Valuation Information / LADM Part 4

Position paper 4

Kara, A.; Zevenbergen, Jaap

Citation (APA)
Kara, A., & Zevenbergen, J. (2023). Valuation Information / LADM Part 4: Position paper 4. In P. van Oosterom, & J. M. Paasch (Eds.), *11th International FIG Workshop on the Land Administration Domain Model & 3D Land Administration (LADM2023)* (pp. 355-368). International Federation of Surveyors (FIG). https://doi.org/10.4233/uuid:1da8981b-d8e6-4670-90ee-5cdebeb4cf39

Important note
To cite this publication, please use the final published version (if applicable).
Please check the document version above.

Position paper 4
Valuation Information / LADM Part 4

Abdullah KARA, Turkey and Jaap ZEVENBERGEN, The Netherlands

1. INTRODUCTION

This paper serves as a discussion basis for a working session on '*Valuation Information / LADM Part 4*', held as one of the four working sessions at the 11th International FIG Land Administration Domain Model (LADM) / 3D Land Administration Workshop. The paper is intended to stimulate discussion on valuation information in the context of land administration and aims to identify the main issues relating to land valuation, in addition to LADM Part 4 – Valuation information as well as further research for the future.

The paper begins with a brief overview of the scope of the value function of LA, the extension of valuation information to LADM, and the current research on valuation presented at the LADM and 3D Cadastres workshops, as well as the themes of recent research. The main challenges for research are presented in Section 3. Possible solutions for increasing research on valuation are explored in Section 4, which would be helped with collaboration with researchers with a background in economics and/or statistics.

2. STATE OF THE ART

Land administration (LA) covers a wide range of systems and processes, and one of the functions of land administration relates to the value of land and its improvements. The scope of the land value function is specified as "*managing the assessment of the value of land and property, the collection of revenue through taxation, and the management and adjudication of disputes relating to land valuation and taxation*" (Enemark et al., 2005; Enemark, 2006).

2.1 Valuation in FIG Commission 7 Workshops

By the end of 2022, seven FIG Workshops on 3D Cadastres, ten FIG Workshops on the Land Administration Domain Model and one joint workshop (9th FIG Workshop on the Land Administration Domain Model / 3D Land Administration) have been organized, and none of them included a specific technical session on the value function of LA, as there were never enough accepted papers to form a session. On the topic of valuation, four papers were presented in the 3D Cadastres workshops (Tomić et al., 2012; Isikdag et al., 2014a; Kara et al., 2018a; 2021a), six papers in the LADM workshops (Kara et al., 2018b; 2018c; Tomić et al., 2018; Radulović et al., 2022; Šiško et al., 2022; Kara et al., 2022), and one in the joint workshop (Kavanagh et al., 2021). This result may not be surprising as (a) these workshops were organized by the working group of FIG Commissions 7 and 3, not Commission 9. It should be noted that there are numerous valuation papers in the FIG Congress as well as Commission 9 workshops, (b) LADM Edition I focuses on the land tenure function of LA, not

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden

on value. While the papers presented in the 7th FIG Workshop on LADM are related to the implementation of the valuation extension of LADM (Kara et al., 2018b; 2018c; Tomić et al., 2018); in the 10th FIG Workshop on LADM one paper is about the use of mass property valuation in spatial planning (Šiško et al., 2022), one paper is mainly about the development of a country profile of the LADM valuation information extension, and the last one is related to the visualisation and dissemination of valuation units and related information. The only working session on valuation information was organized in the 7th FIG Workshop on LADM, 'Working Group 1 - LADM Valuation Information Model Extension', for supporting the development of valuation information part extension of LADM Edition II (The outcomes of the workshop and their treatment in Part 4 are listed below).

2.2 LADM Edition II and Valuation

A meeting of the UN-GGIM Expert Group on Land Administration and Management was held on 14-15 March 2017 in Delft, the Netherlands, and one of the main conclusions was to extend the scope of the LADM conceptual model to include valuation information (Lemmen et al., 2018; UN-GGIM, 2019). In turn, an extension of LADM to valuation information has already been proposed to guide the development of local and national databases and for the private sector to develop information technology products (OGC, 2019). The extension aims to cover all stages of administrative property valuation, namely identifying and grouping properties, valuing properties by individual or mass valuation, recording transaction prices, presenting sales statistics, and dealing with appeals (Çağdaş et al., 2016; Kara et al., 2018; 2020; 2021b). The extension has been developed by reusing as much as possible the existing standards and specifications that are in some way related to land valuation (see Kara et al., 2018). It is worth noting that the content of the proposed valuation information extension of LADM and the content of the land value function defined by Enemark (2005; 2006) are quite similar to each other, but the scope of the extension may be somewhat larger as it aims to cover all administrative valuations (not just taxation) and all input and output data within the valuation processes.

At the 48th plenary week of ISO/TC 211 in Maribor, Slovenia, it was decided that LADM Edition II will be a multipart standard, with Part 4 on valuation information. The New Work Item Proposal (NWIP) and the Committee Draft (CD) for Part 4 received a positive vote with some comments and observations from the member states of ISO/TC 211[1]. It is planned that Draft International Standard (DIS) for part 4 will be submitted in September 2023. The editors expect that Part 4 will be published as an International Standard (IS) in the second half of 2024. The latest version of the Part 4 UML diagrams can be found in the Harmonized Model Maintenance Group (HMMG) repository[2].

The session of 'Working Group 1 - LADM Valuation Information Model Extension' of the 7th FIG Workshop on LADM, the following points were raised by the participants in relation to the development of the LADM valuation information extension[3]. The text in [...] after each point raised explains how it has been dealt with in Part 4.

---

[1] https://www.iso.org/standard/81266.html?browse=tc
[2] https://github.com/ISO-TC211/HMMG
[3] https://wiki.tudelft.nl/pub/Research/ISO19152/LADM2018Workshop/pres_22a.pdf

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden

1) There is an obvious need for a valuation information model. How should the model be designed: (a) a separate model as LADM, (b) a package to LADM (as a separate model but associated to the core LADM classes), (c) integration of the valuation model into LADM [the decision of participating members of ISO/TC 211 was option b].

2) What valuation purposes should be considered when designing (improving) the valuation information model? Tax, mortgage, transaction (sales), utilities, insurance, social transfers [The latest version of the model is designed to support all administrative valuations].

3) Land use planning should be considered when developing (improving) the model [The class level associations are created between Part 4 – Valuation information and Part 5 – Spatial plan information].

4) High rise buildings can limit the view of properties. 3D data should be used for viewshed analysis, solar potential, etc. for increasing accuracy of valuation [An informative annex – Annex B - 3D Profiles for spatial analysis – is included in Part 4 to show how 3D data can be used in valuation processes].

5) Data quality should be considered when developing (improving) the model, e.g., up-to-date data collection, data quality, metadata, etc. [QualityElement from ISO 19157 is included by all classes of Part 4, as they are all designed to be subclasses of VersionedObject].

6) The semantics of the data should be clearly defined in the model. For example, distance to amenities, distance to schools, distance to points of interest (e.g., city center, metro station, schools, business center and so on), area and volume of properties [All the data mentioned are included in appropriate classes].

7) Methods for data collection should be defined, such as LIDAR, satellite imagery, field survey, etc. [Data collection methods defined in Part 2 are utilized in Part 4].

8) Fit for purpose valuation concept may be introduced since it is not clear how many property attributes are enough for valuation? And which property attributes? (Are location, age and condition of property enough?) [An informative annex – Annex D - International valuation standards and LADM – is included to present how Part 4 and valuation standards are related. The terms and definitions used in the model derived from valuation and geographic data standards. Many attributes in Part 4 are optional in order to develop a generic model. Countries can develop their country profiles to include a country-specific needs].

9) What types of property should be included in the valuation model? For example, should the model include data on industrial properties, petrol stations, hotels? [Part 4 does not include specific data on the mentioned properties but can be extended to support these properties].

10) Production value is a new area of attention and should be considered [The inclusion of production value is left to country profiles].

11) Inclusion of unregistered lands in land registry? [This links to a Part 2 issue. Valuation information related to unregistered land can be managed through the country profiles of Part 4. The Social Tenure Domain Model, a specialisation of LADM, can also be extended to include valuation information taking the 'Valuation Of Unregistered Land: A Practice Manual' (GLTN/UN-HABITAT/FIG/RICS, 2021) into account].

12) Valuation of RRRs should be considered, such as usufruct right, ownership right, etc. [Part 4 supports valuation of RRRs].

13) International valuation standards change every two years. Is it right to use these standards to develop a valuation information model? [International standards are maximally reused when developing Part 4].

14) The model should be assessed with further use cases, such as mass valuation, 3D data, etc. More valuation country profiles should be developed for assessing the model and modelling the country specific valuation practices [See below for the country profiles of Part 4].

Several utilizations of LADM valuation information package can be found in the literature. Chinese researchers have developed a LADM valuation information country profile for the management of rural land valuation and taxation information, and for the promotion of linkage between the land registration and land taxation systems (Xu et al., 2016). Croatian researchers have used LADM valuation information to investigate the possibility of using existing authoritative land and other public registries data as a basis for mass property valuation, and to propose a profile (Tomić et al., 2021). Mongolian researchers have developed a profile as a first step towards establishing an advanced land/property valuation system in Mongolia (Buuveibaatar et al., 2023). Montenegrin researchers have developed a profile for valuations carried out for the purposes of property and tourist taxation (Radulović et al., 2023). Moreover, Turkish (Kara et al., 2019) and the Netherlands (Kara et al., 2019) country profiles are also developed to represent current situation on valuation information.

2.3 A Brief Literature Review on Valuation

In addition to the studies related to the extension of LADM valuation information, several guiding references and papers related to the value function of LA have been published in recent years. The guiding references and their brief content are as follows: The Land Administration Guidelines of United Nations Economic Commission for Europe (UNECE) includes a section examining the value of land, methods whereby value can be determined, and the nature of land and property markets (UNECE, 1996). The voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT) of the Food and Agriculture Organization of the United Nations (FAO) provides a set of recommendations for the governance of the administration of the value function (FAO, 2022). Valuing land tenure rights of FAO includes a technical guide on valuing land tenure rights in line with VGGT (FAO, 2017). The Valuation of Unregistered Land of the Global Land Tool Network (GLTN) presents a practical approach for the valuation of unregistered land (GLTN/UN-HABITAT/FIG/RICS, 2021). It is also worth mentioning that the Fit-for-purpose land administration guiding principles of GLTN also includes some recommendations for supporting developing countries in designing their specific strategy for implementing fit-for-purpose LA. (GLTN/UN-HABITAT/Kadaster, 2016). Lastly, it is stated in the New Urban Agenda that developing and using basic land inventory information, such as cadastral, valuation, and land and housing price records are needed to assess changes in values (cf. Clause 104). It also noted the need for the use of geospatial information systems to share and exchange information, including the standardization and dissemination of timely and reliable data including value (cf. Clause 156, 157, and 159) (UN, 2016).

Besides the above, several papers can be considered within the context of the value function of LA. Paasch and Paulsson (2023) examined trends in 3D cadastre research between 2012 and 2021. They analyzed 530 publications on 3D cadastre and identified only eight publications (Tomić et al., 2012; Isikdag et al., 2014a; 2014b; 2015; Toppen, 2016; Kara et al., 2018a; 2020; Asiama and Voss, 2020) related to valuation topics, which is the least among identified other topics (i.e., BIM, 4D cadastre, marine and water applications). Paasch and Paulsson (2023) noted that the articles identified were mainly related to the use of 3D cadastral data in valuation processes. They explained the lack of attention to valuation in the context of 3D cadastre by suggesting that valuation issues may be more discussed in other research communities than in the 3D cadastral domain. It is worth mentioning here that the 3D cadastral questionnaire, which has been organized every four years since 2010, does not include a question on the value function.

There are many studies in broader literature that examine the use of 3D data (e.g., BIM and city models) in valuation processes, such as El Yamani et al. (2021) and Ying et al. (2022). In addition, researchers are also showing an interest in the acquisition of data through remote sensing in support of fair valuation and taxation (Koeva et al., 2021). More recently, AI/ML and computer vision algorithms and techniques are also being used to collect and fuse data to support valuation processes, as in Bin et al. (2020). AI/ML has also been used in value estimation as done in Demetriou (2017), Čeh et al. (2018), Yilmazer and Kocaman (2020) and many others. The value function of LA has been used to support LA processes such as responsible land consolidation as in Asiama et al. (2018). Last but not least, the inclusion of the impact of climate change, greenhouse gas emissions and energy performance in the valuation (which can be referred to as sustainable value) is explored among others in Bourguignon (2023).

Given the brief overview presented above, the main research themes and trends in the value function of LA can be grouped into the following categories:

1) Purposes of valuation (e.g., taxation, land consolidation, planning, regeneration, expropriation, insurance, transactions, etc.)
2) Standards related to valuation (procedural standards (e.g., IVSC, IAAO, RICS, etc.), data standards (e.g., LADM Valuation information), property measurement standards (e.g., IPMSC), reporting standards (IFRS, IVS)
3) Procedures and processes of valuation (every purpose may require different steps and data)
4) Definition and use of value types (market value, tax value, highest and best use value, strategic value, sustainability value, etc.)
5) Valuation of RRRs
6) Relationships between valuation unit, basic administrative unit (spatial unit) and plan unit (including planning restrictions that may dramatically affect value)
7) Content of a valuation registry
8) Valuation registry relationships with other public registries (e.g., building, address, cadastre and land registry, land use, taxation, transaction prices, etc.)

9) Data collection (deriving) though various methods (e.g., AI, computer vision, remote sensing, field survey, etc.) and usage of 3D data in valuation processes (data sources: 3D cadastre, BIM, city models, etc.)

    a. supporting mathematical models with variables generated by 3D analyses (e.g., view, insolation, noise, shadow) in order to better estimate/explain the values of properties,

    b. visualizing valuation units in 3D and disseminating the values of properties associated with the visualized units

10) Data quality (how to increase data quality to better estimate value)

11) Valuation approaches (sales comparison, cost, income, etc.)

12) Mass valuation, computer assisted (automated) valuation model (CAMA)

13) AI/ML algorithms and techniques to better estimate value

14) 3D visualization of valuation units and dissemination of valuation information

15) Governance of valuation information (local, central, state, professional association, etc.).

3. KEY CHALLENGES

The brief overview presented in the previous section shows that there is not a great deal of researcher interest in the value function of LA in the LA domain. The following questions on the key issues and challenges of land valuation are not intended to limit the scope of the session, but to provide an outline to start the discussion:

1) To what extent should LA professionals be involved in/ contribute to land valuation processes? Data collection, data management, data quality check, visualization and dissemination of data developing mass valuation model, price prediction model, comparing AI algorithms in price prediction, etc.

2) The main data used in the valuation process are transaction prices. However, price data are mostly not publicly available or reliable (reported value is well below the sales price). Valuation reports are often not made publicly available. Can this situation be seen as an obstacle to effective research?

3) Mathematical valuation models, formulas, algorithms (value prediction models) are generally not available to the general public. They appear to be confidential business information (formulae). Does this situation create an obstacle to checking/improving the result and doing research? If so, how is this overcome?

4) What strategies can be followed to effectively link valuation registry to the other public registries/databases such as spatial plan, PLRs, building, permit etc.? How can data from other registers be effectively used/included in valuation processes?

5) If basic registration unit and basic valuation units are different, then what sources can be used to develop 3D valuation unit visualizations?

6) Is it realistic to use 3D data in the near future for administrative valuations, such as annual property tax valuations, which may require municipal level 3D data?

7) Are valuation professionals aware of the technological developments in 3D LA? If so, are they able to use the technology? If not, are LA professionals responsible for

bridging the gap? What steps should be taken to initiate collaboration between the valuation and LA communities?

8) What should be the governance structure for the valuation information? Is there a need for a central governance body to carry out the valuation, data collection, quality control, etc.? To what extent should local governments (municipalities) be involved in valuation processes?

9) Could an international effort to document and conceptualize valuation processes (e.g., mass valuation, valuations for annual taxation, etc.) in different countries contribute to the improvement of valuation processes? Does such an effort contribute to some LA processes? Is it possible to take advantage of the International Financial Reporting Standards (IFRS) for the documentation of valuation information?

10) Different countries may have different valuation units, value types and definitions, processes, etc. Can LADM Part 4 - Valuation information, through its terms, definitions and information model, contribute to communication between different stakeholders in the valuation/LA domain? Does your country plan to use/implement LADM Part 4? Are you planning to use LADM Part 4 to develop an information technology product? How can LADM Part 4 - Valuation information be further improved (more profiles, e.g., different property types, spatial analysis to derive information; more detailed inclusion of information on parties in valuation processes, etc.)?

4. POSSIBLE SOLUTIONS

Has there been any progress/interest in research on the value function of LA in recent years? An increasing number of international guidelines and research papers show that LA researchers are interested in the valuation of LA. It is also a good development that the scope of LADM has been extended to include valuation information. Nevertheless, the number of research papers is still small compared to other functions and research areas of LA. It can be indicated that we are at the beginning of a process.

If land valuation research is indeed to be increased, there are a number of ways in which this could be achieved, including raising awareness of the importance of valuation research issues and discussing what the key research questions are. Examples of possible research include:

1) Collection, derivation, management, processing and updating of input and output valuation information

2) Compliance of local practices and processes with international standards and guidance documents

3) Inclusion of an international perspective on publications

4) Investigation on how valuation information can be better visualized and disseminated to the public

5) Leveraging the latest technologies (e.g., AI/ML, computer vision, data analytics, etc.) to better estimate, collect (extract, derive), visualize and share value and related information

6) Carrying out comparative studies on land valuation concepts and processes

In order to increase the number and quality of the research, it may be a promising idea to collaborate with researchers from economics and statistics departments who have a different background and a distinct perspective on land valuation. Furthermore, it may be useful to note that LADM Part 4 - Valuation information can facilitate communication between stakeholders, international comparisons of valuation processes and the development of new products. It should be mentioned here that the ISO process to publish LADM Part 4 as an international standard is still on going. We like to encourage the researcher to support/contribute to the development of LADM Part 4 through national ISO bodies or FIG.

REFERENCES

Asiama, K., Bennett, R., Zevenbergen, J., & Asiama, S. (2018). Land valuation in support of responsible land consolidation on Ghana's rural customary lands. Survey review, 50(361), 288-300.

Asiama, K. & Voss, W. (2020). Conceptualising the Valuation of 3D Property. Proceedings FIG Working Week 2020, International Federation of Surveyors (FIG), Copenhagen, Denmark (2020).

Bin, J., Gardiner, B., Li, E., & Liu, Z. (2020). Multi-source urban data fusion for property value assessment: A case study in Philadelphia. Neurocomputing, 404, 70-83.

Bourguignon, J. Y. (2023). Prospective property valuation in the context of sustainable environmental development for future generations and energy renovation of real estate. FIG Working Week 2023, 28 May - 1 June 2023 l Orlando, Florida, USA.

Buuveibaatar, M.; Lee, K. & Lee, W. (2023). Developing an LADM Valuation Information Model for Mongolia. Land, 12(4), 893. https://doi.org/10.3390/land12040893

Çağdaş, V., Kara, A., Van Oosterom, P.J.M., Lemmen, C.H.J., Isikdag, U., Kathmann, R. and Stubkjaer, E. (2016). An initial design of ISO 19152:2012 LADM based valuation and taxation data model. In: Proceedings of the 11th 3D Geoinfo conference, 20-21 October 2016, Athens, Greece. Peer reviewed Annals, Volume IV-2/W1 / edited by E. Dimopoulou and P. van Oosterom. ISPRS, 2016. ISSN: 2194-9050.

Čeh, M., Kilibarda, M., Lisec, A., & Bajat, B. (2018). Estimating the performance of random forest versus multiple regression for predicting prices of the apartments. ISPRS international journal of geo-information, 7(5), 168.

Demetriou, D. (2017). A spatially based artificial neural network mass valuation model for land consolidation. Environment and Planning B: Urban Analytics and City Science, 44(5), 864-883.

362

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden

El Yamani, S., Hajji, R., Nys, G. A., Ettarid, M., & Billen, R. (2021). 3D variables requirements for property valuation modeling based on the integration of BIM and CIM. Sustainability, 13(5), 2814.

Enemark, S. (2006). Understanding the land management paradigm. In Proceedings: Innovative technology for land administration (pp. 17-27). International Federation of Surveyors.

Enemark, S., Williamson, I., & Wallace, J. (2005). Building modern land administration systems in developed economies. Journal of spatial science, 50(2), 51-68.

Food and Agriculture Organization of the United Nations (FAO) (2022). Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT), Rome. ISBN 978-92-5-107277-6 (revised version) https://www.fao.org/3/i2801e/i2801e.pdf

Food and Agriculture Organization of the United Nations (FAO), 2017. A technical guide on valuing land tenure rights in line with the Voluntary Guidelines on the Responsible governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security. Governance of Tenure Technical Guide No.11, Rome ISBN 978-92-5-130069-5. https://www.fao.org/3/i8252e/i8252e.pdf

GLTN/UN-HABITAT/Kadaster (2016). Fit-for-purpose land administration guiding principles. Global Land Tool Network (GLTN), Copenhagen, Denmark. https://unhabitat.org/sites/default/files/download-manager-files/Fit-For-Purpose%20Land%20Administration.pdf

GLTN/UN-HABITAT/FIG/RICS (2021). Valuation Of Unregistered Land: A Practice Manual. https://unhabitat.org/sites/default/files/2021/09/valuation-of-unregistered-land-a-practice-manual.pdf

Isikdag, U., Horhammer, M., Zlatanova, S., Kathmann, R., & Van Oosterom, P. J. M. (2014a). Semantically rich 3D building and cadastral models for valuation. In Proceedings of 4th International Workshop on 3D Cadastres, Dubai, UAE.

Isikdag, U., Horhammer, M., Zlatanova, S., Kathmann, R., & Van Oosterom, P.J.M. (2014b). Semantically Rich 3D Building and Cadastral Models for Valuation. Coordinates (December) 2014, Centre for Geo-Information Technologies (cGIT).

Isikdag, U., Horhammer, M., Zlatanova, S., Kathmann, R., & Oosterom, P. (2015). Utilizing 3D building and 3D cadastre geometries for better valuation of existing real estate. In: Proceedings FIG Working Week 2015 From the Wisdom of the Ages to the Challenges of the Modern World, Sofia, Bulgaria, 17–21 May 2015. International Federation of Surveyors (FIG), Copenhagen, Denmark.

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden

Kara, A., van Oosterom, P. J., Çağdaş, V., Işıkdağ, Ü., & Lemmen, C. H. J. (2018a). 3D data for better property value estimation in the context of LADM valuation information model. In proceedings of 6th International FIG Workshop on 3D Cadastres, 2-4 October 2018, Delft, the Netherlands.

Kara, A., Çağdaş, V., Işıkdağ, Ü., van Oosterom, P. J. M., Lemmen, C. H. J., & Stubkjær, E. (2018b). The LADM valuation information model based on INTERLIS. In proceedings of 7th International FIG Workshop on the Land Administration Domain Model 2018: in conjunction with Sixth Croatian Congress on Cadastre (VI. HKK).

Kara, A., Işıkdağ, Ü., Çağdaş, V., van Oosterom, P. J. M., Lemmen, C. H. J., & Stubkjær, E. (2018c). A database implementation of LADM valuation information model in Turkish case study. In proceedings of 7th International FIG Workshop on the Land Administration Domain Model 2018: in conjunction with Sixth Croatian Congress on Cadastre (VI. HKK).

Kara A., Çağdaş, V., Lemmen C., Işikdag U., van Oosterom P., Stubkjær E. (2018d). Supporting Fiscal Aspect of Land Administration through a LADM-based Valuation Information Model. 2018 World Bank Conference on Land and Poverty, The World Bank - Washington DC, March 19-23, 2018.

Kara, A., Kathmann, R., van Oosterom, P. J., Lemmen, C. H. J., & Işikdağ, Ü. (2019). Towards the Netherlands LADM Valuation Information Model Country Profile. In FIG Working Week 2019: Geospatial Information for a Smarter Life and Environmental Resilience.

Kara, A., Van Oosterom, P., Çağdaş, V., Işıkdağ, Ü., & Lemmen, C. (2020). 3 Dimensional data research for property valuation in the context of the LADM Valuation Information Model. Land use policy, 98, 104179. https://doi.org/10.1016/j.landusepol.2019.104179

Kara, A., van Oosterom, P., Kathmann, R., & Lemmen, C. (2021a). Requirements and opportunities for web-based 3D visualization and dissemination of property valuation information. In proceedings of 7th International FIG Workshop on 3D Cadastres, 11-13 October 2021, New York, USA.

Kara, A.; Çağdaş, V.; Isikdag, U.; van Oosterom, P.; Lemmen, C. & Stubkjaer, E. (2021b). The LADM Valuation Information Model and its application to the Turkey case. Land use policy, 104, 105307. https://doi.org/10.1016/j.landusepol.2021.105307

Kara, A., van Oosterom, P., Kathmann, R., Ilgar, A., & Lemmen, C. (2022). LADM valuation information model compliant prototype for visualisation and dissemination of 3D valuation units and groups. In proceedings of 10th International FIG workshop on the Land Administration Domain Model, 31 March - 2 April 2022, Dubrovnik, Croatia.

Kavanagh, J., Ortiz, P., & Barbieri M. (2021). The Alignment of ILMS and LADM, Including a New Valuation Model. In proceedings of 9th FIG Workshop on the Land Administration Domain Model / 3D Land Administration, on-line, 24 June 2021.

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

Koeva, M., Gasuku, O., Lengoiboni, M., Asiama, K., Bennett, R. M., Potel, J., & Zevenbergen, J. (2021). Remote sensing for property valuation: a data source comparison in support of fair land taxation in Rwanda. Remote sensing, 13(18), 3563.

Lemmen, C. H. J., van Oosterom, P. J., Kara, A., Kalogianni, E., Shnaidman, A., Indrajit, A., & Alattas, A. (2019). The scope of LADM revision is shaping-up. In proceedings of 8th Land Administration Domain Model Workshop 2019.

OGC (2019). OGC White Paper on Land Administration. Editors: Christiaan Lemmen, Peter van Oosterom, Mohsen Kalantari, Eva-Maria Unger and Cornelis de Zeeuw. External identifier of this OGC® document: http://www.opengis.net/doc/wp/land-admin Internal reference number of this OGC® document: 18-008r1. Copyright © 2019 Open Geospatial Consortium.

Paasch, J. M., & Paulsson, J. (2023). Trends in 3D cadastre–A literature survey. Land use policy, 131, 106716.

Radulović, A., Sladić, D., & Govedarica, M. (2022). Extended LADM country profile for property valuation in Serbia. In proceedings of 10th International FIG workshop on the Land Administration Domain Model, 31 March - 2 April 2022, Dubrovnik, Croatia.

Radulović, A.; Sladić, D.; Govedarica, M.; Raičević, D. (2023). Using LADM and BIM for property and tourist taxation in the municipality of Bar, Montenegro. Land Use Policy, 131, 106715. https://doi.org/10.1016/j.landusepol.2023.106715

Šiško, J., Tomić, H., Gašparović, S., & Šiško, D. (2022). The use of mass property valuation in spatial planning: an LADM approach. In proceedings of 10th International FIG workshop on the Land Administration Domain Model, 31 March - 2 April 2022, Dubrovnik, Croatia.

Tomić, H., Mastelić Ivić, S., Roić, M., & Jurakić, G. (2018). Are Croatian Official Registers complying with the LADM Fiscal/Valuation Extension? In proceedings of 7th International FIG Workshop on the Land Administration Domain Model 2018: in conjunction with Sixth Croatian Congress on Cadastre (VI. HKK).

Tomić, H., Roić, M., & Mastelić Ivić, S. (2012). Use of 3D cadastral data for real estate mass valuation in the urban areas. In proceedings of 3rd International FIG Workshop on 3D Cadastres, 25-26 October 2012, Shenzhen, China.

Tomić, H.; Ivić, S. M.; Roić, M. & Šiško, J. (2021). Developing an efficient property valuation system using the LADM valuation information model: A Croatian case study. Land Use Policy, 104, 105368. https://doi.org/10.1016/j.landusepol.2021.105368

Toppen, T.P. (2016). The use of 3D city models in real estate valuation and transactions: defining and developing a use case requiring 3D city models in real estate valuation and

transaction applications. Student thesis: Master. 30 September 2016. Eindhoven University of Technology, the Netherlands.

UN-GGIM (2019). Framework for Effective Land Administration – A reference for developing, reforming, renewing, strengthening or modernizing land administration and management systems. Expert Group on Land Administration and Management United Nations Committee of Experts on Global Geospatial Information Management (UNGGIM).

United Nations (UN) (2016). New Urban Agenda. Endorsed by the United Nations General Assembly at its Sixty-Eighth Plenary Meeting of the Seventy-First Session on 23 December ISBN: 978-92-1-132731-1 https://habitat3.org/wp-content/uploads/NUA-English.pdf

United Nations Economic Commission for Europe (UNECE) (1996). Land Administration Guidelines: With Special Reference to Countries in Transition United Nations, New York and Geneva. ISBN 92-1-116644-116646
https://unece.org/DAM/hlm/documents/Publications/land.administration.guidelines.e.pdf

Xu, Z.; Zhuo, Y.; Li, G.; Liao, R. & Wu, C. (2016). Towards a Valuation and Taxation Information Model for Chinese Rural Collective Construction Land. Sustainability, 11(23), 6610. https://doi.org/10.3390/su11236610

Yilmazer, S., & Kocaman, S. (2020). A mass appraisal assessment study using machine learning based on multiple regression and random forest. Land use policy, 99, 104889.

Ying, Y., Koeva, M., Kuffer, M., & Zevenbergen, J. (2022). Toward 3D Property Valuation—A Review of Urban 3D Modelling Methods for Digital Twin Creation. ISPRS International Journal of Geo-Information, 12(1), 2.

BIOGRAPHICAL NOTES

Abdullah Kara holds a Ph.D. degree from Yıldız Technical University (YTU) with a thesis on the extension of Land Administration Domain Model (LADM) with valuation information, which is used as a basis for the development of LADM Part 4 - Valuation information. He is currently working as a post-doctoral researcher at the GIS Technology Section, Delft University of Technology. He has been actively involved in FIG working groups.

Jaap Zevenbergen is professor of land administration and management at the University of Twente, faculty ITC. He teaches and delivers trainings to students from all over the world on responsible land administration, and has been and is involved with dozens of PhD candidates in the field, both as (co) supervisor and as external examiner. He has acted as consultant and researcher linked to land interventions at national and global scales, and has recently been appointed as independent member of the Netherlands Council for Real Estate Assessment.

366

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden

CONTACTS

Abdullah Kara
Delft University of Technology
Section GIS-technology Faculty of Architecture and the Built Environment
P.O. Box 5030 2600 GA Delft
THE NETHERLANDS
E-mail: A.Kara@tudelft.nl
Website: https://www.tudelft.nl/

Jaap Zevenbergen
University of Twente
Faculty of Geo-Information Science and Earth Observation/ITC
P.O. Box 217, 7500 AE Enschede
THE NETHERLANDS
Phone: + 31 53 4874351
E-mail: j.a.zevenbergen@utwente.nl
Website: www.itc.nl

Abdullah Kara and Jaap Zevenbergen
Valuation Information / LADM Part 4

11th International FIG Land Administration Domain Model / 3D Land Administration Workshop
11-13 October 2023, Gävle, Sweden