Towards an international information standard for immovable property valuation & A knowledge organization system for the development of ISO 19152:2012 LADM Valuation Module

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Land administration is the processes of determining, recording and disseminating information about the ownership, value and use of land.

Management of value information has not been addressed in research and standardization.

This research presents a valuation information model which provides a template for the specification of valuation databases used for recurrently levied property taxes.

HABITAT III - New Urban Agenda

We will support local governments and relevant stakeholders, through a variety of mechanisms, in developing and using basic land inventory information, such as a cadaster, valuation and risk maps, as well as land and housing price records ... to assess changes in land values ... (Clause 104).
Valuation standards

• International Valuation Standards, International Valuation Standards Council (IVSC)

• European Valuation Standards, The European Group of Valuers' Associations (TEGoVA)

• Standard on Mass Appraisal of Real Property, International Association of Assessing Officers (IAAO)

• Standard on Ratio Studies, International Association of Assessing Officers (IAAO)
Area and volume measurement standards

- EN 15221-6:2011 Facility Management, Part 6: Area and Space Measurement in Facility Management
- ISO 9836:2011 Performance Standards in Building – Definition and calculation of area and space indicators
- International Property Measurement Standards: Office Buildings
- RICS Code of Measuring Practice
Geographic information standards

- ISO 19152:2012 Land Administration Domain Model
- INSPIRE D2.8.I.6 Data specifications on Cadastral Parcels
- INSPIRE D2.8.III.2 I Data specifications on Buildings
- OGC CityGML
- OGC LandInfra / InfraGML
- OGC IndoorGML
Research problem, aim and methodology

**Problem** - No standardized information model that defines the semantics of valuation databases or registries.

**Aim** - An information model for valuation databases for public valuations for recurrently levied immovable property taxes.

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**Stage 1 - Identification of valuation domain semantics**

- **Method** – A linguistic analysis for procedural valuation standards
- **Output** – A knowledge organization system for property valuation domain in terms of thesaurus

**Stage 2 - Identification of country applications**

- **Method** – Questionnaire based country analyses
- **Output** – Description of valuation system in respondent countries

**Stage 3 - Evaluation of existing geographic information standards**

- **Method** – A comparative analysis for geographic information standards
- **Output** – Selection of base standard for valuation information model

**Stage 4 - Development a valuation information model**

- **Method** – Data modeling based on findings of the previous analyses
- **Output** - A conceptual valuation information model based on ISO LADM
An **Immovable Property Valuation Thesaurus** was developed in order to reveal core semantic (terms and term relationships) of the valuation domain.

The purpose is to support the identification of candidate classes and attributes for the development of valuation information model.

The thesaurus consists of five concept collections and 139 terms derived from glossaries and main text of the international valuation standards.
Stage 1 – Identification of valuation domain semantics

The thesaurus was encoded through the Simple Knowledge Organization Systems (SKOS) specifications developed by W3C. See, http://cadastralvocabulary.org/IPVT.rdf.
Stage 2 – Identification of country applications

A questionnaire based dataset has been obtained from delegates of FIG Comm. 7 and Comm. 9 in order to create an inventory that reveals commonalities and differences among valuation systems used for recurrently levied property taxes.
Stage 2 – Identification of country applications

24 responses from 22 countries are available at http://isoladm.org/ValuationQuestionnaire

Respondents
1. Argentina (D. A. Erba, C. A. Basilio)
2. Bolivia (J. G. A. Flores)
3. Brazil (E. Silva)
4. Colombia (D. R. Gutiérrez)
5. Costa Rica (J. M. Díaz)
6. Croatia (H. Tomić)
7. Cyprus (A. Aristidou)
8. Denmark (E. Stubkjaer)
9. Denmark (M. Velpuri)
10. Ecuador (F. R. Bueno)
11. Greece (P. Chryssy)
12. India (M. Velpuri)
13. Latvia (R. Pētersone)
14. Macedonia (V. Miskovski)
15. The Netherlands (R. Kathmann)
16. Poland (P. Parzych, J. Bydłosz)
17. Singapore (M. Velpuri)
18. Slovenia (D. Mitrović)
19. South Africa (M. Velpuri)
20. South Korea (L. Young-ho, K. Bong-Jun)
21. Spain (A. Velasco)
22. Turkey (V. Çağdaş, A. Kara)
23. UK (B. Elder)
24. UK (P. Wyatt)

Some results are ...
Stage 2 – Identification of country applications

A1 - Please indicate the organizations responsible for valuation of properties for property taxation purposes through name in national language and English translation.

<table>
<thead>
<tr>
<th>Ministry of Finance / Taxation</th>
<th>Croatia, Denmark, Greece, Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipalities / local governments</td>
<td>Macedonia, Turkey, the Netherlands, Bolivia, Brazil, Costa Rica, Ecuador, South Africa, India</td>
</tr>
<tr>
<td>Surveying and cadastral authorities</td>
<td>Slovenia, Cyprus, Argentina, Colombia, Spain</td>
</tr>
<tr>
<td>Other authorities</td>
<td>South Korea (Ministry of Land, Infrastructure and Transport), Latvia (State Land Service under Ministry of Justice)</td>
</tr>
</tbody>
</table>

A3 - Please mention value type (e.g. market value, tax value, capital value) used by the responsible organization for property taxation?

<table>
<thead>
<tr>
<th>Annual value</th>
<th>Singapore, India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Book value</td>
<td>Poland (for commercial properties)</td>
</tr>
<tr>
<td>Cadastral value</td>
<td>Spain</td>
</tr>
<tr>
<td>Capital value</td>
<td>India</td>
</tr>
<tr>
<td>Commercial value</td>
<td>Costa Rica (for commercial properties)</td>
</tr>
<tr>
<td>Market value</td>
<td>Brazil, Colombia, Croatia, Cyprus, Denmark, Ecuador, Latvia, Macedonia, Slovenia, the Netherlands, United Kingdom (for domestic dwellings)</td>
</tr>
<tr>
<td>Rateable value</td>
<td>United Kingdom (for non-domestic hereditaments)</td>
</tr>
<tr>
<td>Self assessed value</td>
<td>Bolivia</td>
</tr>
<tr>
<td>Tax value</td>
<td>Greece, South Korea, Turkey</td>
</tr>
<tr>
<td>Area</td>
<td>Poland (for properties other than commercial)</td>
</tr>
</tbody>
</table>
### A4 - Please mention the public registry datasets (e.g. cadastre, land registry, building registry) which are used in valuation procedures, and their mutual functions?

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cadastre</td>
<td>Croatia, Macedonia, Slovenia, Turkey, the Netherlands, Argentina, Brazil, Colombia, Costa Rica, Ecuador, Latvia, Poland, South Africa, South Korea</td>
</tr>
<tr>
<td>Land register</td>
<td>Croatia, Slovenia, Turkey, Latvia, Poland</td>
</tr>
<tr>
<td>Municipal registers / inventories</td>
<td>Denmark, Macedonia, Turkey, Bolivia, Costa Rica</td>
</tr>
<tr>
<td>Address register</td>
<td>Slovenia, Turkey, the Netherlands,</td>
</tr>
<tr>
<td>Land use plans</td>
<td>Slovenia, Turkey</td>
</tr>
<tr>
<td>Other inventories</td>
<td>United Kingdom (Rating List, Council Tax List), Cyprus (Land Information System), the Netherlands (Base register for inhabitants and companies), Costa Rica (building permits), India (Property and Vacant Land Tax Information System)</td>
</tr>
</tbody>
</table>

### A5 - Which methods are applied for collecting market data needed for valuation?

<table>
<thead>
<tr>
<th>Source</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public registries</td>
<td>Croatia, Denmark, Macedonia, Slovenia, the Netherlands, Ecuador, Latvia, South Korea, Spain</td>
</tr>
<tr>
<td>Declaration / statements (by request)</td>
<td>Denmark, Greece, Macedonia, United Kingdom, the Netherlands, Brazil, India, South Africa, Spain</td>
</tr>
<tr>
<td>Field investigation</td>
<td>Macedonia, Cyprus</td>
</tr>
<tr>
<td>Other sources (Internet, newspapers)</td>
<td>Brazil, Colombia, India, Spain</td>
</tr>
<tr>
<td>Market data is not collected</td>
<td>Argentina, Costa Rica, Turkey, Poland</td>
</tr>
</tbody>
</table>
Stage 2 – Identification of country applications

A6 - Is there any special valuation database for storing datasets used in (e.g. property characteristics) or produced with (e.g. sales statistics) valuation procedures?

<table>
<thead>
<tr>
<th>Yes, national level</th>
<th>Croatia (eProperty), Denmark (SVUR), Greece (TAXIS), Macedonia (Registry for Lease and Prices), Slovenia (Real Estate Valuation Database), United Kingdom (VOA &amp; Land Registry), Cyprus (Computerised Integrated Land Information System), the Netherlands (Basisregistratie WOZ), India (Property and Vacant Land Tax Information System), Latvia (Real Estate Market Database), Singapore, South Africa (eCadastre), Spain (Cadastre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes, municipal level</td>
<td>Turkey, Bolivia, Costa Rica, South Korea</td>
</tr>
<tr>
<td>Yes, other</td>
<td>Poland (local appraisal associations)</td>
</tr>
<tr>
<td>No</td>
<td>Argentina, Brazil, Colombia, Ecuador</td>
</tr>
</tbody>
</table>

B1 - Do you have a (computer aided) mass appraisal system in your country? If yes, please indicate also responsible authorities?

<table>
<thead>
<tr>
<th>Yes</th>
<th>Denmark, Slovenia, the Netherlands, Cyprus, Spain, South Korea, South Africa, Latvia, India, Costa Rica (partly), Colombia (partly), Brazil, Bolivia</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Croatia, Greece, Macedonia, Turkey, United Kingdom, Poland, Ecuador, Argentina</td>
</tr>
</tbody>
</table>

B3 - Which CAD/GIS/CAMA software packages are used in mass appraisal?

<table>
<thead>
<tr>
<th>In-house developed software</th>
<th>Denmark, Slovenia, Cyprus, the Netherlands, Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial software</td>
<td>Cyprus (SPSS), Bolivia (AutoCAD, MicroStation, ArcGIS), Colombia (ArcGIS, AutoCAD, MapInfo, QGIS, Gvsig, Erdas and econometric software), Costa Rica (ArcGIS, AutoCAD, QGIS, Gvsig),</td>
</tr>
</tbody>
</table>
ISO LADM

LADM is an abstract conceptual model that focuses on the legal and geographical aspects of land administration.

The conceptual data model of LADM consists of the following three packages: (1) Administrative Package, (2) Spatial Unit Package, and (3) Party Package.

LADM also relates cadastral information systems with other property related databases, such as address, taxation and valuation databases.
Stage 3 - Evaluation of geographic information standards

OGC LandInfra

OGC LandInfra is a conceptual data model focusing on land and civil engineering facilities.

LandInfra’s LandDivision and Condominium packages specify the representation of property units, land parcels, and condominiums.

The scope is limited to activities in respect to infrastructure facilities, therefore attributes assigned to mentioned packages are related to determination and surveying of boundaries of divisions of land.
Stage 3 - Evaluation of geographic information standards

**OGC CityGML**

CityGML is an XML-based format for the storage and exchange of virtual 3D city models.

CityGML’s **Building** module specifies **buildings, building parts, and their physical features**, such as **installations** (chimneys, stairs, balconies), **rooms** and **interior installations** (stairs, railings, radiators).

**OGC IndoorGML**

IndoorGML specifies indoor space (e.g. rooms, corridors) bounded by architectural components (e.g. roofs, walls) from geometric, cartographic, and semantic viewpoints.
INSPIRE Data Specification on Buildings (INSPIRE BU)

INSPIRE BU provides four profiles for representations of constructions, buildings, building parts, and their features with different levels of detail in geometry and semantics.

INSPIRE Data Specification on Cadastral parcel (INSPIRE CP)

INSPIRE CP is concerned with the spatial aspect of immovable properties, including basic property units and cadastral parcels.
Main property characteristics commonly used in valuation processes
(derived from international valuation standards)

| Land (parcel) characteristics          | Parcel area                              |
|                                      | Topography                               |
|                                      | Land use                                 |
|                                      | Private law restrictions (e.g. easement) |
|                                      | Public law restrictions                   |
| Improvements (e.g. building, building unit, other construction) characteristics | Size                                     |
|                                      | Living area                              |
|                                      | Age                                      |
|                                      | Effective age                            |
|                                      | Use type                                 |
|                                      | Number of stories or floors              |
|                                      | Construction materials                   |
|                                      | Construction type                        |
|                                      | Construction quality                     |
|                                      | Available utilities                      |
|                                      | Building features (e.g. air-conditioning, fireplace, garage, pool) |
|                                      | Energy efficiency                        |
| Locational characteristics            | Neighborhood                             |
|                                      | Risks of natural disasters               |
|                                      | Closeness to point of interests           |
|                                      | External nuisances (e.g. heavy traffic, airport noise) |
|                                      | View                                     |
### Representation of valuation units in geographic information standards

<table>
<thead>
<tr>
<th>Valuation unit</th>
<th>Components</th>
<th>LADM</th>
<th>LandInfra</th>
<th>CityGML</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land</td>
<td>Parcel</td>
<td>LA_SpatialUnit</td>
<td>LandParcel</td>
<td>-</td>
<td>CadastralParcel (CP)</td>
</tr>
<tr>
<td>Improvements</td>
<td>Building</td>
<td>LA_SpatialUnit</td>
<td>Building</td>
<td>_AbstractBuilding</td>
<td>AbstractBuilding (BU)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ExtPhysicalBuildingUnit</td>
<td>CondominiumBuilding</td>
<td>Building</td>
<td>AbstractBuilding (BU)</td>
</tr>
<tr>
<td></td>
<td>Building unit</td>
<td>LA_SpatialUnit</td>
<td>BuildingPart</td>
<td>BuildingPart</td>
<td>BuildingPart (BU)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ExtPhysicalBuildingUnit</td>
<td></td>
<td>Room</td>
<td>AbstractBuildingUnit (BU)</td>
</tr>
<tr>
<td></td>
<td>Other constructions</td>
<td>LA_SpatialUnit</td>
<td>SuperficieObject</td>
<td>-</td>
<td>AbstractConstruction (BU)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ExtPhysicalBuildingUnit</td>
<td></td>
<td></td>
<td>AbstractOtherConstruction (BU)</td>
</tr>
<tr>
<td>Land and improvements together as Land Property</td>
<td>Land property</td>
<td>LA_BAUnit</td>
<td>PropertyUnit</td>
<td>-</td>
<td>BasicPropertyUnit (CP)</td>
</tr>
<tr>
<td>Land and improvements together as Condominium Property</td>
<td>Condominium main parts</td>
<td>LA_LegalSpaceBuildingUnit</td>
<td>CondominiumUnit</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Joint facilities</td>
<td>LA_LegalSpaceBuildingUnit</td>
<td>BuildingPartType</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Accessory parts</td>
<td>LA_LegalSpaceBuildingUnit</td>
<td>BuildingPartType</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
### Representation of land characteristics in geographic information standards

<table>
<thead>
<tr>
<th>Land characteristics</th>
<th>LADM</th>
<th>LandInfra</th>
<th>INSPIRE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>area (LA_SpatialUnit)</td>
<td>parcelArea (LandParcel)</td>
<td>areaValue (CadastralParcel) (CP)</td>
</tr>
<tr>
<td>Land use</td>
<td>type (ExtLandUse)</td>
<td>plannedLandUse (LandParcel)</td>
<td>currentLandUse (LandParcel)</td>
</tr>
<tr>
<td>Easement</td>
<td>LA_RRR LA_Restriction</td>
<td>Easement</td>
<td>-</td>
</tr>
<tr>
<td>Public restrictions</td>
<td>LA_RRR LA_Restriction</td>
<td>Easement</td>
<td>Data Specification on Area Management Restriction, Regulation Zones and Reporting Units</td>
</tr>
<tr>
<td>Topography</td>
<td>-</td>
<td>LandElement</td>
<td>Data Specification on Elevation</td>
</tr>
</tbody>
</table>
### Representation of improvement characteristics in geographic information standards

<table>
<thead>
<tr>
<th>Improvement characteristics</th>
<th>LADM</th>
<th>LandInfra</th>
<th>CityGML</th>
<th>INSPIRE BU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>area (LA_SpatialUnit)</td>
<td>floorArea (BuildingPart)</td>
<td>-</td>
<td>officialArea, officialVolume</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(BuildingAndBuildingUnitInfo)</td>
</tr>
<tr>
<td>Living area</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Chronologic age</td>
<td>-</td>
<td>-</td>
<td>yearOfConstruction</td>
<td>dateOfConstruction, dateOfDemolition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>yearOfDemolition (_AbstractBuilding)</td>
<td>(AbstractConstruction)</td>
</tr>
<tr>
<td>Effective age</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>dateOfRenovation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(AbstractConstruction)</td>
</tr>
<tr>
<td>Economic life</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Remaining economic life</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Number of stories</td>
<td>-</td>
<td>floorNumber (BuildingPart)</td>
<td>storeysAboveGround</td>
<td>numberOfFloorsAboveGround</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>storeysBelowGround (_AbstractBuilding)</td>
<td>(AbstractBuilding)</td>
</tr>
<tr>
<td>Construction materials</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>materialOfStructure, materialOfFacade, materialOfRoof</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(BuildingInfo)</td>
</tr>
<tr>
<td>Construction technique</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>materialOfStructure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(BuildingInfo)</td>
</tr>
<tr>
<td>Construction quality</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Available utilities</td>
<td>utilityNetworkType</td>
<td>type (FacilityPart)</td>
<td>/UtilityNetworkADE</td>
<td>connectionToElectricity, connectionToGas,</td>
</tr>
<tr>
<td></td>
<td>(LA_LegalSpaceUtilityNetwork)</td>
<td></td>
<td></td>
<td>connectionToSewage, connectionToWater</td>
</tr>
<tr>
<td></td>
<td>ExtPhysicalUtilityNetwork</td>
<td></td>
<td></td>
<td>(BuildingAndBuildingUnitInfo)</td>
</tr>
<tr>
<td>Other features</td>
<td>-</td>
<td>-</td>
<td>BuildingInstallation</td>
<td>numberOfDwellings, numberOfBuildingUnits</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Room</td>
<td>(AbstractBuilding)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AbstractInstallation</td>
<td>Installation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Room</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AbstractInstallation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Room</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AbstractInstallation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Room</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>InternalInstallation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AbstractBuildingUnit</td>
<td></td>
</tr>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
Evaluation

- LADM and LandInfra specify of all types of valuation units with different designations. They have limited attributes for the physical aspects of valuation objects.

- LandInfra is not concerned with database storage. It focuses on surveying aspect, not recording of property rights and right holders unlike LADM.

- INSPIRE applies a minimalistic approach for the specification of cadastral parcels, but exhaustive for the physical description of buildings.

- INSPIRE CP is consistent with LADM and LandInfra, but does not cover the property rights aspect.

- CityGML provides a comprehensive information model for buildings for 3D visualization purposes. Like INSPIRE BU, it has a rich set of attributes for representing physical characteristics for the buildings.

- IndoorGML has limited capabilities for the representation of valuation objects, since the focus is to provide description of indoor space for indoor navigation. It is considered out of scope for further investigation.
Result

LADM provides the most relevant basis for the development of a valuation information model.

Because ...

- It is an ISO standard for the domain of land administration, which is related to management of information concerning the ownership, value and use of land.
- It emphasizes the relationship to other property related databases (e.g. valuation).
- Its abstract structure provides a flexible frame for development of country specific information models.
**Stage 4 - Research statement**

**Purpose:** Extend LADM from the fiscal point of view to provide an information model for valuation databases.

**Scope:** Administrative valuations applied for recurrently levied property taxes.

**Methodology:** Supply LADM with new classes, attributes and relationships from developed thesaurus, country applications and existing geoinformation standards.
Stage 4 – Valuation information model – Overview
VM_ValuationUnit represents basic recording units of valuation databases, such as

a. Only land (e.g. parcel),
b. Only improvements (e.g. buildings),
c. Land and improvements together as land property,
d. Land and improvements together as condominium property
**VM_Parcel** specifies cadastral parcels, and sub-parcels that reflect a division of parcels according to land use categories for taxation (e.g. France and Spain).
VM_AbstractBuilding defines common aspects of buildings and condominium buildings.

VM_Building represents buildings that are considered as complementary parts of property units, which also may be taxed or valued separately from the parcels.

VM_CondominiumBuilding specifies buildings that contain main condominium units, joint facilities and accessory parts.
**VM_ValuationUnitGroup** clusters valuation objects according to zones (e.g. administrative divisions, value zones) or type of valuation objects (e.g. commercial, residential) that have similar functional characteristics.
**Stage 4 – Valuation information model – Valuation**

**VM_Valuation** defines input and output data used and produced within single or mass appraisal processes.

**VM_ValuationApproach** data type class specifies information about traditional valuation approaches or methods, used in both single property appraisal and mass appraisal.
VM_SalesComparisonMethod documents comparable units used in comparison approach, and monetary adjustments made for the sales prices.

VM_CostMethod organizes cost method related data, such as type of cost, age of improvements and depreciations.

VM_IncomeMethod renders information used in direct and yield capitalization approaches, such as gross and net incomes, capitalization rates, gross rent multipliers.
**VM_MassAppraisal** specifies mass appraisal-related information, such as model type (e.g. additive) and analysis type (e.g. multiple regression), and accuracy of mass appraisal.
VM_TransactionPrices defines information content of transaction contracts or declarations provided by parties. VM_SalesStatistics represents information related to price statistics produced through analysis of transaction prices.
Stage 4 – Valuation information model
Concluding remarks

- Valuation is a central theme in the LADM context, but so far not addressed.
- Comparison with related geographic information standards confirms LADM as the basis.
- A basic structure, based on outcome of semantic analysis, is developed in some detail.

Future works

- Refinement/amendments based on analysis of questionnaires.
- Database implementation and test of the model.
- Formal standard approval process.

Questions / Comments?