FIGuring the Future: AI and AVMs Transforming Property Valuation

Authors: Malgorzata Renigier-Bilozor, Peter Ache, Thomas Dimopolous, Artur Janowski

Malgorzata Renigier-Bilozor, Prof.
Faculty of Geoengineering
University of Warmia and Mazury in Olsztyn, Olsztyn, Poland
ORCID:0000-0002-4630-7564
e-mail: malgorzata.renigier@uwm.edu.pl
Peter Ache, Dipl.- Eng.
International Federation of Surveyors – FIG
Chair of the Commission 9 „Valuation and the Management of Real Estate“
e-mail: peter.ache.fig@achemail.de
Thomas Dimopoulos
Neapolis University Pafos
ORCID:0000-0001-9553-4774
e-mail: thomas@axiavaluers.com
Artur Janowski, Associate Prof.
Faculty of Geoengineering
University of Warmia and Mazury in Olsztyn, Olsztyn, Poland
e-mail: artur.janowski@uwm.edu.pl
ORCID:0000-0002-5535-408X

Abstract

The rapid and current advances in artificial intelligence (AI) will fundamentally and disruptively change property valuation. This will bring a mixture of transformative opportunities and professional challenges.

This paper examines the intersection of AI technologies with Automated Valuation Models (AVMs) and Computer-Assisted Mass Appraisals (CAMAs), focusing on how these innovations are redefining valuation practices. By integrating AI with the expertise of valuation professionals, the study highlights pathways to achieving greater precision, efficiency, and transparency in property assessments. The integration of AI requires a deliberate approach to address key concerns related to data quality, ethical considerations, regulatory compliance, and the continuous development of professional competencies. These issues are explored in depth, with a view to fostering responsible adoption of AI in valuation processes. The analysis further underscores the relevance of these developments to **FIG Commission 9's** objectives, aligning with its mission to uphold professional standards, enhance transparency, and promote international cooperation in the field of valuation.

To provide practical guidance, the paper presents nine targeted recommendations designed to support the integration of AI into valuation practices. These recommendations aim to ensure that technological advancements serve as tools to enhance, rather than replace, professional expertise, while maintaining ethical integrity and fostering collaboration across the global valuation community.

1. Introduction

Automation in real estate valuation has origins that trace back to the 1950s (Dimopoulos & Bakas, 2019, Gluac & Rosiers, 2021), while it started to become more popular in the 1980s (Gwartney, 1970; Carbone & Longini, 1977, Renigier-Bilozor et al. 2022). The most common forms of automated

solutions are Automated Valuation Models (AVMs) and Computer Assisted Mass Appraisals (CAMAs). AVMs are primarily employed to provide quick and efficient estimations of individual property values, often utilized by financial institutions for mortgage approvals and refinancing purposes. On the other hand, CAMAs are used by local government agencies for property tax assessment, focusing on a broad range of properties at once. CAMAs integrate property-specific data, owner information, and usage statistics to assist in the systematic appraisal of property values across a region, ensuring consistency and fairness in tax assessment. AVMs and CAMAs have coexisted with traditional valuation methods, but recent discussions have intensified due to several key factors (Dimopoulos & Bakas, 2019; Dimopoulos, 2020):

- **Technological Advancements:** Rapid improvements in AI and big data have enhanced AVM accuracy, leading to wider use and scrutiny.
- **Real Estate Market Dynamics:** The need for real-time, cost-effective valuations in fluctuating markets has increased reliance on AVMs.
- **Regulatory Interest:** Greater regulatory focus ensures AVMs do not pose risks or biases, sparking discussions on oversight and standards.
- **Data Accessibility:** Digitization has expanded data availability, enabling more refined AVMs and market competition.
- **Market Penetration:** Growing reliance on AVMs in sectors like real estate and banking fuels debate on their impact and limitations.
- **Public and Professional Scrutiny:** Rising AVM use has led to questions about appraisers' roles and the ethical implications of replacing traditional methods.

Above all, however, it can be noted that there are extensive concerns that seem to be less rational and more emotional, as the **successful utilization of AVM technologies** have **enhanced real estate markets and land administration** in many advanced economies. Possibly the fear of too great and disruptive changes has priority here. On the other hand, the vast expansion and development of new technologies sometimes brutally displaces conventional solutions and approaches. Due to this fact the principal undertaking is not to allow the **brutal takeover** of the real estate market by, for example, "**AI commercial business**" through understanding, developing, and controlling new approaches/ solutions tailored to the new realities in the real estate markets.

Nowadays the question is not if, but when and how the AVM (as part of the entire AI) will be a common tool that will enable increasing real estate market analyses and valuation efficiency (Renigier-Bilozor & Janowski, 2024). The presence of a significant resistance and reluctance to adopt AVMs (Automated Valuation Models) for more widespread use may result in real estate valuation and the real estate industry continuing to rely on "conventional" numerical methods. In an age where society seems to "know everything" and many believe they fully understand modern solutions in real estate valuation and market analysis, nearly everyone has an opinion on the topic. **Broadly speaking, some valuation clients, in extreme cases, assume that the outcome of a valuation is the product of manipulation by valuers, casting doubt on their opinions.** Even appraisers themselves do not always have a clear view of the situation. **While many would appreciate tools to assist them in the valuation process, they also fear that these innovations could lead to reduced earnings or even a loss of jobs, as machines and automation could replace human roles.** Some appraisers worry that they won't be able to keep up with the change of pace in the industry.

2. Transparency in Real Estate Markets and the use of AVM

The real estate market plays a central role in a country's economic and social stability. Real estate not only represents a significant investment class but also serves as living and working space for the population. A well-functioning real estate market contributes to the financial stability of households, influences the labor market, and directly impacts economic performance. Furthermore, market distortions, such as price bubbles or social inequality, can have far-reaching negative consequences for both society and the economy.

Transparency in the real estate market is a complex and multifaceted concept that extends far beyond the mere availability of information. According to the FIG position paper "Viewpoint on Transparency in Real Estate Markets," transparency encompasses the free accessibility and traceability of relevant data, enabling all market participants—including investors, state institutions, and the general public—to make informed and sustainable decisions (Ache, P. et al 2024).

A transparent real estate market structure requires that information be available in a form that is both comprehensive and comprehensible. This includes not only data on individual properties, such as purchase prices, geographical location, and physical characteristics, but also aggregated statistical information on market segments and regional trends. This is further complemented by expert opinions, appraisals, and assessments that reflect market, tax, and mortgage lending values. The FIG position paper emphasizes that transparency is not solely about the existence of data but also about ensuring its quality, timeliness, and consistency. Granular data, tailored to regional and functional submarkets, plays a key role in providing differentiated insights into market mechanisms. In addition, ensuring transparency in property ownership and transactions is critical for mitigating risks associated with money laundering, corruption, and tax evasion. The Financial Action Task Force (FATF) highlights the importance of transparency and beneficial ownership in fostering accountability and reducing the misuse of real estate for illicit purposes (FATF, 2014).

Transparency can be structured along several dimensions:

1. **Access to Information:** Relevant information must be equally accessible to all market participants.
2. **Availability of Information:** A sufficient database covering various market segments and stakeholders must be ensured.
3. **Quality of Information:** The data provided must be up-to-date, reliable, and consistent.
4. **Objectivity of Information:** Market analyses and appraisals should be free from individual biases and conflicts of interest.

Furthermore, transparency plays a central role in ethical and regulatory contexts. The position paper calls for the implementation of transparency standards in professional codes of conduct for appraisers, brokers, and other market actors. These standards aim to ensure that valuations and analyses are not only methodologically sound but also ethically responsible.

In summary, transparency in the real estate market requires a precise definition and clear measurability to contribute effectively to market stability and efficiency. It forms the foundation for trust among all stakeholders and is essential for developing sustainable and responsible real estate policies. Automated Valuation Models (AVMs) play a crucial role in enhancing market transparency. They utilize large datasets and advanced algorithms to estimate property values objectively and comprehensibly. Modern AVMs, based on machine learning and artificial intelligence, can not only deliver more accurate valuations but also uncover hidden patterns and trends that traditional valuation methods might overlook. However, the use of AVMs requires clear standards and transparent methodologies to build trust among market participants and regulatory authorities. The connection between transparency and AVMs becomes particularly evident in the use of data for determining property values. AVMs enable the analysis of vast datasets and their transformation into precise valuations. This not only contributes to market stability but also increases stakeholders'

confidence in the validity of the results. At the same time, the use of AVMs introduces new challenges related to data protection, data quality, and ethical standards.
In conclusion, the real estate market represents a cornerstone of economic and social stability. Transparency is a critical factor in promoting market efficiency and trust. AVMs offer the potential to increase transparency by providing accurate valuations and making market data more accessible. To fully realize this potential, clear standards and mechanisms must be established to ensure transparency in all aspects of real estate valuation and market analysis.

3. Global Perspectives on using AVMs

Define the global real estate industry is witnessing a significant shift as major organizations increasingly focus on the development and implementation of Automated Valuation Models (AVMs). Esteemed bodies such as the Royal Institution of Chartered Surveyors (RICS), the European Group of Valuers' Associations (TEGoVA), the International Association of Assessing Officers (IAAO), and the International Valuation Standards Council (IVSC) are at the forefront of this transformation. Below is the main diversity in the interpretation and definition of AVMs by major valuation organizations in the current landscape (Fig. 1).

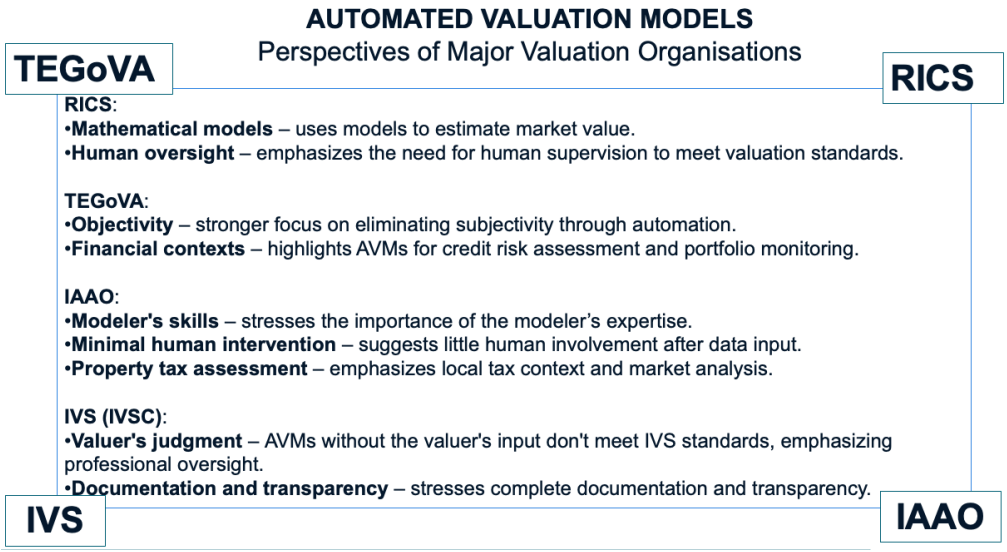

Figure 1: Main diversity in the interpretation and definition of AVMs. *Source: own elaboration based on TEGoVA (2022/2025), RICS (2021), IVSC (2025), IAAO(2018).*

In general, **these organizations highlight AVMs'** role in **enhancing valuation accuracy**, **efficiency**, and **objectivity** through advanced modelling techniques, **reducing human bias**. However, **they stress** the need for **professional judgment** to complement AVM outputs and ensure **compliance with international standards**. **This focus underscores AVMs' importance in modernizing property valuation by integrating technology with expert oversight for precise, reliable results**.
In this context, the exceptionally broad expertise of surveyors and related professions plays a particularly important role. This is especially relevant when it comes to handling geodata and property information related to real estate. The need for high-quality and representative real estate data, the increasing importance of land registration and securing property rights, and the current challenges posed by climate change make it essential to consolidate all competencies and enable

the use of AVMs (Automated Valuation Models). FIG, international Federation of Surveyors aims to be this unifying framework.

4. Integrating AI and Human Expertise in AVMs

To address challenges with AVMs, the current trend is a hybrid approach that blends traditional and modern techniques using an agile process. This approach combines manual and automated processes, merges human insight with computational tools, and integrates classical statistics with advanced analyses, leading to Hybrid Automated Valuation (HAV). HAV employs tailored algorithms to solve specific issues in real estate market analysis and valuation, forming the foundation for creating **healthy human-machine collaboration** (Renigier-Biłozor et al., 2022, Renigier-Biłozor & Janowski, 2024). The **"healthy collaboration"** means a synergistic relationship where human expertise, intuition, and decision-making remain at the forefront, guiding and shaping the contributions of machine intelligence. Here, machines act as amplifiers of human potential—processing complex datasets, revealing hidden patterns, nuances, and streamlining workflows—while the human role remains pivotal in interpreting insights, applying contextual understanding, and making ethical, informed decisions. This partnership not only optimizes outcomes but also redefines the narrative of technology as a collaborator instead of a competitor, unlocking innovative possibilities in real estate and beyond. By reinforcing **human sovereignty**, it ensures that humans maintain ultimate control and authority in decisions. Operating within a framework of **human-centric governance**, this collaboration firmly places human needs and values at its core, with machines strictly assisting humans in overcoming their limitations without compromising ethical integrity or human priorities.

Contemporary modelling emphasizes transparency and interpretability over the traditional "**black box**" concept. **Explainable Artificial Inteligence (XAI**) and techniques like feature importance analysis and interpretable algorithms help reveal how inputs affect outputs, identifying biases and errors. This shift bridges complexity and comprehension, fostering trust and collaboration among developers, experts, and users. Modelling is evolving into a transparent, accountable practice, making data insights accessible for informed decision-making and societal progress.

A major criticism of AVMs is **the exclusion** of the **human component,** often rooted in job security fears among appraisers. Ironically, AVMs were designed to support human work, boosting efficiency and reducing errors. **Integrating AVMs with human expertise** forms a hybrid model that leverages both strengths for innovation and reliable decision-making. Embracing AVMs as complementary tools preserves jobs and creates opportunities for skill development in the evolving real estate market.

Understanding the market's complexity requires acknowledging human-driven decisions influenced by emotions and motives**. Cognitive science** and soft computing enhance market analysis by exploring human capabilities. According to Renigier-Biłozor and Janowski (2024), "a major challenge in current methodological solutions is the behavioural factor, which is often neglected. This approach not only better captures relationships in the real estate market but is also primarily focused on designing systems that align with human cognitive abilities, making them easier to interpret, and more efficient to improve and modify." **Soft computing's** tolerance for imprecision makes decision-making more adaptive. AI and human collaboration can create resilient, informed market strategies, with human oversight remaining essential for complex scenarios.

Extending AI-based methods and procedures to AVM and/or CAMA processes increases the efficiency of analysis in the most problematic aspects and provides an effective alternative to traditional methods. Figure 2 presents the main advantages of utilizing the most promising modern technologies based on cognitive science and AI to overcome or eliminate certain human limitations in real estate market analyses.

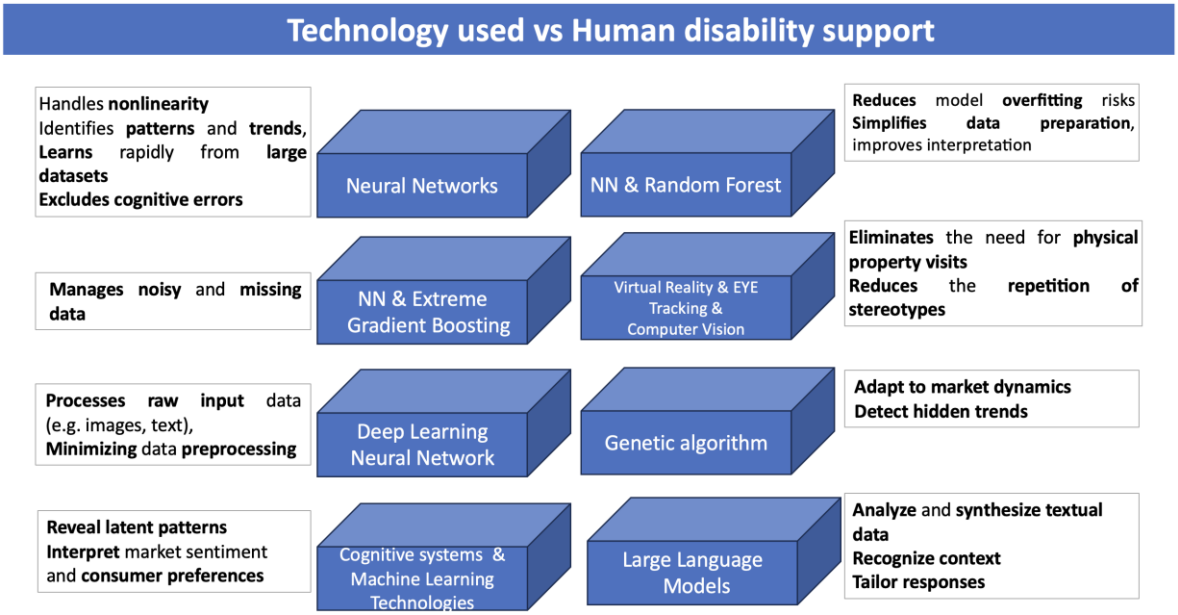

Figure 2: Technology vs Human Limitations on real estate market. *Source: own elaboration*

The integration of AI in AVMs and real estate market analyses offers substantial potential to enhance the efficiency, accuracy, and depth of market analyses. However, it is essential to manage the quality of data, the costs of implementation, and the process of adaptation to new technologies to maximize the benefits of these advancements. **Embracing AI as a complementary tool than a replacement for human expertise can lead to a more resilient, innovative, and forward-thinking real estate industry. Clarifying "transparency in the real estate market" is crucial for informed decisions by investors, policymakers, and authorities, and for the ethical management of personal data.** This foundational understanding supports successful AI integration in property valuation and the development of effective policies, such as tax regulations. However, the opaque, "black box" nature of AI-driven AVMs can undermine transparency, making results difficult to interpret and unacceptable for critical decision-making. **To prevent misuse, professional organizations must uphold strict ethical standards.** A rigorous, evidence-based approach is essential to align transparency with accountability. **The EU has recognized the importance of this balance by implementing the AI Act, signed on March 13, 2024, and published on July 12, 2024** (The EU Artificial Intelligence Act., 2024)**.** This Act, which came into force on August 2, 2024, with full implementation by August 2026, sets a global precedent for AI regulation and was unanimously approved by all 27 member states.

5. Advancing AI Property Valuation by Overcoming Limitations

Utility of AVMs and Key Considerations

The widespread use of AI is undeniable, and constructive criticism should focus on ensuring safe and beneficial use of AVMs to prevent financial, security, and privacy issues. UNESCO's "Recommendation on the Ethics of Artificial Intelligence" (2021) highlights AI's significant impact on society and underscores the importance of ethical practices in AI deployment.

Data Quality and Standards

AVM accuracy relies on high-quality data that reflects current market trends and local factors. Poor data can lead to faulty valuations and loss of trust. Consistent data collection and standardization are essential for reliability, especially for properties with unique features or rare transactions.

Challenges and Best Practices for Implementing AVMs

The shift toward AVMs improves efficiency but introduces challenges. AI offers objectivity by eliminating human emotional biases, but concerns remain over job security and accountability. Human oversight is essential for complex cases and legal responsibility. Clear guidelines must address who is accountable for AVM-based errors and ensure consistent data inputs and model maintenance to minimize inaccuracies.

Employment Impact

Automation may streamline valuation processes without necessarily causing job loss. Instead, human valuers could focus on complex cases, enhancing service quality and maintaining trust in the financial ecosystem.

Ethical Challenges and Guidelines

Key ethical considerations include transparency, accountability, and human oversight. AVMs must disclose their methods and data sources to avoid algorithmic bias. Responsibility for errors should be clearly assigned, and human judgment should validate AVM outputs.

Implementing AVMs effectively requires adherence to best practices:

- **Ensure Data Quality**: Regularly update and validate data inputs to maintain accuracy.
- **Maintain Transparency**: Clearly communicate AVM capabilities and limitations to stakeholders.
- **Continuous Model Training**: Update AI models to reflect evolving market conditions.
- **Data Security**: Protect sensitive information to ensure compliance and maintain trust.

By addressing these challenges and following best practices, the valuation profession can enhance accuracy, fairness, and trust in AVMs. **FIG Commission 9's** leadership in promoting standards and facilitating international collaboration is crucial in this endeavor.

6. Conclusions and Recommendations

As the field of artificial intelligence (AI) continues to evolve at a rapid pace, its integration into fields such as real estate valuation presents both opportunities and challenges. Ensuring accuracy and transparency in Automated Valuation Models (AVMs) is essential as they become central to decision-making processes. This article has examined how AI and behavioral insights can drive enhancements in AVMs to foster more efficient and equitable property valuation.

In alignment with the **objectives of FIG Commission 9,** we propose the following **„9 RECOMMENDATIONS"** to guide the future of property valuation:

1. **Embrace AI as a Complementary Tool**
   Integrate AI and AVMs to augment human expertise rather than replace it. This synergy combines technological efficiency with professional judgment, leading to more accurate and reliable valuations. FIG Commission 9 can promote this approach to encourage balanced adoption of technology within the profession.
2. **Establish High Data Quality Standards**
   Develop rigorous data quality indicators to ensure AVMs produce trustworthy outputs. High-quality, standardized data reflecting current market trends and local factors is crucial. FIG Commission 9 can spearhead initiatives to create international data standards, enhancing consistency and reliability across borders.
3. **Promote Transparency and Explainability**

Implement explainable AI techniques to make AVM processes transparent. Clear methodologies and understandable outputs build trust among stakeholders and comply with ethical standards. **FIG Commission 9's** emphasis on professional ethics supports this recommendation, fostering greater acceptance of AVMs.

4. **Ensure Ethical Use of AI**
   Adopt ethical guidelines to prevent biases and discrimination in AI-driven valuations. Professional organizations, including FIG Commission 9, should champion these standards to align transparency with accountability and uphold the integrity of the valuation profession.
5. **Continuous Monitoring and Model Updates**
   Regularly update AVMs to reflect changing market conditions and maintain accuracy. Ongoing monitoring minimizes inaccuracies and adapts to evolving market dynamics. FIG Commission 9 can encourage best practices in model maintenance, ensuring AVMs remain effective tools for valuers.
6. **Enhance Collaboration Between Valuers and Technologists**
   Foster collaboration between valuation experts and AI developers. This partnership ensures that AVMs accurately capture market complexities and human behaviors, resulting in more nuanced valuations. FIG Commission 9 can facilitate forums and workshops to promote such collaboration, bridging the gap between technology and practice.
7. **Advocate for Clear Regulatory Frameworks**
   Engage with policymakers to develop regulations that balance innovation with consumer protection. Support initiatives like the EU AI Act to set global precedents for AI governance in valuation. FIG Commission 9 can play an advisory role in shaping these frameworks, advocating for regulations that benefit the profession and the public.
8. **Invest in Professional Development**
   Encourage valuers to acquire new skills in AI and data analytics. Continuous learning ensures professionals remain competent in an industry increasingly influenced by technology. FIG Commission 9 can provide educational resources and training programs, empowering valuers to adapt and thrive.
9. **Explore Advanced Technologies for Future Innovations**
   Investigate integrating emerging technologies such as blockchain for transparent transaction records, cognitive-based technologies for attribute significance indication and VR/AR for interactive property analyses. Embracing innovation positions the valuation profession at the forefront of technological advancement. FIG Commission 9 can support research and development in these areas, guiding the profession toward a dynamic future.

By implementing these recommendations, the **real estate valuation industry can navigate** the **evolving landscape confidently and ethically**. These guidelines align with **FIG Commission 9's** mission to advance the profession, promote high standards of practice, and facilitate international collaboration among valuation professionals.The integration of AI in AVMs presents an opportunity for the profession to enhance its methodologies, uphold ethical standards, and better serve society. **FIG Commission 9's** leadership and engagement are vital in shaping this future, ensuring that technology and human expertise work together to advance property valuation globally. **In a broader and long-term perspective,** the goal is to cultivate opportunities for enhancing awareness and fostering a deeper understanding of the real estate market through alternative perspectives and innovative frameworks. This far-reaching aim seeks to challenge entrenched stereotypes and inspire scholarly and professional discourse, paving the way for a reimagined future of real estate market modeling amidst rapidly advancing technological progress.

References

Ache, P. et al (2024). International Federation of Surveyors. *FIG- Position Paper: Viewpoint on Transparency in Real Estate Marktets.*

Ache, P., & Krägenbring, R. (2023). ImmoWertA – Muster-Anwendungshinweise zur Immobilienwertermittlung. *zfv – Zeitschrift für Geodäsie, Geoinformation und Landmanagement, 3/2023*, 137–146. https://doi.org/10.12902/zfv-0432-2023

Carbone, R., & Longini, R. L. (1977). A Feedback Model for Automated Real Estate Assessment. *Management Science, 24*, 241–248.

Dimopoulos, T., Bakas, N. P. (2019). Artificial intelligence for mass appraisals of residential properties in Nicosia: mathematical modelling and algorithmic implementation, Seventh International Conference on Remote Sensing and Geoinformation of the Environment (RSCy2019), https://doi.org/10.1117/12.2538430

Dimopoulos, T. (2020). Critical Investigation of Novel Computational Techniques for Automated Valuations of Real Estate Properties in Cyprus. *PhD Thesis*.

Financial Action Task Force (FATF). (2014). *Transparency and Beneficial Ownership*. FATF. https://www.fatf-gafi.org/en/publications/Fatfrecommendations/Transparency-and-beneficial-ownership.html

Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change, 114, 254– 280*. https://doi.org/10.1016/j.techfore.2016.08.019

Glumac, B., & Des Rosiers, F. (2021). Towards a taxonomy for real estate and land automated valuation systems. *Journal of Property Investment & Finance, 39*(5), 450-463. https://doi.org/10.1108/JPIF-07-2020-0087

Gwartney, T. (1970). A Computerized Assessment Program. *Assessment Law & Valuation*, 125–142.

International Association of Assessing Officers (IAAO). (2018). *Standards on Automated Valuation Models*.

International Valuation Standards Council (IVSC) (2025). *IVS International Valuation Standards*.

Renigier-Biłozor, M., et al. (2022). International acceptance of automated modern tools use must-have for sustainable real estate market development. *Land Use Policy, 113*, 105876. https://doi.org/10.1016/j.landusepol.2021.105876

Renigier-Biłozor, M., Janowski, A., & d'Amato, M. (2019). Automated Valuation Model based on Fuzzy and Rough Set Theory for Real Estate Market with Insufficient Source Data. *Land Use Policy, 78*, 104–115. https://doi.org/10.1016/j.landusepol.2018.06.012

Renigier-Biłozor, M., Chmielewska, A., & Kamasz, E. (2024). The soft computing based model of investors' condition and cognition on a real estate market. *Land Use Policy, 141*, 107150. https://doi.org/10.1016/j.landusepol.2024.107150

Renigier-Bilozor, M., & Janowski A. (2024) Human-Machine Synergy in Real Estate Similarity Concept. Real Estate Management and Valuation, vol. 32, no. 2, Sciendo, 2024, pp. 13-30. https://doi.org/10.2478/remav-2024-0010

Royal Institution of Chartered Surveyors (RICS) (2021). *RICS Valuation - Global Standards*.

The European Group of Valuers' Associations (TEGOVA). (2022/2025). *International Valuation Standards*.

The EU Artificial Intelligence Act. (2024) The Act Texts. https://artificialintelligenceact.eu/the-act

UNESCO (2021). Recommendation on the Ethics of Artificial Intelligence. Available at: https://unesdoc.unesco.org/ark:/48223/pf0000380455