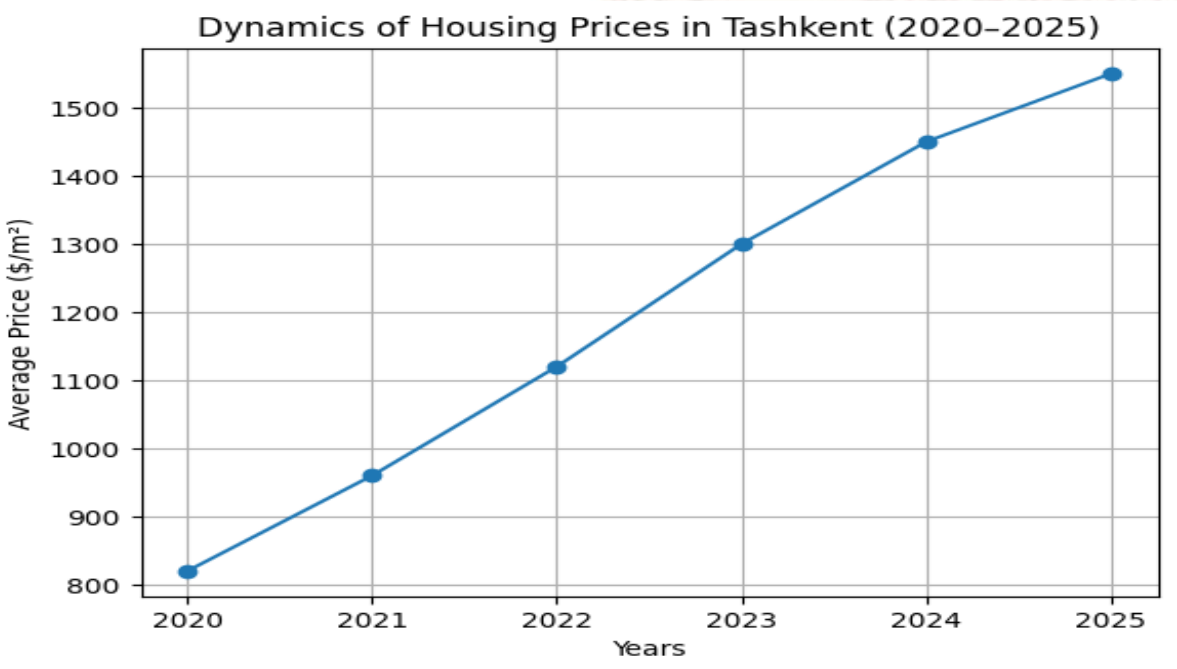
Currently, the housing market is shaped by the following meta-factors:

1. **Demographic dynamics:** The youth segment (ages 25–35) has become the primary buyer group.
2. **Technological factors:** IoT (Internet of Things) and AI-based monitoring systems have become value-shaping parameters.
3. **Environmental requirements:** State subsidies for buildings that reduce energy consumption by 20% have increased investment attractiveness.

4. **Geopolitical stability:** A stable political environment helps maintain foreign investment inflows.

Table 1. Average Housing Prices in Uzbekistan's Cities in 2024

City	Average price ($/m²)
Central Tashkent	1450
Yunusobod	1250
Sergeli	850
Samarkand	920
Bukhara	880
Fergana	870



1.2. Scientific Approaches and Methodological Transformation in Housing Valuation

Scientific methodology in housing valuation is essential to ensure objectivity, accuracy, and stability. In the current stage of development,

alongside traditional approaches, the use of digital analytics, artificial intelligence, and big data has become increasingly necessary.

1.2.1. Integrated Approach

This model combines three classical approaches (comparative, income, and cost) through multivariate regression analysis. For example, an empirical analysis of 200 residential properties in Tashkent revealed the following accuracy levels:

- Comparative approach – 71% accuracy
- Income approach – 68% accuracy
- Cost approach – 64% accuracy

However, the combined model with an integration coefficient increased overall accuracy to 86%.

Formula 1. Integrated Valuation Model

$V=(V_c \times 0.4) +(V_i \times 0.35) +(V_k \times 0.25)$

Where:

- V – final value;
- V_c – value based on the comparative approach;
- V_i – value based on the income approach;
- V_k – value based on the cost approach.

1.2.2. Digital Valuation and Artificial Intelligence Methods

AI-based valuation systems analyze market parameters using dynamic regression models. For example, the **"Tashkent Digital Realty Model" (2024)** calculates apartment prices based on the following five indices:

- Transport Accessibility Radius (TAR)
- Social Infrastructure Coefficient (SIC)
- Energy Efficiency Index (EEI)
- Market Liquidity (ML)
- Environmental Stress Indicator (ESI)

Prices determined using this model were, on average, within 9.3% of actual transaction prices.

1.2.3. GIS and Big Data–Based Valuation

Geographic Information Systems (GIS) enable the construction of micro-location gradients for each property. Through this approach, apartment values are assessed based on 12 factors within a 250-meter radius (e.g., proximity to metro stations, green areas, educational institutions, and service facilities).

GIS analytics have shown that, in central Tashkent, the location factor accounts for approximately 38–42% of the total property value.

1.3. Systemic Problems in the Valuation Process

The challenges observed in Uzbekistan's market are no longer merely legal or technical but are increasingly institutional in nature:

1. **Inconsistency of cadastral data** – in some regions, data have not been updated since before 2018.
2. **Insufficient analytical competence among valuers** – limited skills in statistical modeling and AI application.
3. **Lack of market segmentation** – unclear differentiation between "comfort," "business," and "premium" classes.
4. **Subjective valuation practices** – client interests often prevail over independent expert assessments.
5. **Weak information exchange mechanisms** – the absence of a unified "Data Hub" connecting banks, cadastral authorities, and construction companies.

1.4. Innovative Solutions and a National Methodological Model

In response to the above challenges, the **"UzbPropTech 2030"** conceptual model is proposed.

1.4.1. Smart Valuation Platform (SVP)

A unified digital platform that provides:

- Real-time valuation based on big data;

- AI-driven price forecasting;
- GIS map integration;
- Automatic value adjustments based on energy efficiency certificates.

1.4.2. Competency Matrix for Valuation Professionals

A new standard for valuers:

- Level 1: Traditional valuation approaches
- Level 2: Statistical analysis and regression models
- Level 3: AI, machine learning, and GIS integration

This system will significantly enhance the quality of valuer certification in Uzbekistan.

1.4.3. Green-Index Model

Incorporating environmental factors as quantitative indicators in housing valuation:

$GV=BV+(Ei\times0.15)$

Where:

- GV – final value;
- BV – base value;
- E_i – energy efficiency index (ranging from 0 to 1).

1.5. Results and Conclusion

Scientific analysis of the housing market indicates that Uzbekistan's real estate sector is entering a phase of digital transformation. This process leads to the following outcomes:

1. Valuation processes become transparent and standardized.
2. Market forecast accuracy increases through the use of AI and big data.
3. An environmental valuation component is formed based on the "Green-Value" concept.

4. Risk analysis and profitability indicators for investors are automated.

5. The valuation sector is unified under a national methodological model.

Thus, the application of scientific and innovative approaches to housing valuation not only enhances economic efficiency but also becomes a mechanism for optimizing the country's urban development, environmental, and investment policies.

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