



DIGITAL TRANSFORMATION FOR RESPONSIBLE LAND ADMINISTRATION

FIG Commission 7 & 2 Annual Meeting 2023

2-4 October 2023, Deventer

SDG Land Administration Indicators based on ISO 19152 LADM

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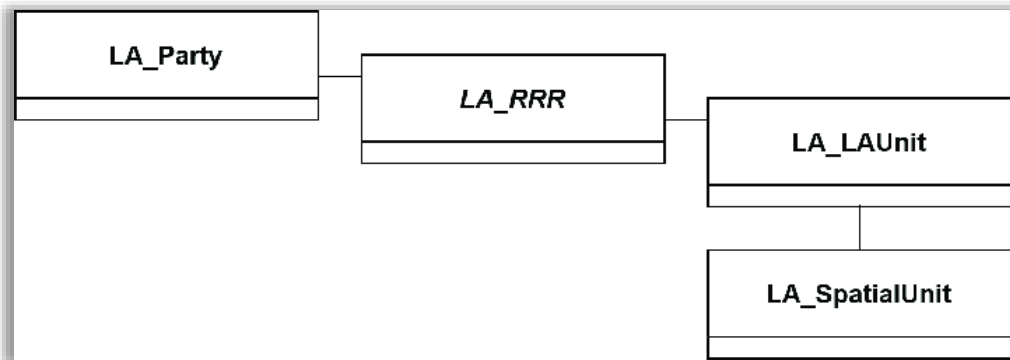


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ISO 19152 Land Administration Domain Model



- Shared Vocabulary — Provides terms
- Not a Replacement — Enhances understanding of system similarities and differences.
- Customization — Can be extended and customized

Source: ISO

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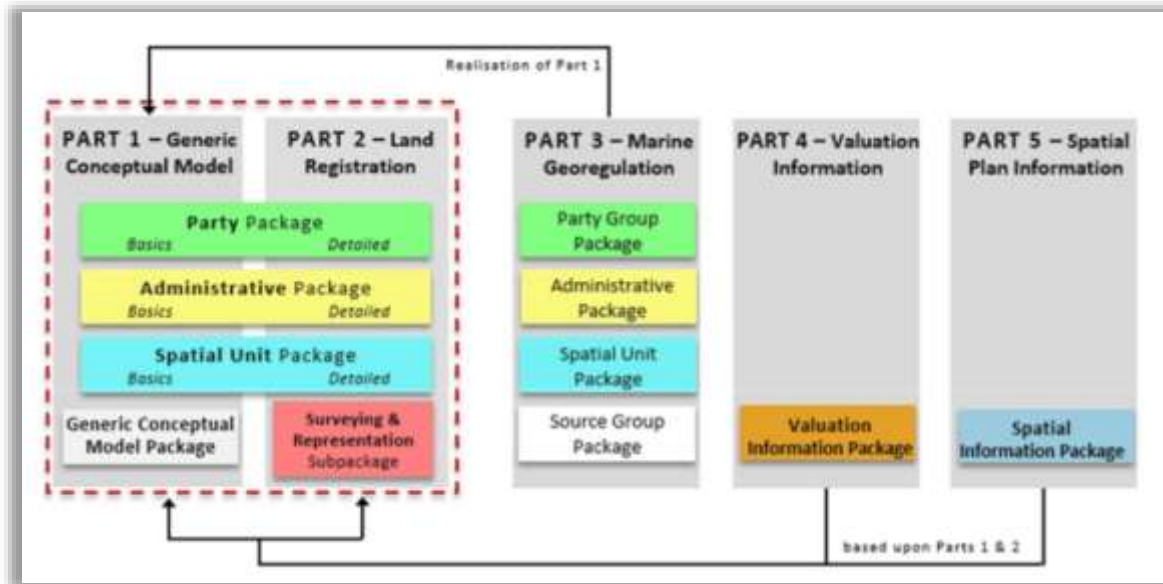


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ISO 19152 Land Administration Domain Model



- LADM Edition I — limited to the land tenure
- LADM Edition II — to include land value, land use and land development
- Five parts — *Generic Conceptual Model, Land Registration, Marine Georegulation, Valuation Information, and Spatial Plan Information*

Source: Kalogianni et al., 2023

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Sustainable Development Goals



- Broad scope – 17 goals
- Comprehensive - 169 targets and 248 indicators
- Sub-indicators
- Land's Crucial Role in SDGs
 - Environment
 - food security
 - economic development
 - Urbanization
 - climate change

Source: United Nation

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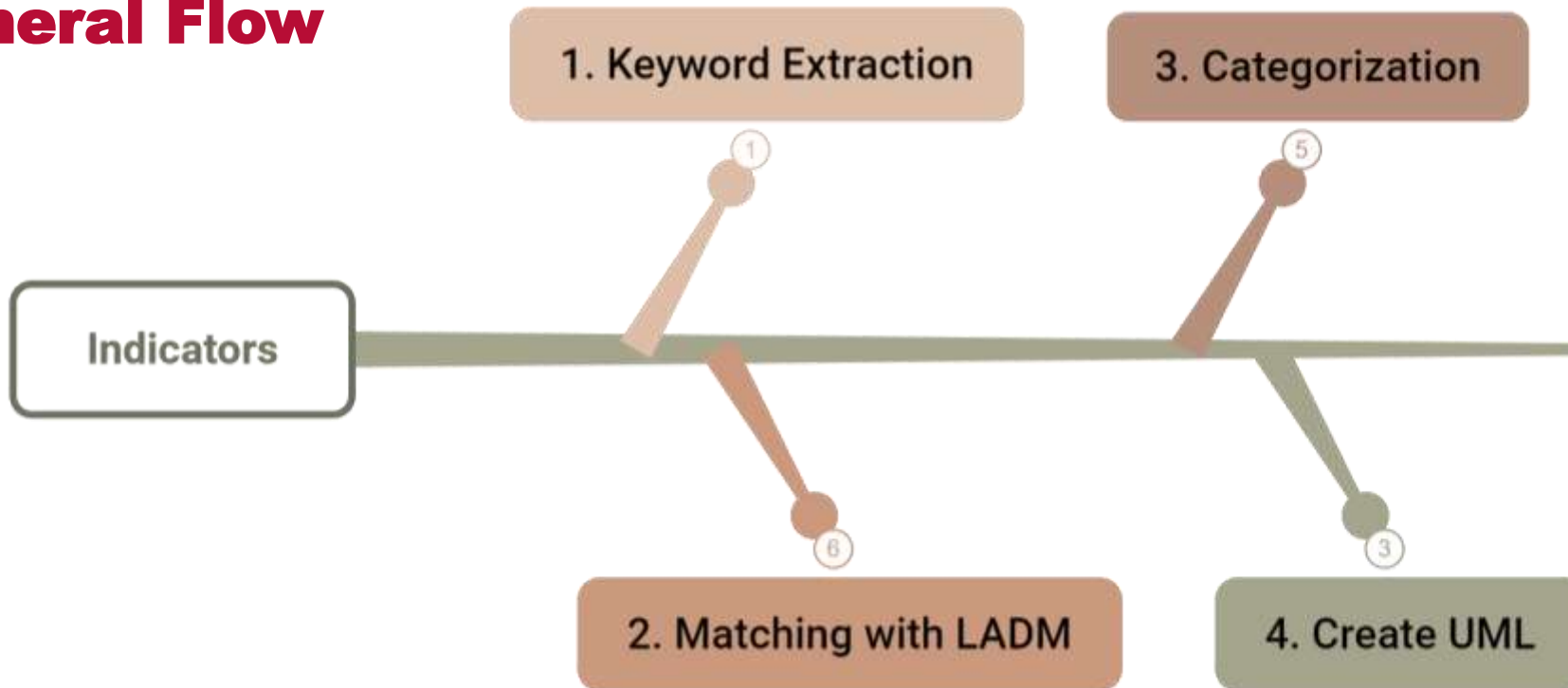


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General Flow



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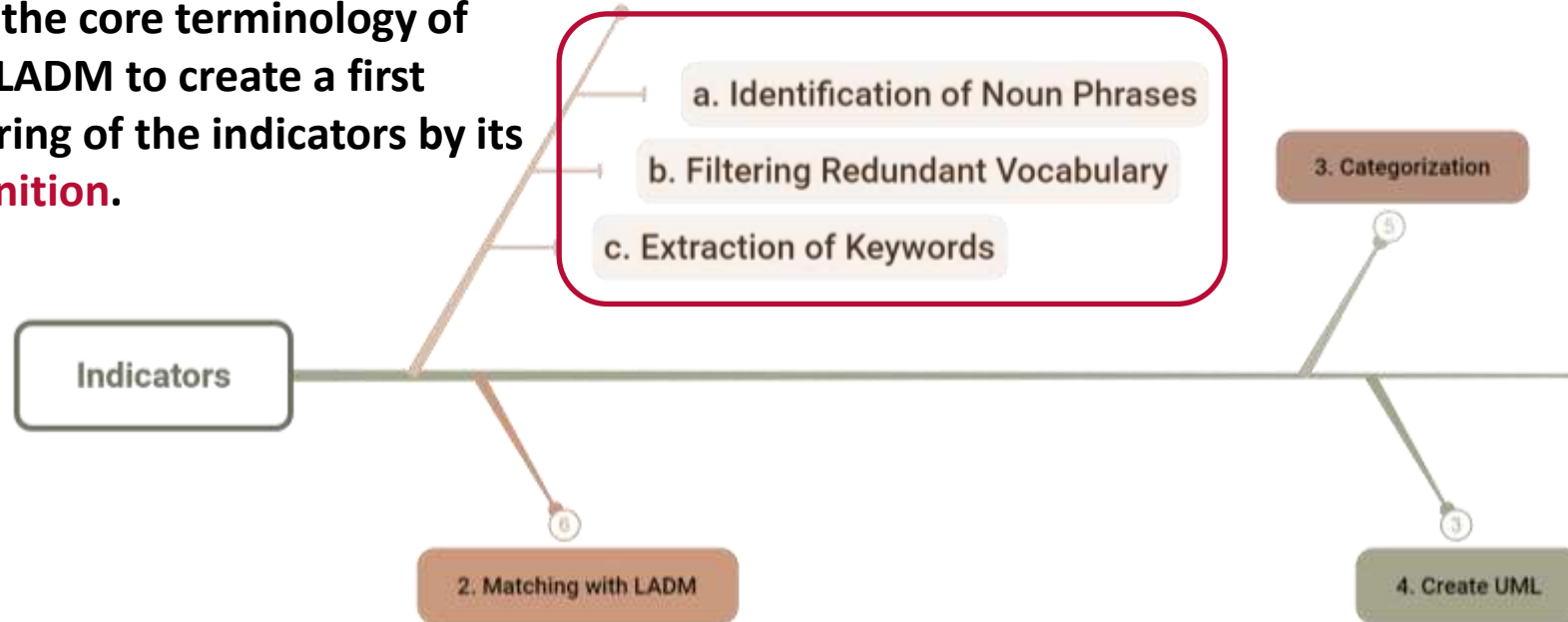




Step 1

1. Keyword Extraction

Use the core terminology of the LADM to create a first filtering of the indicators by its **definition**.



Core terms:

- Land
- Party
- Rights
- Responsibilities
- Restrictions
- Spatial Units
- Marine
- Valuation
 - value
- Spatial Plan
 - plan unit
- Source

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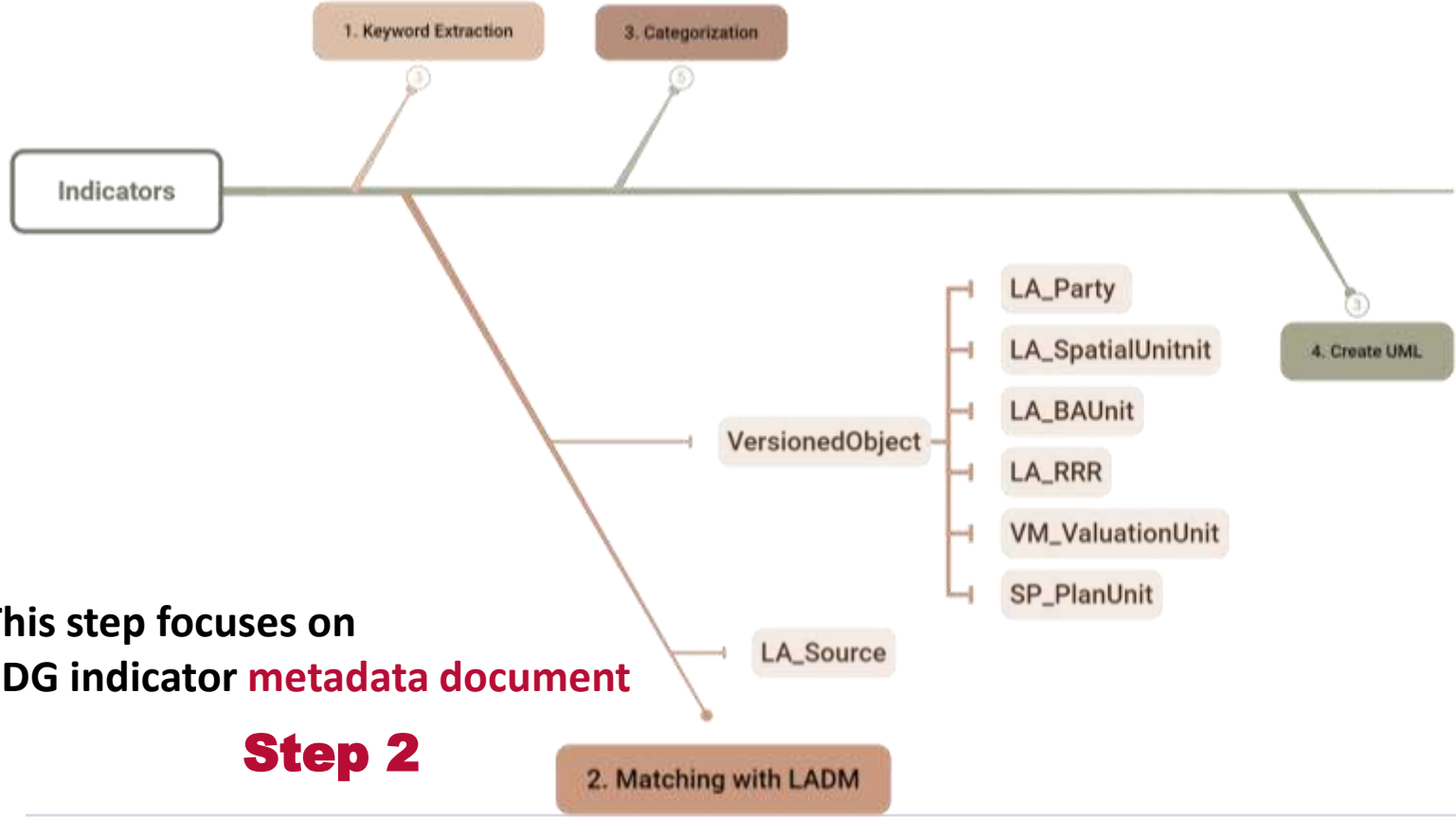


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Background | Selection | Classification | Development | Case | Summary and future work



This step focuses on
 SDG indicator **metadata document**
Step 2

- **“0.f. Related indicators”**
 — connections and potential overlaps
- **“2.a. Definition and concepts”**
 — explain Indicator Definitions
- **“3.a. Data sources”**
 — databases and organizations
 - household surveys
 - WHO
- **“4.c. Method of Computation”**
 — specific calculation methods
 - formulation of mathematical equations
 - tabulated scoring systems

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SDG indicator metadata document

- “0.f. Related indicators” — connections and potential overlaps

Example:

Indicator 5.1.1 “Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex”, **to avoid duplication, it does not cover areas of law that are addressed under indicator 5.a.2** “Proportion of countries where the legal framework (including customary law) guarantees women’s equal rights to land ownership and/or control”;

- “2.a. Definition and concepts” — explain Indicator Definitions

Example:

Indicator 1.4.1, “Proportion of population living in households with access to basic services”, **the precise definition of “basic services” is drinking water, sanitation, hygiene, energy, mobility, waste collection, health care, education and information technologies.**

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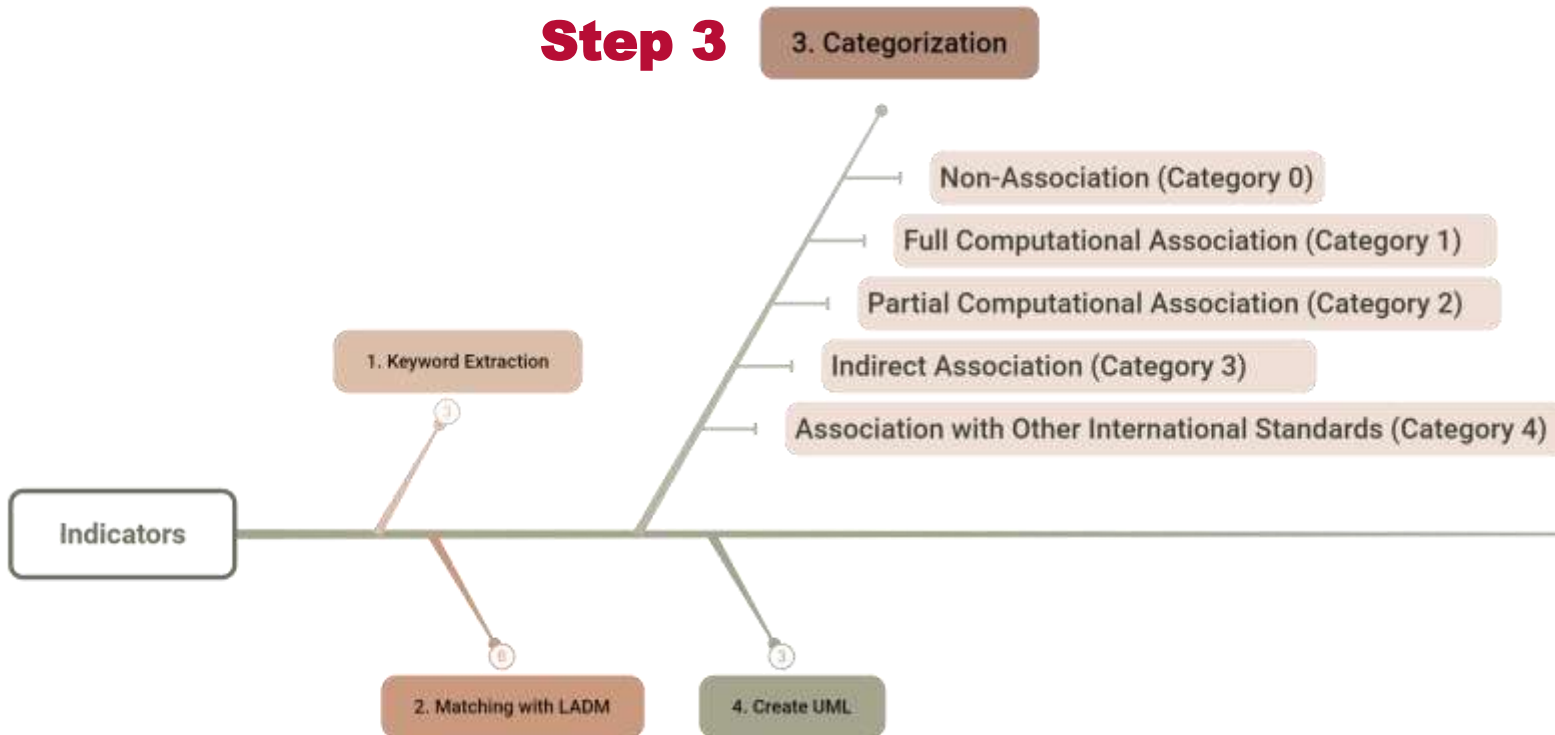


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Step 3



Indirect Association (Category 3):
 ■ lacks direct expression (calculation).

Example:
 indicator 14.6.1 *“Degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing”*, the computation method is based on **surveys and scoring**, and it is related to **marine and land rights** within LADM.

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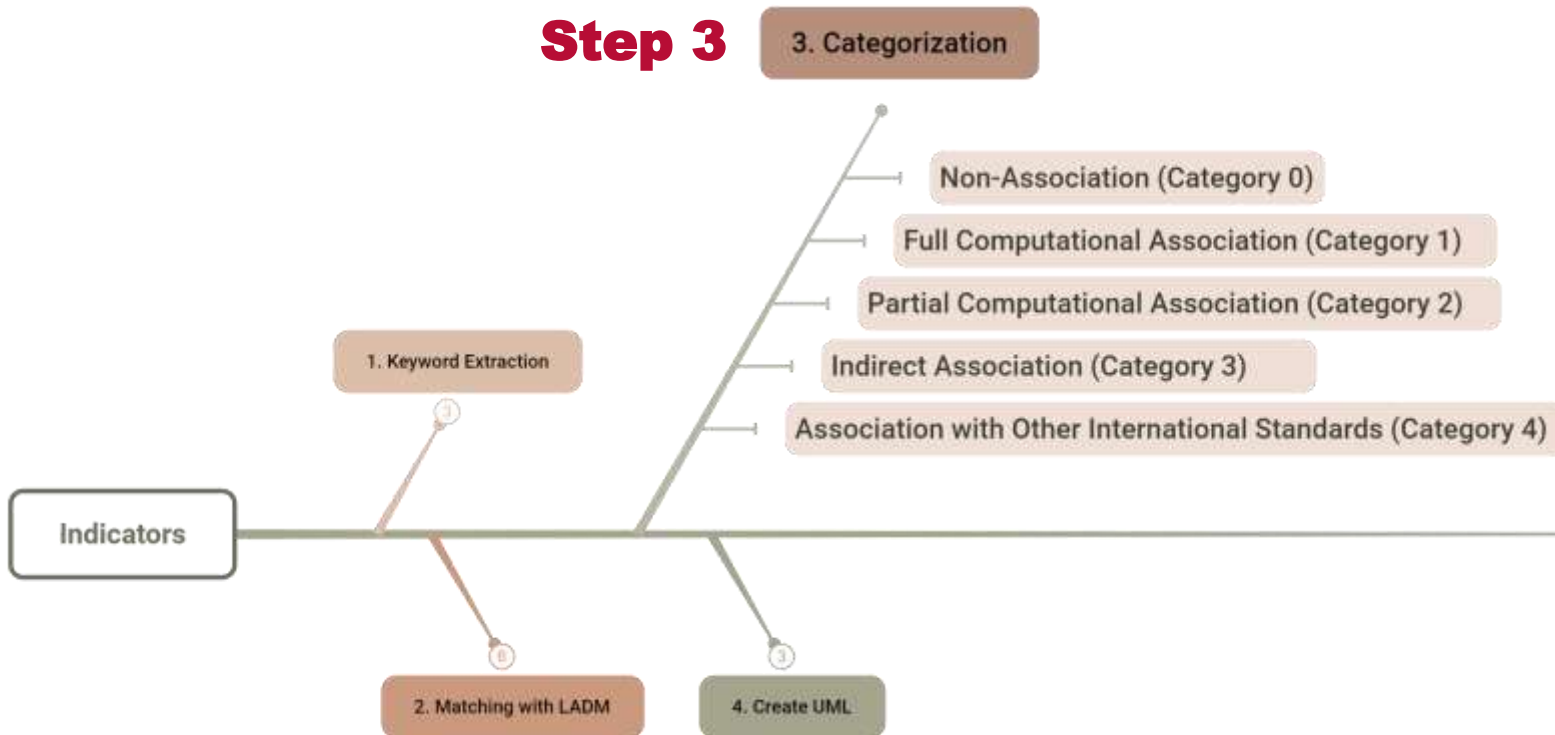


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Step 3



Indirect Association (Category 3):

- indirectly use, but final expressions do not have directly relation with LADM.

Example:

indicator 1.2.2 *“Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions”*, **“Poverty”** includes a **“housing”** dimension, which is related to **“BAUnit”** .

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Summary:

Category	Number of Indicators	Description
Category 0	219	
Category 2	10	1.4.2, 1.5.2, 5.a.1, 6.4.2, 9.1.1, 11.1.1, 11.2.1, 11.3.1, 11.5.1, 11.7.1
Category 3	11	1.2.2, 1.4.1, 5.a.2, 6.1.1, 6.3.2, 6.5.1, 6.5.2, 11.4.1, 14.6.1, 14.7.1, 15.2.1
Category 4	8	2.4.1, 6.6.1, 14.5.1, 15.1.1, 15.1.2, 15.3.1, 15.4.1, 15.4.2

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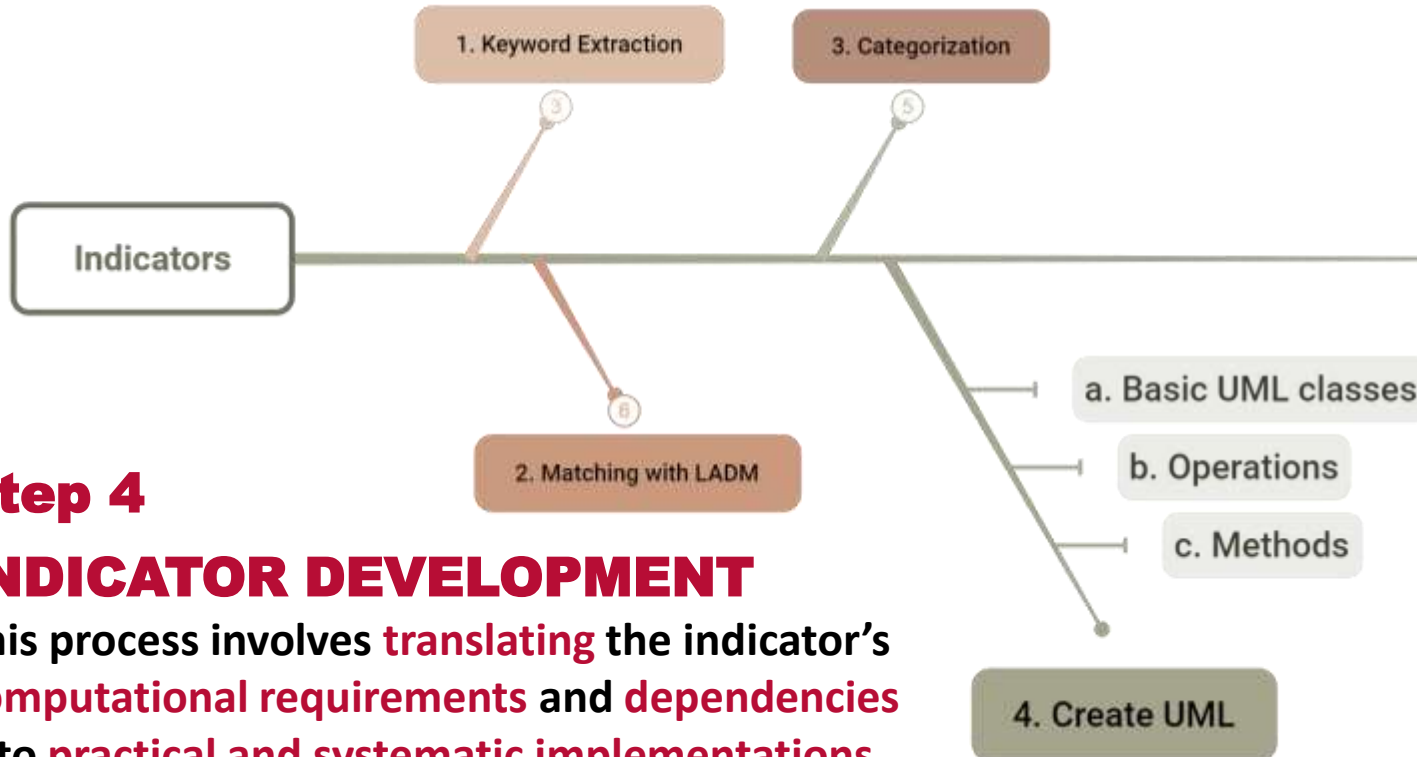


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Step 4 INDICATOR DEVELOPMENT

This process involves **translating** the indicator’s computational requirements and dependencies into **practical and systematic implementations**.

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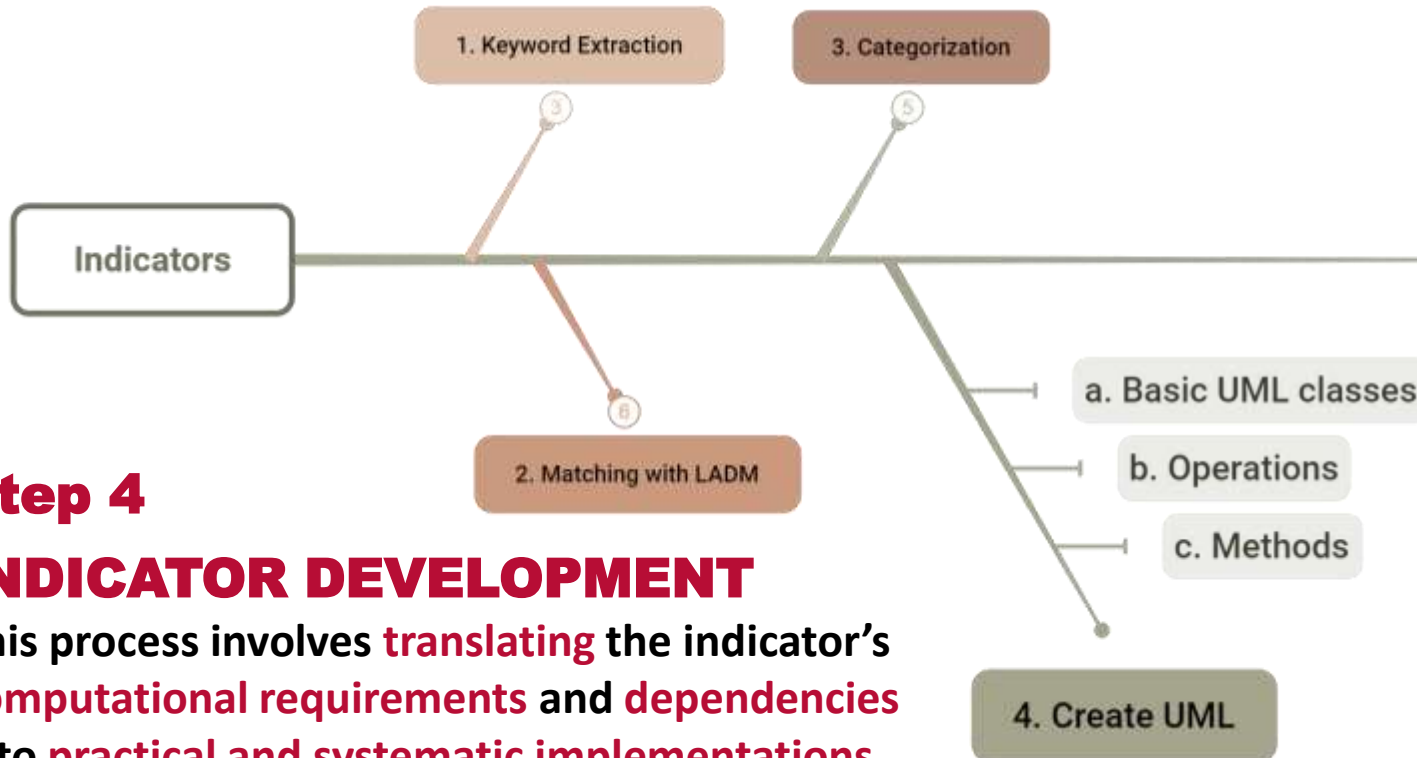


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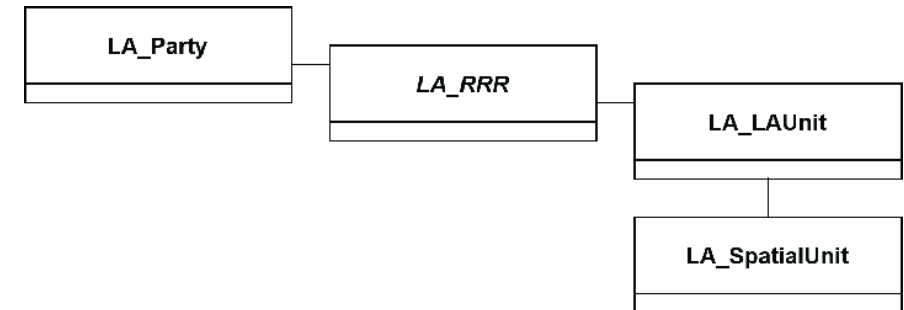
Step 4

INDICATOR DEVELOPMENT

This process involves **translating** the indicator's **computational requirements and dependencies** into **practical and systematic implementations**.

1. Represent with Basic UML classes

- information is based on in LADM,
- information is based on in other standards (e.g., ISO 19144),
- information is extracted from other databases



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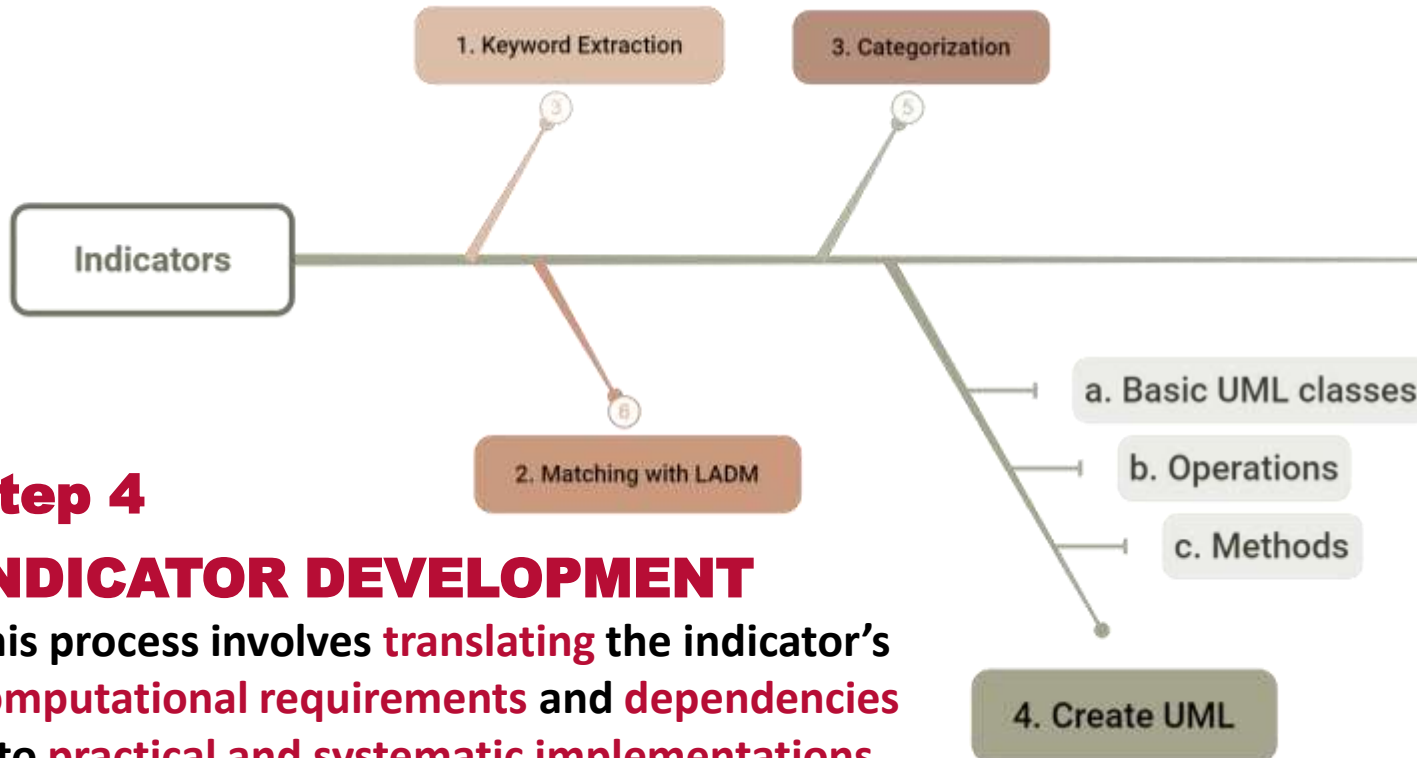


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Step 4

INDICATOR DEVELOPMENT

This process involves **translating** the indicator's **computational requirements and dependencies** into **practical and systematic implementations**.

2. Add compartments

- Operation

3. Implementation Method

- includes an attached note defining the steps of computation.
- using programming languages (i.e., Python, Java, pseudo code).
- Link to the operation

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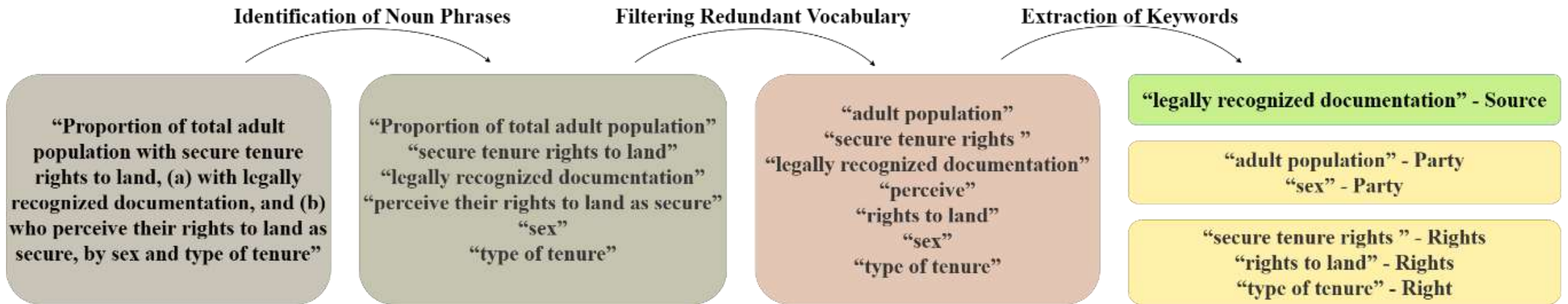




CASE

the 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”*

Step 1: Keywords Extraction



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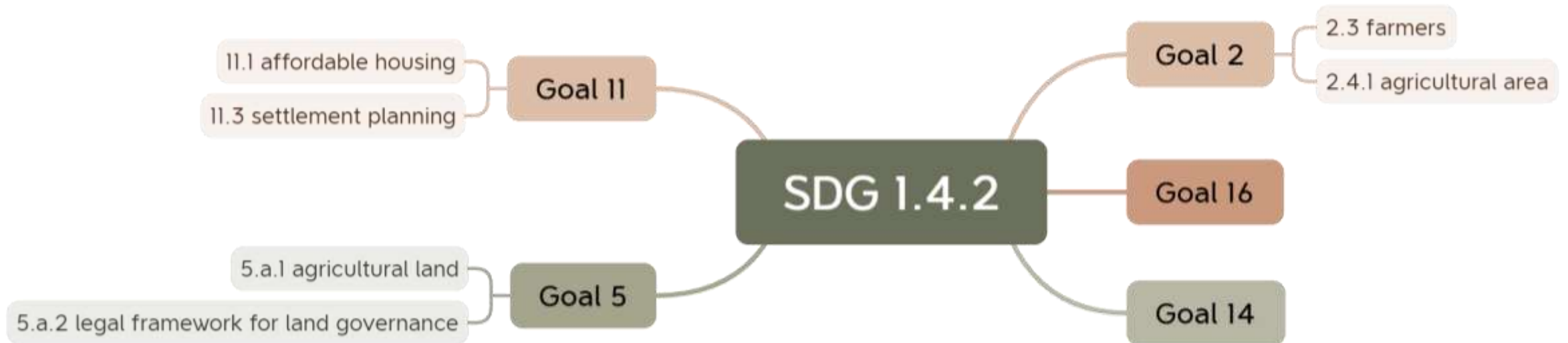


Background	Selection	Classification	Development	Case	Summary and future work
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CASE

the 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”*

Step 2: Matching with LADM_0.f. Related indicators



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Background	Selection	Classification	Development	Case	Summary and future work
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CASE

the 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”

Step 2: Matching with LADM

from a cadaster system compliant with LADM

Part (A): $\frac{\text{People (adult) with legally recognized documentation over land}}{\text{Total adult population}} \times 100$

from censuses or inter-censal projections

Part (B): $\frac{\text{People (adult) who perceive their rights as secure}}{\text{Total adult population}} \times 100$

household survey

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Background	Selection	Classification	Development	Case	Summary and future work
------------	-----------	----------------	-------------	-------------	-------------------------

CASE

LA_RRR

the 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*”

Step 2: Matching with LADM

LA_Party

LA_Source, LA_Party

Part (A): $\frac{\text{People (adult) with legally recognized documentation over land}}{\text{Total adult population}} \times 100$

Part (B): $\frac{\text{People (adult) who perceive their rights as secure}}{\text{Total adult population}} \times 100$

**External:
Population**

**External:
SecureLandRightsAdult**

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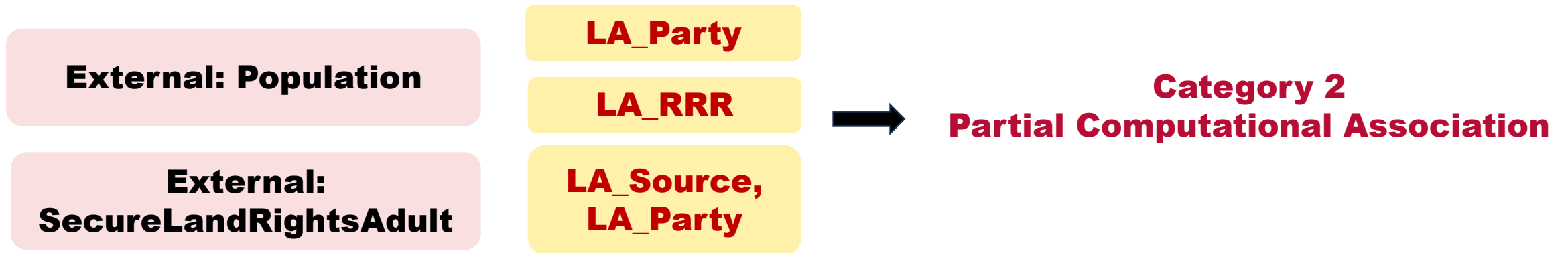


Background	Selection	Classification	Development	Case	Summary and future work
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CASE

the 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”*

Step 3: Classification



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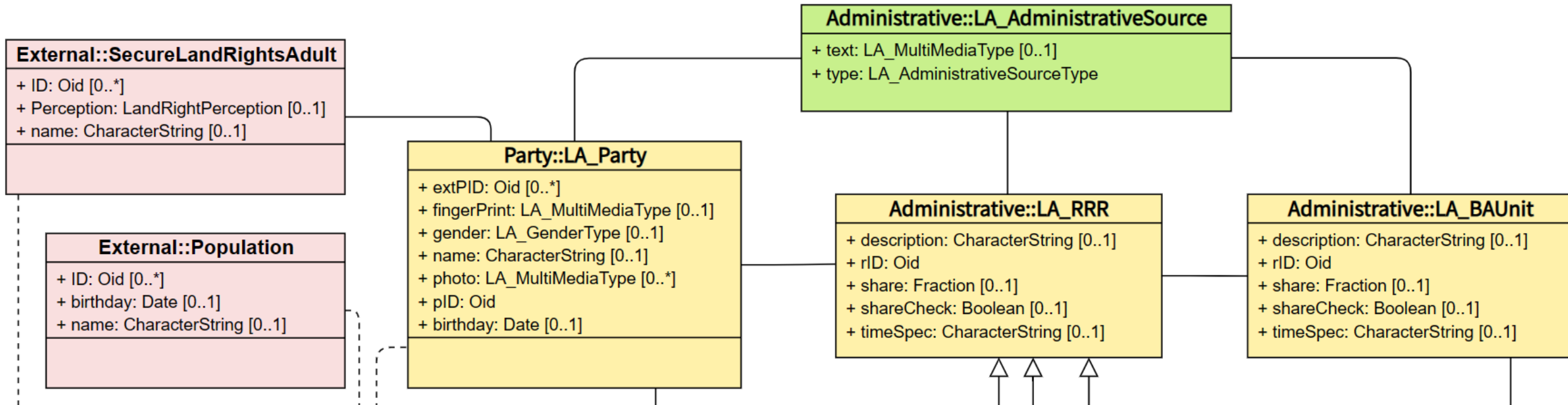
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Step 4: Development

1. Represent with UML classes



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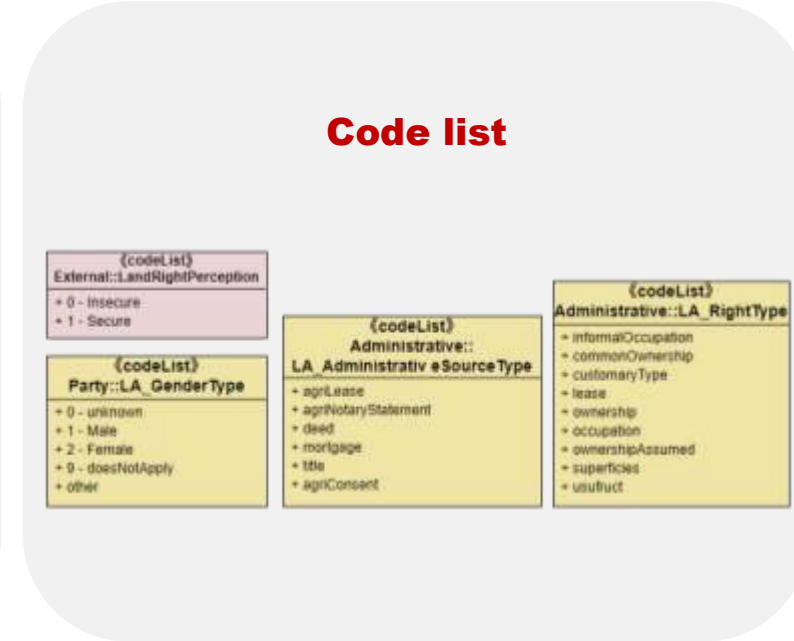
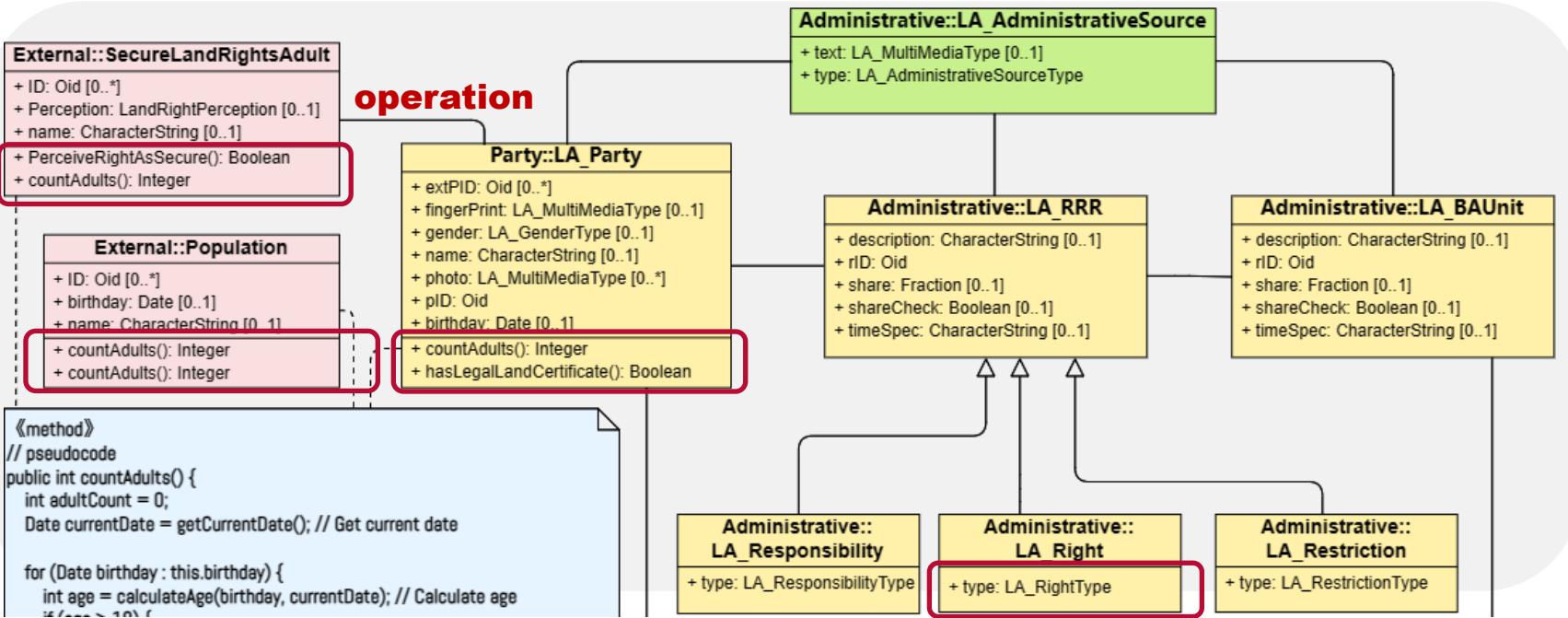
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Step 4: Development

2. Add compartments



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Background	Selection	Classification	Development	Case	Summary and future work
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Step 4: Development

3. Implementation Method

```

«method»
// pseudocode
public int countAdults() {
  int adultCount = 0;
  Date currentDate = getCurrentDate(); // Get current date

  for (Date birthday : this.birthday) {
    int age = calculateAge(birthday, currentDate); // Calculate age
    if (age > 18) {
      adultCount++;
    }
  }
  return adultCount;
}
private Date getCurrentDate() {
  // Implement logic to obtain the current date (may use a date library)
  return currentDate;
}
private int calculateAge(Date birthday, Date currentDate) {
  // Implement logic to calculate the age (may use a date library)
  return age;
}
}
  
```

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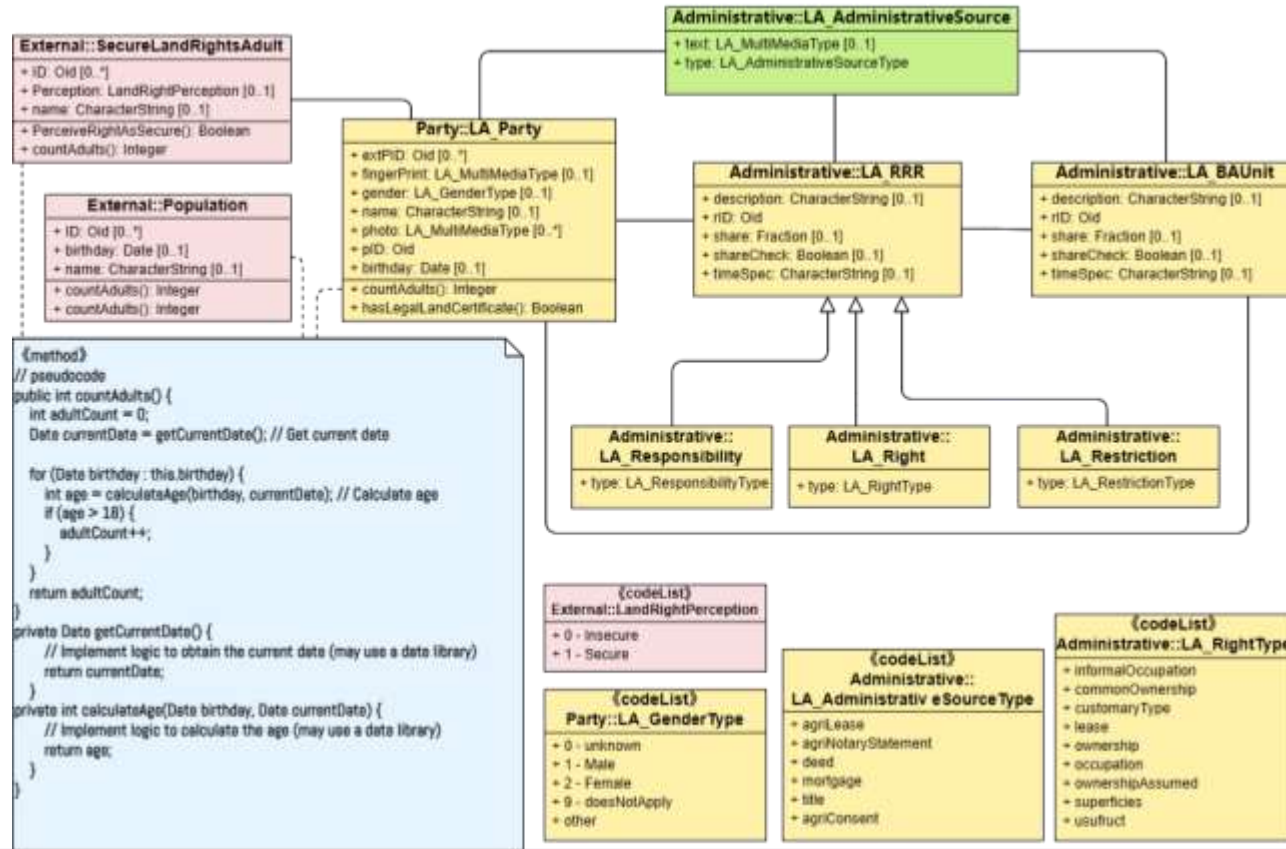
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Background | **Selection** | **Classification** | **Development** | **Case** | **Summary and future work**

Step 4: Development



Modeling of SDG Indicator 1.4.2 calculation in UML class diagram

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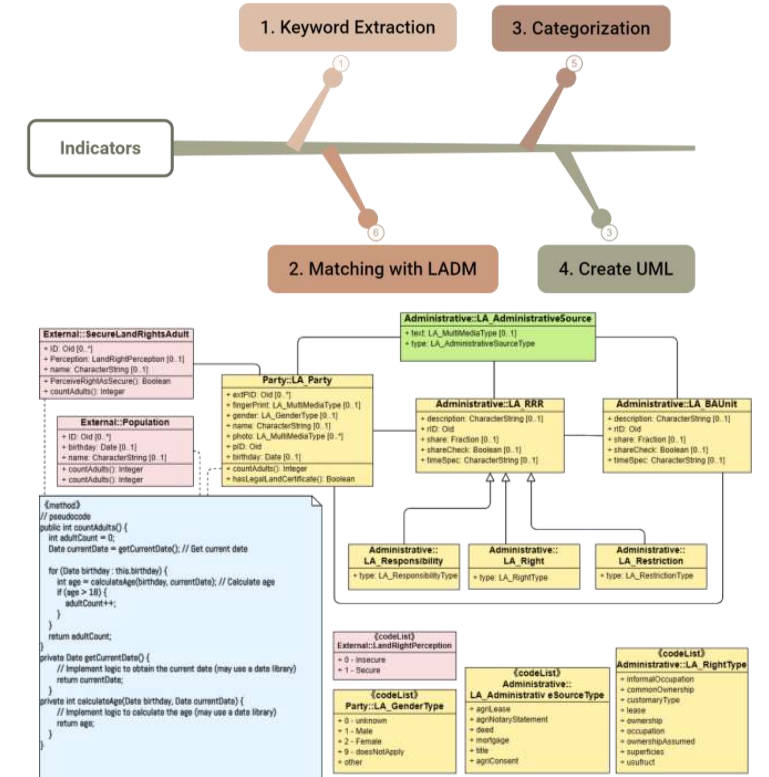
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Summary

- Approach developed
- Analyzed SDG indicators in LADM context
- Classified them in categories
- Computation of indicator values modeled (based on LADM classes and adding extensions)



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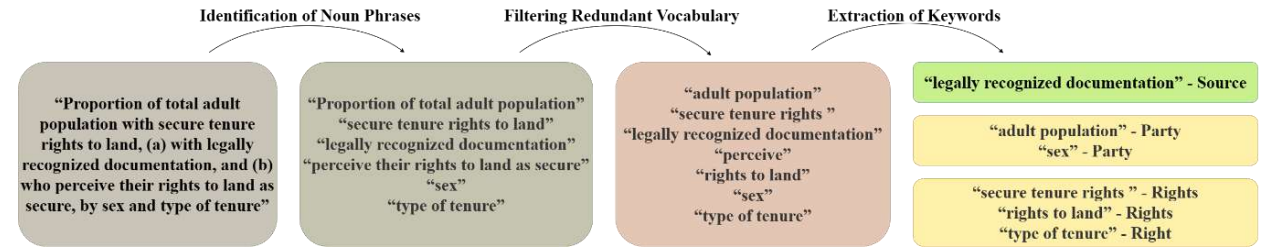
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Future work

- Semantic Network and Ontology Integration
- Further Exploration of Category 1 Indicators
- Practical Implementation and Case Studies



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Thanks!

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