SDG Land Administration Indicators based on ISO 19152 LADM

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SUMMARY
This paper explores the connection between the Sustainable Development Goals (SDGs) and the ISO19152 Land Administration Domain Model (LADM). The SDGs, comprising of 17 goals and numerous indicators, address various social, economic, and environmental challenges globally. Land plays a pivotal role in achieving these goals, particularly in areas related to the environment, food security, economic development, urbanization, and climate change.

The LADM provides a framework for describing land administration systems, focusing on land rights, responsibilities, restrictions, and their geospatial components. It serves as a common language for stakeholders in land administration, facilitating communication and enhancing understanding across different systems.

This extended abstract presents a systematic methodology for selecting, categorizing, and developing indicators based on their relationship with LADM. It includes a detailed case study of SDG Indicator 1.4.2, "*Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure*." The study highlights the potential for LADM to support the achievement of SDGs across various domains, from poverty reduction to environmental preservation, through (direct or indirect) calculation.

Future work includes exploring advanced techniques for indicator selection, practical implementation through case studies, and rigorous testing and validation of computed indicators. This research aims to provide a solid foundation for aligning land administration with the sustainable development agenda outlined in the SDGs.

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1. INTRODUCTION

The Sustainable Development Goals (SDGs) are a global agenda for sustainable development, with some goals closely linked to land management. ISO 19152, the Land Administration Domain Model (LADM), is an international standard that provides a framework for land administration systems. The aim of this research is to identify the pertinent land administration indicators delineated within the SDGs and investigate how they can be linked or expressed using the LADM.

2. Indicator Classification and Selection

A systematic methodology is developed for the purpose of refining and discerning indicators from SDGs, comprising of four steps, as presented in Figure 1.

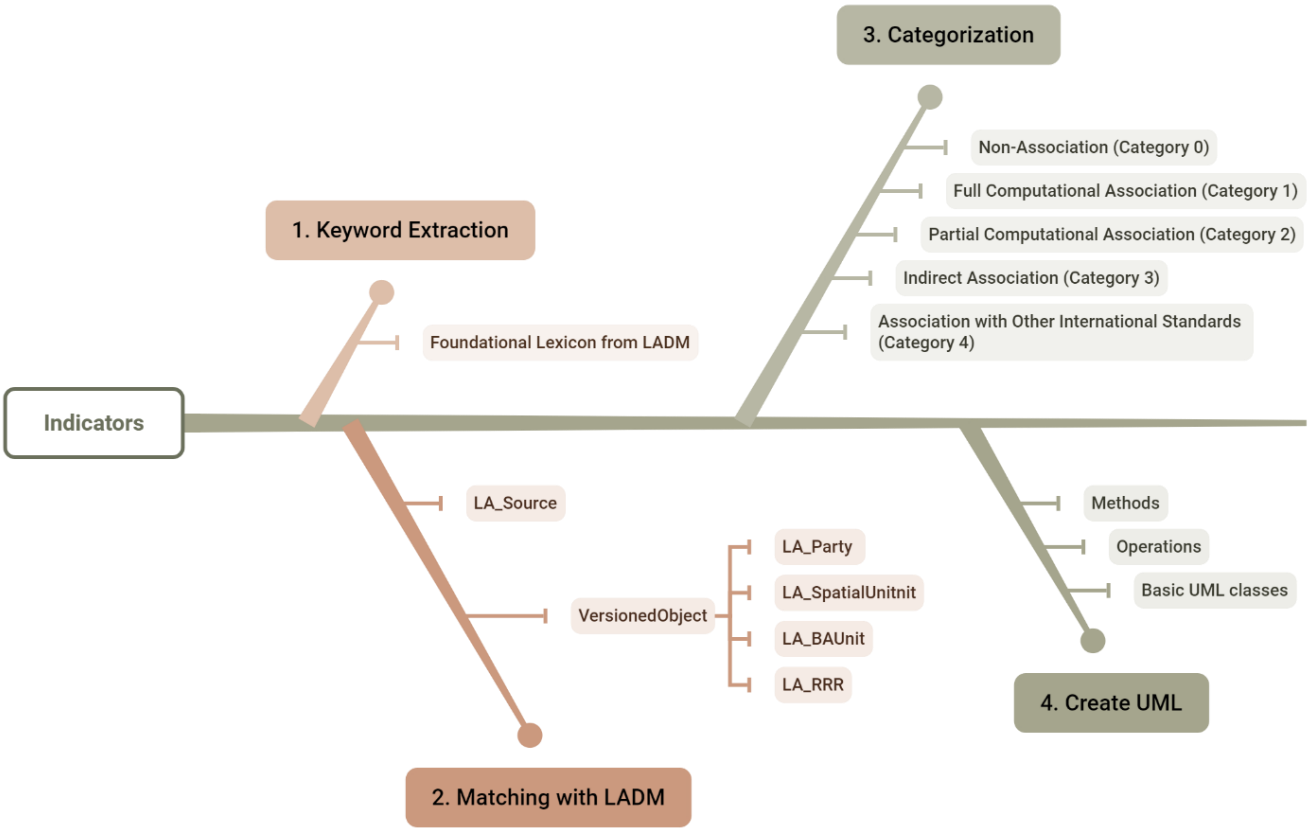

Figure 1. General Flow

1.1 Step 1: Keyword Extraction and Preliminary Filtering:

First and foremost, it becomes indispensable to use the core terminology of the LADM to create a first filtering for the identification of the relevant indicators. The core terms constituents: Land, Party, RRR (Rights, Responsibilities, Restrictions), Spatial Units, Marine, Valuation and Spatial Plan.

Subsequently, relevant terminology from the SDGs indicators is extracted. Meanwhile, the complex semantic interplay among these extracted terms decodes the relationships that may encompass synonymy, hypernymy, or contextual relevance. Each term is subjected to careful evaluation, gauging its alignment with the core LADM terminology.

1.2 Step 2: Matching with LADM core classes

A key aspect of this evaluation was the meticulous examination of specific sections within the indicator metadata documents (United Nations, 2023), namely, “0.f. Related indicators”, “2.a. Definition and concepts”, “3.a. Data sources” and “4.c. Method of Computation”. Subsequently, a rigorous alignment process was conducted, associating the basic classes (and sub-classes) from the various parts of LADM Edition II with these selected indicators. As previously mentioned, the basic classes are LA_Party, LA_SpatialUnit, LA_BAUnit, LA_RRR, VM_ValuationUnit and SP_PlanUnit. For those indicators that could be matched and have clear calculation formulas, the data names that LADM couldn't provide and might require sourcing from external datasets should be noted.

1.3 Step 3: Indicator Categorization:

The categorization criteria employed are elucidated as follows:

1. **Non-Association (Category 0)**: These indicators demonstrate no discernible direct or computational correlation with LADM.
2. **Full Computational Association (Category 1)**: Indicators falling within this category exhibit an unequivocal and comprehensive computational interdependence with LADM. All the data required for the calculation of these indicators can be obtained from a Land Administration System that conforms to the LADM.
3. **Partial Computational Association (Category 2)**: These indicators, while partly reliant on data provided by LADM for their calculations, necessitate additional external data sources. They thus establish a partial computational nexus with LADM.
4. **Indirect Association (Category 3)**: LADM offers supportive roles during the indicator generation process.
    - **a.** Indicator involves LADM elements (classes or attributes) but lacks direct expression (and therefore calculation) within the structure of the model.
    - **b.** Indicator indirectly utilizes LADM elements, and their final expressions do not have directly relation with LADM.

5. **Association with other Standards (Category 4):** Indicators categorized as such are fundamentally linked with other (international) standards in order to be computed and potentially may partly rely on the LADM.

1.4 Step 4: Create UML

This last step focuses on describing the computational process of the indicator within the UML diagram.

3. Indicator Development

This section outlines the development process for selected indicators. The UML diagrams are used to represent indicator computation: 1) UML Diagram Representation, 2)Addition of Attributes and Operations, 3) Implementation Method. A detailed example is provided for SDG Indicator 1.4.2 (see Figure 2), which measures the proportion of adults with secure land tenure rights. This indicator is categorized as having partial computational association with LADM.

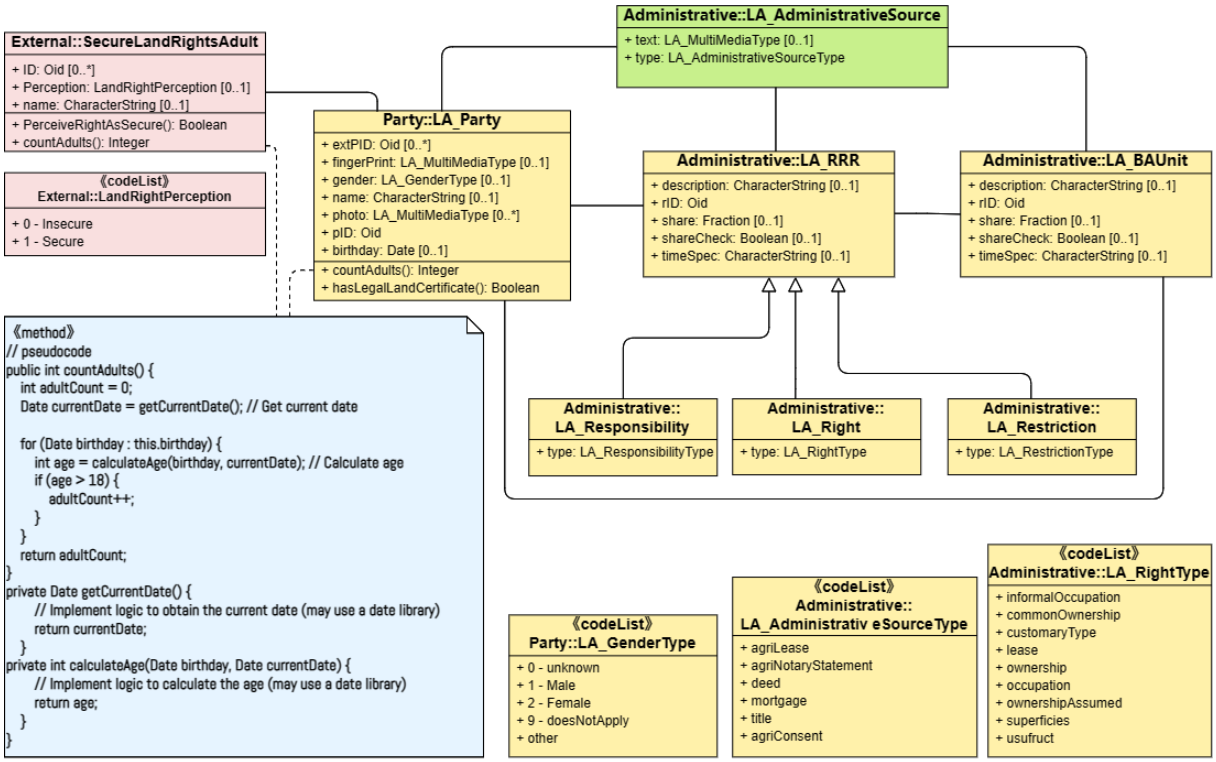

Figure 2. Modelling of SDG Indicator 1.4.2 calculation in UML class diagram

4. Conclusions and Future Work

The study classifies indicators into four categories based on their association with LADM. It highlights the importance of land administration in achieving various sustainability goals. Future work includes exploring semantic network and ontology integration for indicator selection, revisiting Category 1 indicators, and practical implementation through case studies, data collection, testing, and validation of selected indicators.

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