LADM COL
Land Administration Model

Vol. 3:

Conception of the LADM-COL for Cadastral Management

IGAC
INSTITUTO GEOGRÁFICO
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Land Administration Model – Colombia
Volume 3

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Preliminary Considerations

The Instituto Geográfico Agustín Codazzi (Agustin Codazzi Geographic Institute —IGAC by its acronym in Spanish—), in its exercise as the maximum cadastral authority, gives the following linear and progressive documents, with the present one being the first. These documents are the result of a research process emphasized in bibliographical review and the generation of documents that could be used as input for the comprehension, development, and promotion of the Land Administration Domain Model (LADM) and the adoption of this one to the Colombian profile, denominated as LADM-COL.

Throughout the document review, it will be possible to encounter diverse technical and methodological analyses of the process, history, changes, and behavior that the LADM-COL Extended Model Cadastral-Registration, and the various application models that surged in the framework of Multipurpose Cadastre, thus seeking to make the cadastral approach the center of these writings so that the various actors of the cadastre and the community in general have within reach a purified and synthetic version of the processes, lessons and current state of the adoption of the models, based on official documentation from the IGAC as the governing body.

Regarding the documentation of these models, it has been observed that if the official information, issued by different national organizations, is contrasted over time, since the conception of the standard's inclusion in Colombia, it may present some ambiguities or appear to be inconsistent in terms of the terminology associated with designated them and the competencies related to them. This corresponds to the institutional development, evolution, and understanding of the implementation of the Land Administration Model in Colombia, oriented towards cadastral management with a multipurpose emphasis.

In the ensuing part is a conceptual map displaying the name of each document, a brief description, and the position that it occupies within the sequence, to delimit its scope and provide the reader with a general overview that allows them to navigate its contents more easily (Figure 1).
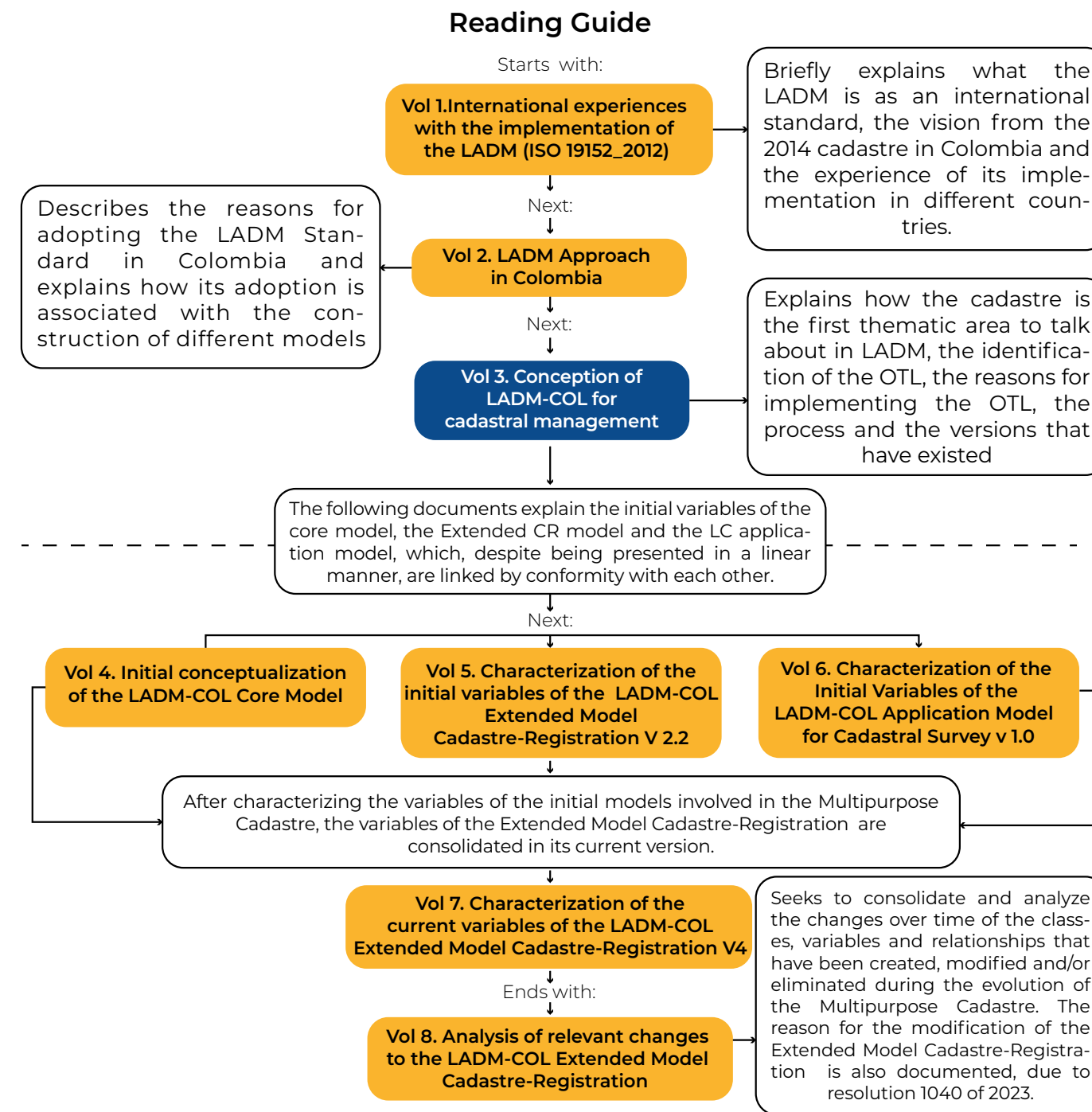

Figure 1. Reading Guide for Documents Related to LADM Conceptualization in Colombia.

Introduction

EIn previous documents, not only the LADM as an international standard has been described but also the motivations behind its adoption to Colombian territory. In this volume, a cover over the jurisdiction, versions, and differences in the adoption of the model needs to be done, for exclusive aims of cadastral management.

To address the conception process of the model in the Colombian context this document is divided into four sections:

1. The first section explains how the Multipurpose Cadastre becomes a relevant topic for land administration based on the CONPES 3958 from 2019. Likewise, it describes the objectives and some essential concepts to fully understand the LADM-COL model background.
2. The second section presents the LADM-COL Extended Model Cadastre-Registration (MECR by its acronym in Spanish), including its objectives, structure, and components. It also explains the reasons and the fixed moment in which Cadastre and Register turn into the first extended model for the characterization of its Legal Land Object (LLO).
3. The third section explains the concept of *application models*, it also presents the models that have been made based on LADM-COL Extended Model Cadastre-Registration till present in response to the necessity of adapting it for specific purposes like cadastral formation, updating, conservation, and dissemination processes in the country.
4. Finally, the last section presents a series of conclusions and recommendations that include the major findings in the implementation process of the LADM-COL in the cadastral management for the Multipurpose Cadastre framework, this also includes the challenges and opportunities found in the process.

Contextualization of LADM-COL

Based on the definition of the Colombian model, delimited by the LADM ISO 19152:2012 standard, it was established that the local model would be called LADM-COL. For convenience purposes, in this volume, the local model will be referred to as the *core model*.

To contextualize the first elements of the core model, it is necessary to identify its emphasis, as well as which the legal *land objects* (LLO) or basic administrative units (BA Units) that should be represented and characterized as the basis of land administration system (LAS), that is the reason why organizations that have responsibilities on the land administration modernization process as part of their mission like IGAC, the Superintendence of Notary's and Registration (SNR by its acronym in Spanish), the Colombian Spatial Data Infrastructure (ICDE by its acronym in Spanish), and the Swiss development cooperation (SECO) focus their knowledge on determining aspects that go beyond the concept of *land*, to the scope of *territory*. In that sense, the *Multipurpose Cadastre* and its LLO, *property*, are the basis of the entire system and have progressive levels for the use of the information as shown below (Figure 2):
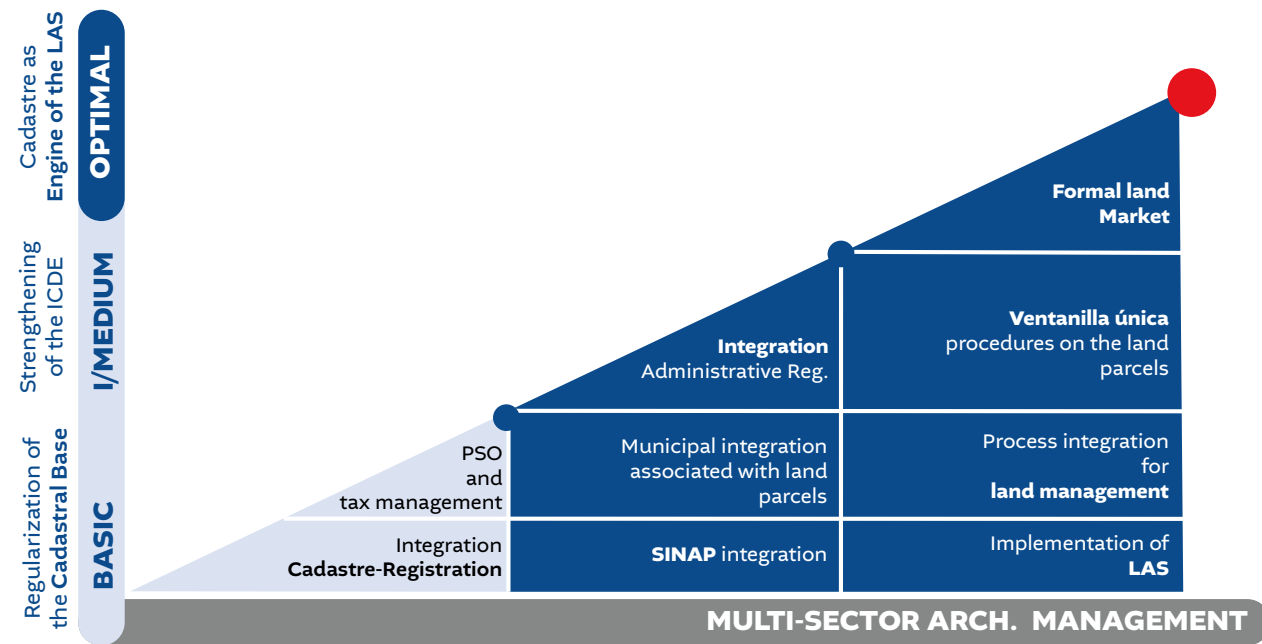
Figure 2. Progression Levels for Cadastral Information Use. **Source:** Swisstierras (2020).

Understanding that over time conventional cadastre has focused on the taxation component Figure 2, the commitment to the *multipurpose* approach[1] (National Planning Department, 2019) gives the Colombian government the possibility to use the collected information in the cadastral processes for many different purposes in the land administration framework. For this to be possible, it is important that the organizations responsible for the identification and land register (IGAC & SNR) joint forces achieve the interrelation of their data under the same standard interoperable with the LAS. As a result of what was mentioned above, the necessity to create an extension of the model under the LADM-COL, with a different thematic approach, which will correspond to the land parcel cha-racterization to satisfy these conditions.

[1] CONPES 3958 de 2019.

LADM-COL Extended Model Cadastre-Registration

Based on the concept of *property* as a defined LLO and agreed upon guide-lines of the ICDE, which can be found in the document called *Guidelines for the Governance of Extended Models and LADM_COL Application* (Lineamientos para la gobernanza de modelos extendidos y de aplicación LADM_COL in Spanish), issued in May 2022, the IGAC and the SNR created the LADM-COL Extended Model Cadastre-Registration (MECR by its acronym in Spanish), whose purpose is to characterize, in a unified and organized way, the cadastral information with a multipurpose approach in the national territory, to the create the LAS database.

During the land modernization project carried out by the SNR, the ICDE, and the SECO together with the IGAC, for the first time it was determined that the MECR should be adopted with legal support, which is why after extensive days of negotiation, and analysis and agreement between the organizations named above, the Joint Resolution IGAC 642 SNR 5731 was issued on May 30, 2018.

The purpose of this joint resolution was to adopt the LADM-COL model as the interoperability standard of the multipurpose cadastre information, misleadingly implying that the IGAC and the SNR would be the organizations responsible for adopting the standard at the national level and applying governance of the LADM-COL Core model when actually the ICDE would be the organization responsible for this task, while IGAC and the SNR would have exclusive competence in the area of Cadastre-Registration. In the technical appendix of the joint resolution, there is a diagram that represents the modularity process of LADM-COL.

As a scope of application, it is important to highlight that the LADM-COL model presented in the administrative act was approved by both IGAC and SNR. This Model responds to the standardization of information carried out in the multipurpose cadastre and for those land administration systems that intend to interoperate with the Cadastral Information system (IGAC & SNR, 2018). Howe-ver, the purpose of the resolution is conflicted, since it is an official adoption

of the LADM-COL core model, the IGAC and/or the SNR should not have been the organizations in charge of issuing the regulations.

To understand better the mistake made during the resolution issuing, it is important to consider the diagram presented below (Figure 3) since it describes how a Cadastre-Registration model is created with the word that precedes it mentioned as *Core*, and upon verification, it is observed that the word *Extended* is nowhere to be found both in the resolution or appendix.
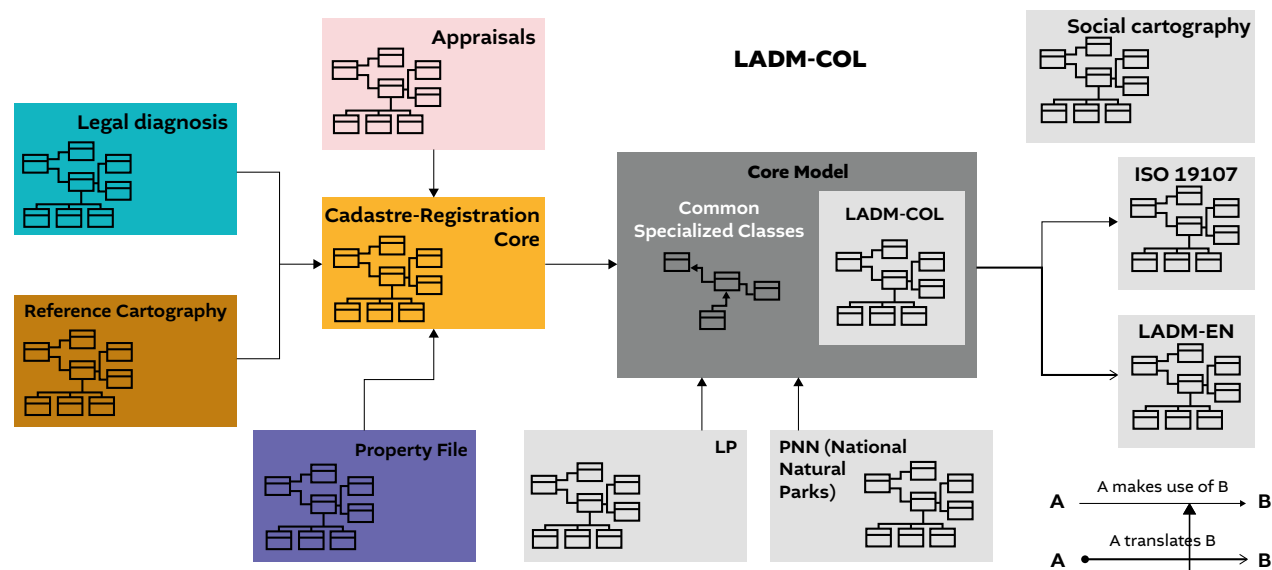

Figure 3. Outline of Conformance of Extended Models and Application Models for Multipurpose Cadastre Information. **Source:** IGAC *&* SNR (2018).

However, it can be seen how this model is connected to another model, which is actually the adoption of the LADM Standard to the Colombian profile, known as the LADM-COL Core. When comparing it with what is discussed in these documents, a conceptualization mistake is found. This mistake presents discrepancies

with the current documentation, as it refers to the terminology used when talking about a Core Cadastre-Registration Model since, according to the ICDE guidelines and the adoption of the LADM standard, said model must be an *extended* model corresponding to the second level of conformity of the standardization and modernization process of land administration system in Colombia.

The proposed MECR structure in the regulations is composed of each one of the visual elements in Figure 4, which are called according to the technical appendix *models*, they have the objective of ensuring the coherence and existence of the main characteristics of the LLO Predio. For a better understanding of the concept in the regulations, it is necessary to refer to four components of the model: The first is the Legal Diagnosis Model, the second is the reference Cartographic Model, the third is the property file (Ficha predial in Spanish) Model, and the fourth is the Valuation Model. Each of these models; which from now on will be called *small models*[2], make up the Core Cadastre-Registration Model proposed in the resolution.

It is important to highlight that in Figure 4 the small models have their own names, without any prefixes or suffixes, that specifically link them to a particular model. Additionally, all of these small models have the same version number in their name, which in this case is 2.2[3]. The definition of small models —that are really submodels— is based on the conception of the cadastral information characterization process. If you seek to understand the elements

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[2] These should have been designated as *submodels*, as outlined in the ICDE guidelines document. Their primary function is to provide relevant information, although not essential for the minimum characterization of the basic administrative unit or LLO.

[3] The version control of the LADM model is given by numbers and points, that is, if the model requires a structure modification, the first number must be modified, if the model changes are minor or minimal, the second must be modified and up to the third number for the naming of a version) This suggests the existence of unpublished preliminary versions since there were versions that were part of the preliminary conception process of the models (IGAC *&* SNR, 2018).

or attributes that are part of each one, its definition and object catalogs are detailed in the Technical Appendix of the Joint Resolution IGAC 642 SNR 5731, issued on May 30, 2018, each of these aspects will be addressed in detail.

LADM-COL Extended Model Cadastre-Registration Over Time

During the two years after the issuing of Resolution 642 of 2018 (2019 and 2020), IGAC and SNR formalized some working groups for the analysis and arrangement of a "proposal to improve the administrative act related to the model LADM-COL", as they found reasons to modify and repeal its entirety. As a result, the IGAC Resolution 499 and the SNR Resolution 04218 "By which the LADM-COL Extended Model Cadastre-Registration is adopted" were issued.

This document is currently in force, and its objective is to

> Adopt the LADM-COL Extended Model Cadastre-Registration, in the latest version approved by the Agustin Codazzi Geographic Institute (IGAC) and the Superintendence of Notary's and Registration (SNR), as the standard for the interoperability of cadastre and registration information, in conformance with what is published in the model repository provided by the IGAC. (IGAC & SNR, 2020)

Currently, the version of this model is version 4.0 defined and published by both IGAC and SNR.

The importance of establishing solid legal support for the creation of a data model that complies with the LADM-COL standard must be acknowledged. According to the joint definition made with the ICDE, this model has the capacity to characterize the Legal Land Object *property* for cadastral management with a multipurpose approach.

Aligning with the legal revision linked to the implementation of the LADM-COL model for cadastral management in Colombia, specific aspects of the current resolution will be addressed. This resolution has the objective of regulating the Extended Model Cadastre-Registration.

First of all, when talking about the principles that are an integral part of LADM and that were addressed in Joint Resolution 499 of 2020, the *Legal Independence Principle* is referenced again, defined as "the one in which a single individual is legally designated as the responsible party for the data associated with a land object and that guarantees the administration and maintenance of that data" (IGAC & SNR, 2020).

The standards and elements agreed on by the IGAC and the SNR must be used to define, adopt, and govern the cadastral and register information that builds the input for the LAS. This is where the name LADM-COL Extended Model Cadastre-Registration comes from. This model will allow the storage of the minimum variables needed to identify or characterize the properties in Colombia, with the possibility of future adjustments or modifications to the model, adding or eliminating variables, or altering its structure, as part of its evolution process. However, to achieve such modifications, as well as the preliminary versions, the procedure must be previously approved by both the IGAC and the SNR, in accordance with the principle of legal independence, through a steering committee defined in the resolution. This committee consists of the following members:

- » Head of the IGAC's Legal office or their delegate
- » Head of the IGAC's Technology and Telecommunications office or their delegate.
- » IGAC's Cadastre Subdirector or their delegate.
- » IGAC's Geography and Cartography Subdirector or their delegate.
- » Head of the SNR's Information Technology Office or their delegate.

- » SNR's Superintendent Delegated for Land Protection, Restitution, and Formalization or their delegate.
- » SNR's Registration Technical Director or their delegate.

The functioning of the steering committee, and how to convene it in advance, can be found in IGAC Resolution 499 of 2020. However, it is necessary to clarify that, if we are referring to the LADM-COL Extended Model Cadastre-Registration, it has had different versions that have been published and officially implemented, which are listed below:

LADM-COL Extended Model Cadastre-Registration Version 2.2 (Figure 4) (Appendix A)
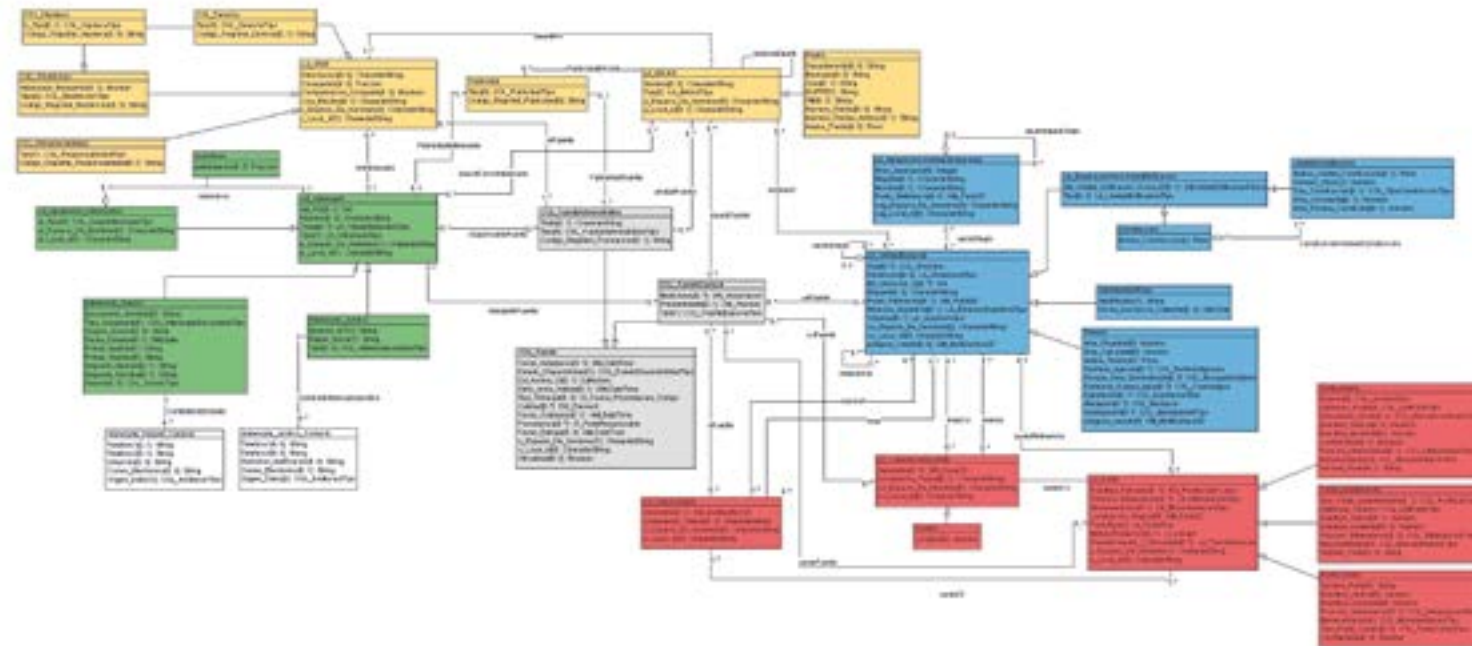
Figure 4. LADM-COL Extended Model Cadastre-Registration Version 2.2.
Source: GitLab IGAC (2023).

LADM-COL Extended Model Cadastre-Registration Version 3 (Figure 5) (Appendix B)
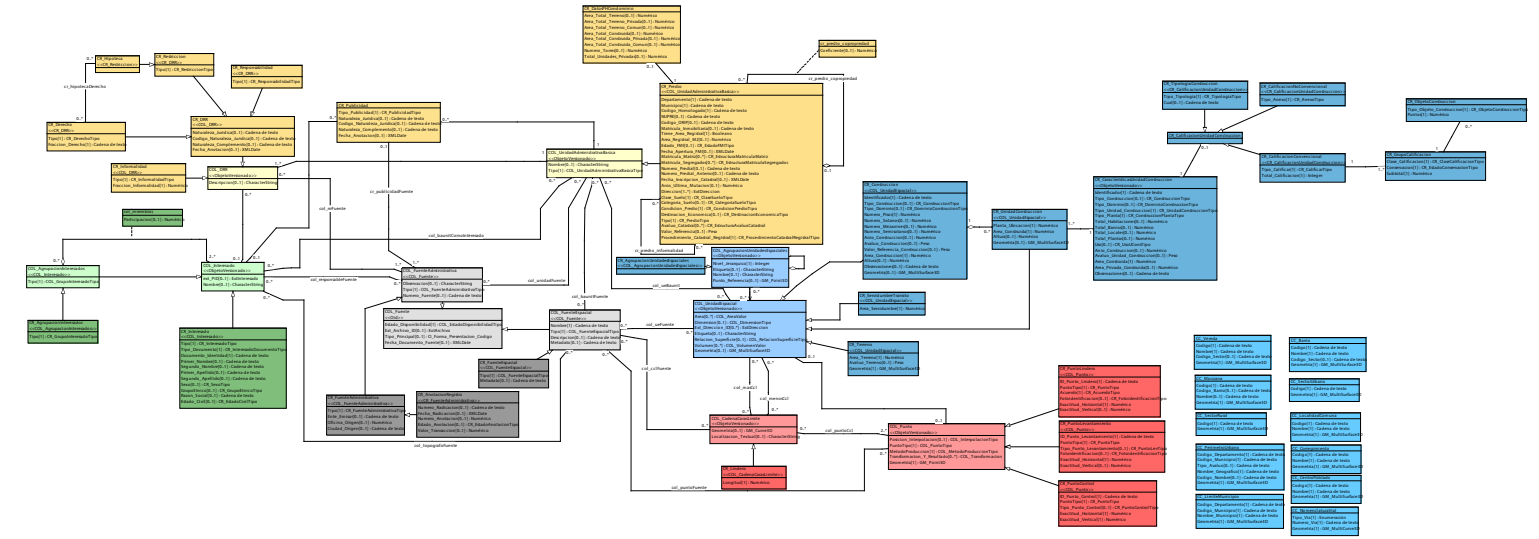
Figure 5. LADM-COL Extended Model Cadastre-Registration Version 3.2 Main structure.
Source: GitLab IGAC (2023).

There are substantial changes in its structure between these two versions, considering the elimination of 6 classes and the creation of 20 classes, of which 7 are physical, and 13 are temporary tables containing some relationships within the extended model. Furthermore, to include some complementary elements that allow characterizing the cadastre in Colombia, a submodel called the Cadastral Cartography Submodel was created. It comprises 11 classes that are directly associated with cartographic elements which during the parcel survey assisted in identifying the Property as a Basic Administrative Unit.

One of the biggest changes between these two versions is that 17 attributes were added to the physical table linked to the property. This led to the creation of 3 new classes that will be part of the structure's component (which will be elaborated upon in a subsequent document).

The changes between these two versions stick to the reality of the Colombian territory, as the initial Extended Model Cadastre-Registration was expressed using variables, attributes, and relationships of the international LADM Standard (ISO 19152:2012) however, when it was incorporated into the Colombian profile (LADM-COL), they were deemed unnecessary due to the methodology employed for the characterization of cadastral information in the country.
LADM-COL Extended Model Cadastre-Registration Version 4.0 (Figure 6) (Appendix C)
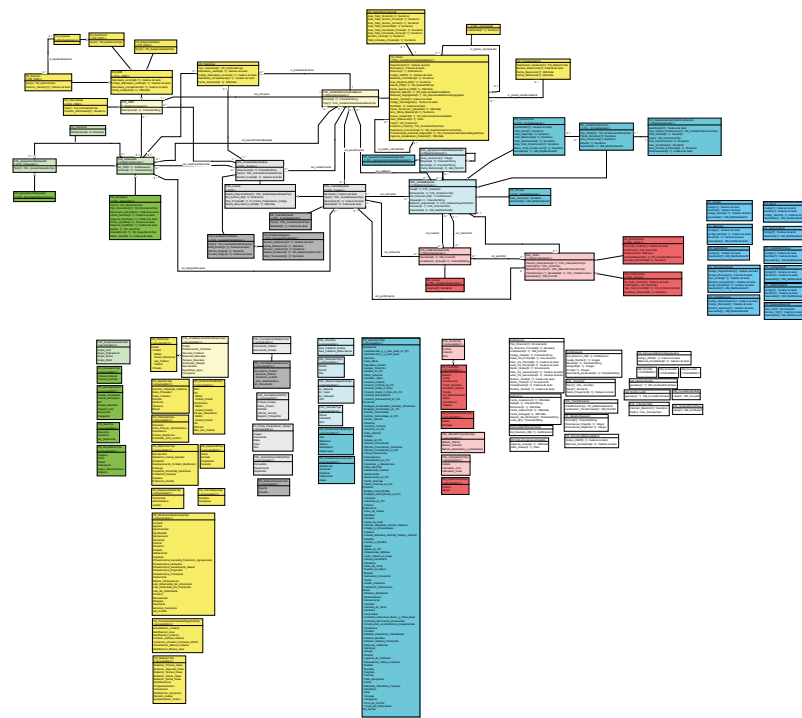

Figure 6. LADM-COL Extended Model Cadastre-Registration Version 4.0.
Source: GitLab IGAC (2023).

In the current version, based on a general analysis of the changes in the extended models, it is possible to determine a variation in the colors used to distinguish the various packages and sub-packages derived from the LADM ISO 19152:2012 standard, due to the last version approved (4.0) and published by the IGAC (Resolution 499 of 2020) in December 2022 (Figure 7), was jointly prepared by the IGAC, the SNR, and the ICDE, following and applying the guidelines established for the creation of extended models by the ICDE.

The details of the first and current versions, as well as an analysis of the changes between them, are described in greater detail in other documents in this series of publications.

Application Models in Accordance with the LADM-COL Extended Model Cadastre-Registration

As mentioned before, there is a core model (LADM-COL) from which MECR is derived. The two models are different in that: the first one is central and serves as the articulating axis for the LAS, whereas the second one is a specific extension designed to manage cadastral and registration information.

However, even under the cadastre-registration framework, there are still different purposes or specific applications. An example of this is the generation of reports that cadastral managers must deliver to the IGAC and the SNR to have the information within their jurisdiction of the entire national territory. Another instance could be the collection of data during an updating process, which also necessitates the creation of a functional outline or model for that particular purpose. These will be further explained.

In general, the IGAC defines these models as the *application models*, defined as "derived models for multiple purposes, which must be in accordance with the Extended Model (related to its thematic area and LLO) and the LADM_COL

Core Model" (IGAC, 2023). This means that there is a third family of models that emerge, which is kind of an extension of the existing ones.

Extended models are derived from the Core Model, as well as the Application Models come from the Extended Models. Because they are *derived from* or *extended* they have different conformance levels, as they should comply with the model they are derived from. Therefore, a model has different *conformance levels* depending on the extent to which it preserves the classes or structure of the model from which it is derived, as it registers the information of the parent model and incorporates the specific data of its function into it.

Furthermore, the ICDE establishes that application models would be generated by the organizations responsible for each extended model. These organizations will also have creative freedom to design as long as the conformance with the extended model of the specific topic is respected. This is done with the objective of implementing it in the organization's information systems, adapting the systems, and offering citizens better and more effective services (ICDE, 2022).

Likewise, the ICDE clarifies that it will not be able to define the governance of application models, as each organization must manage the application models they desire through their own means, including but not limited to "application, dissemination, conflict solution, versioning, transition, among others" (ICDE, 2022, p.23). This means that even entities with identical control over data from different jurisdictions (e.g. two cadastral managers from different territories) can build *tailored* application models, as long as they adhere to the extended model they are derived from, or as long as they don't clash with the model defined by the competent organization of such information.

Having the application model concept and based on Article 5 of Resolution 499 issued in 2020, which states that

> The Agustin Codazzi Geographic Institute (IGAC) and the Superintendence of Notary and Registration (SNR) can create application models based on the identified data on the

> LADM-COL Extended Model Cadastre-Registration. The goal is to implement the model in the organizations' information systems, adapt it, and offer better and more efficient services to the community. (IGAC *&* SNR, 2020)

Thus, it can be understood how the application models are constructed in accordance with the specific requirements within the same cadastral framework, as well as the formation, updating, conservation, or dissemination of cadastral information.

As a result of its application, it is established that there are four application models focused on specific necessities, which will be addressed below according to their purpose, process, and time of issue. The published and currently valid versions will be named as well.

Since the joint resolution SNR 04218 IGAC 499, issued on May 28th,2020, the approved application models include:

LADM-COL Cadastral Survey Application Model (CS)

The LADM-COL Cadastral Survey Application Model defines the minimum data semantics and structure for the characterization of physical, legal, and economic components of the parcels in a municipality, via the formation processes or cadastral updating with a multipurpose approach. This implies that its sole objective is to provide a structure for data acquisition in the cadastral procedures, regardless of the method employed, without any prejudice to its adaption by a cadastral manager.

On the IGAC's website, is available a standard tool for decentralized and authorized cadastral managers to establish a defined and organized structure, which facilitates the integration and interoperability between cadastral systems and software development for fieldwork. Therefore, cadastral managers who wish to begin their updating and/or cadastral formation processes in their

jurisdiction —or another jurisdiction— whether or not they have employed cadastral operators, may use this model as an outline for the cadastral database that must be implemented during the process.

Since its creation, this model has undergone several modifications to its structure, as the experiences of its implementation in pilot projects have led the IGAC to make some conformance adjustments. Initially, this model was designed for the collection of cadastral data. However, it appears (Figure 8) that there is a bias related to the methodologies defined for the Multipurpose Cadastre since in many cases the structure of the application model was limiting with some of them. A specific case occurs when collecting information by an indirect method, which involves the utilization of secondary information for property identification and characterization. This is why the collection of all information that responds to the topography and representation sub-package cannot be guaranteed.

Additionally, according to Article 14 of Resolution 388 of 2020, cadastral managers should implement this model in the database as the main and only one for cadastral management. However, this model is not fully accomplished because it doesn't include all the variables needed for the cadastral conservation process. This implies that each cadastral manager will define these variables in their database, thereby losing conformance to the LADM-COL Extended Model Cadastre-Registration.

Presented below are the different versions of the LADM-COL Cadastral Survey Application Model. It is important to note that these versions are currently in force and are used in massive surveys cadastral processes with a multipurpose approach. **LADM-COL Cadastral Survey Application Model Version 1.0 (Figure 7) (Appendix D)**

This is the first version released and officially used to collect cadastral information in the formation and/or updating processes. The diagram represents a set of interconnected classes (represented with rectangles), each of which has attributes that describe them and all of which are aligned according to the
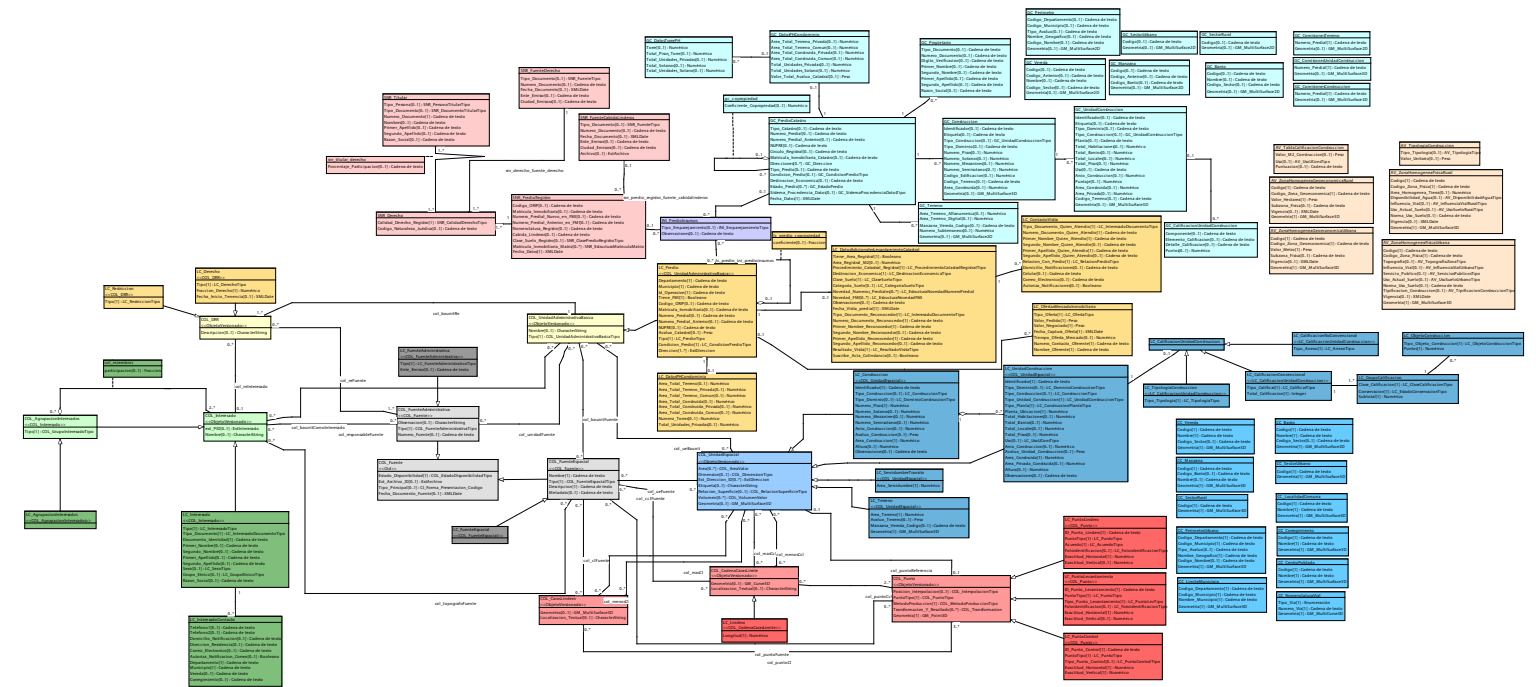

Figure 7. Structure of the LADM-COL for Cadastral Survey Application Version 1.0. **Source:** GitLab IGAC (2023).

colors belonging to the international standard (without taking into account the LADM-COL standard for Colombia). However, beyond this initial observation, the detailed evaluation of the model is limited since in the context of a modernization and innovation process, it would be expected that the products generated would have a significant impact in line with an a posteriori evaluation.

Simultaneously with the model publication, an open software code development is presented that serves as a complement to QGIS software. Its purpose is to manage spatial and cadastral data that is linked to the LAD-COL Cadastral Survey Application Model (Assist Complement LADM-COL). This addition would provide a new utility and comprehension level for the implementation of international normative at issue.

LADM-COL Cadastral Survey Application Model Version 1.2. (Figure 8) See Appendix E
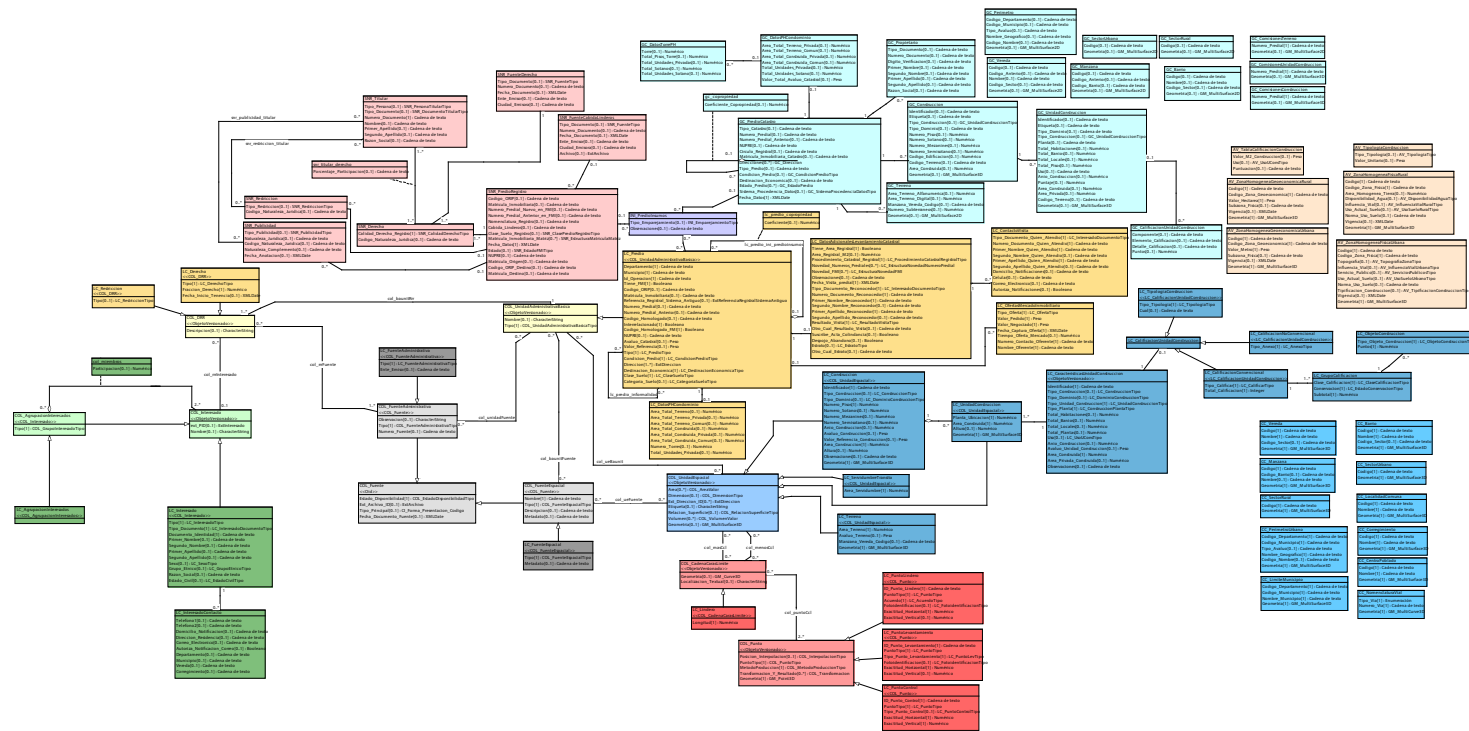

Figure 8. Structure of the LADM-COL Cadastral Survey Application Model Version 1.2.
Source: GitLab IGAC (2023).

This model integrated the LC_CaracteristicasUnidadConstruccion class into the Spatial Unit Package. This class corresponds to the representation of existing buildings that were present in the cadastral alphanumeric information and geographic information gap that was overlooked in the first version.

On traditional cadastre, buildings with similar uses and characteristics were considered as an integral edification unit. When comparing the two versions of the models, this concept would be removed from the first version, because it is possible to identify these buildings by their land location, specifically floors.

To solve this problem, the second version of the application model added a new class that allowed the migration of existing information, in this way, a detailed process of spatial data mining is not needed but it is connected with existing procedures during each cadastral activity.

The changes in the spatial source class were necessary, as it was considered important to include the identification attributes, such as the source identification and metadata, in the CR_FuenteEspacial class, with the aim of controlling and monitoring the product inputs within the cadastral management processes.

Another one of the relevant changes between the two versions is the modification of the Input Submodel of the Superintendence of Notary and Registration, as in the permanent working groups they noticed some unnecessary variables that made the model more complex. Some of the classes that have been eliminated include CR_publicidadBAUnit and CR_publicidadInteresado as the dissemination could store in its table the relationship with the parcel, leaving the group party aside, as it seeks to store the annotations that affect the right of direct ownership of the property when the interested parties do not intervene.

Finally, is important to highlight the creation of a temporary table that seeks to store the existing relationship between formal and informal parcels, this was called CR_predioinformalidad, which was a missing class in the first version, but which is necessary to the land parcel characterization, as it is related to the physical and legal reality of a significant amount of parcels in the country.

LADM-COL Cadastral Survey Application Model Version 2.0 (Figure 9) See Appendix F

In this version, like in the MECR, the colors changed in comparison to the previous version, they now follow the guidelines provided by the ICDE, as it is the group responsible for the implementation of the ISO 19152:2012 standard[4] (National Planning Department, 2020).
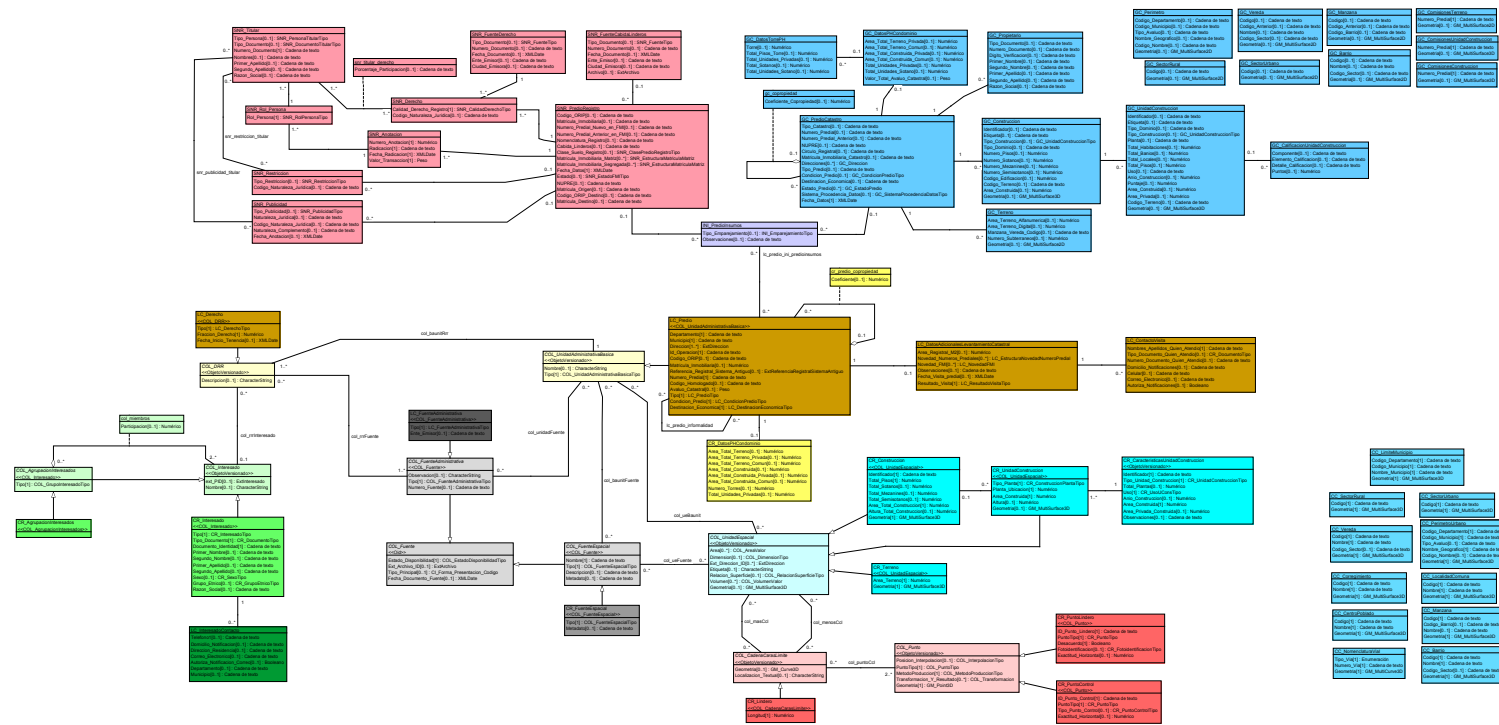
Figure 9. Structure of the LADM-COL Cadastral Survey Application Model Version 2.0.
Source: GitLab IGAC (2023).

The impact that the Cadastral Survey Model modification had was seen in the slowdown of cadastral processes that were carried out when it was modified. In these modifications, the inclusion and exclusion of variables and classes are taken into account, as well as the lack of understanding of their application and the staff shortage that understands its function. This is the end of the analysis of all the existing versions related to the Cadastral Survey Application Model.

LADM-COL Cadastre-registration Interchange Application Model (IC)

The LADM-COL Cadastre-Registration Interchange Application Model (Figure 10) defines the semantics and data structure of the Interchange of cadastral and register information. See Appendix G.

This model facilitates interoperability with the SNR throughout the query of registered data related to rights, restrictions, responsibilities, and data of the properly registered owners. In the same way, this model will be the standard for data submission by cadastral organizations in order to carry out the update of the base data of the register, in accordance with cadastral procedures with register effects defined on Resolution 1040 of 2023 and the later inscription to the Land Property Identification Number (NUPRE by its acronym in Spanish; IGAC 2023).
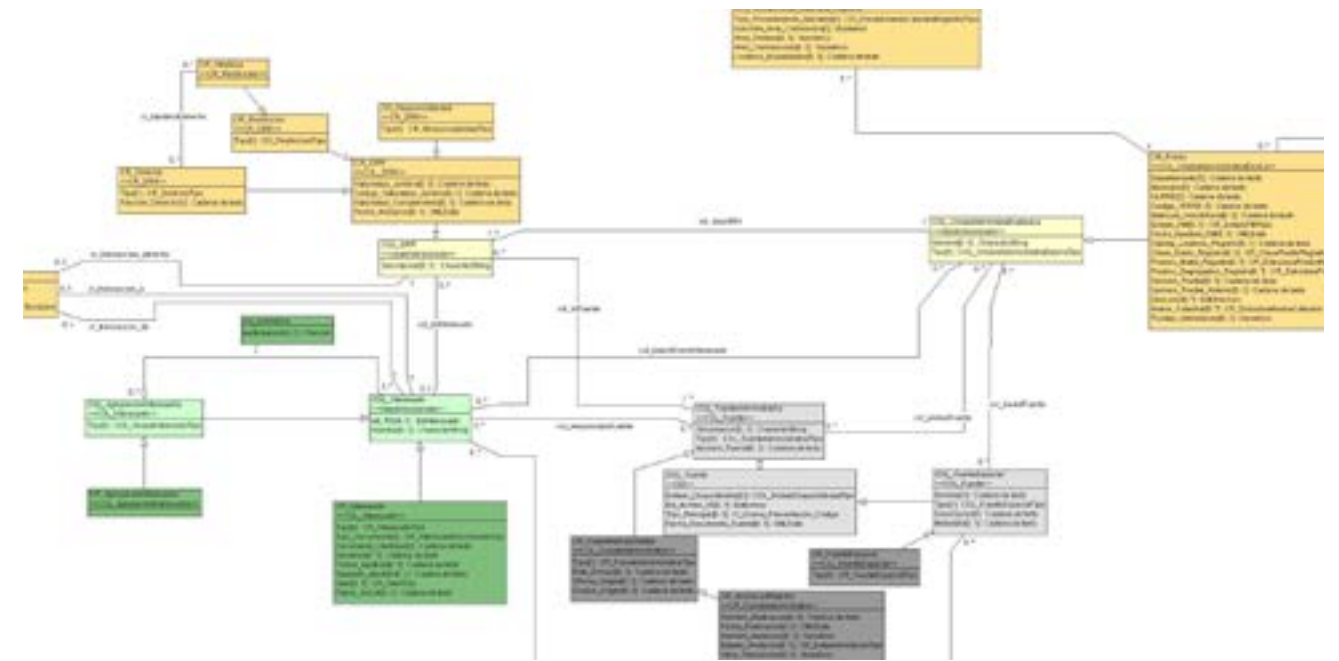

Figure 10. Structure of the LADM-COL Cadastre-Registration Interchange Application Model.
Source: GitLab IGAC (2023).

The specific characteristic of this model is the absence of the Spatial Unit Package in its structure. This is because of how the SNR stores information, since each participating organization saved their data in the way that best suited them, thus obtaining the best way to transfer and interchange it among themselves. As a result of the analysis, the Spatial Unit Package was removed, because the physical localization of the land parcels depends on the cadastral functions.

This model was created and structured based on the LADM Extended Model Cadastre-Registration version 3.2, hence, it is recommended that the organizations involved in this process (IGAC & SNR) review their structure, to verify if it is necessary to make adjustments according to the latest version of the extended model, since as mentioned before, every application model must comply with the model in the second conformance level.

LADM-COL Cadastral Information Report Application Model (CIR)

This model (Figure 11) arises from the necessity to consolidate cadastral information within the National Cadastral Information System (SINIC by its acronym in Spanish). This system makes it possible to receive, validate, and consolidate the cadastral information of the national territory, which is later updated in their local databases by cadastral managers. The defined file format submission of this information is INTERLIS (XTF) as the main programming language within the implementation process of the LADM-COL standard (See Appendix H).

An additional objective that led the IGAC to create this application model was being able to generate statistics for making better decisions within the efficiency of the cadastral managers' labor, strengthening, socialization, improvement of strategies, and transfer of knowledge, among others.

The LADM-COL Cadastral Information Report Application Model was established in Resolution 315 of February 15th, 2022, issued by IGAC. This document aims to facilitate compliance for cadastral managers, regarding the obligation
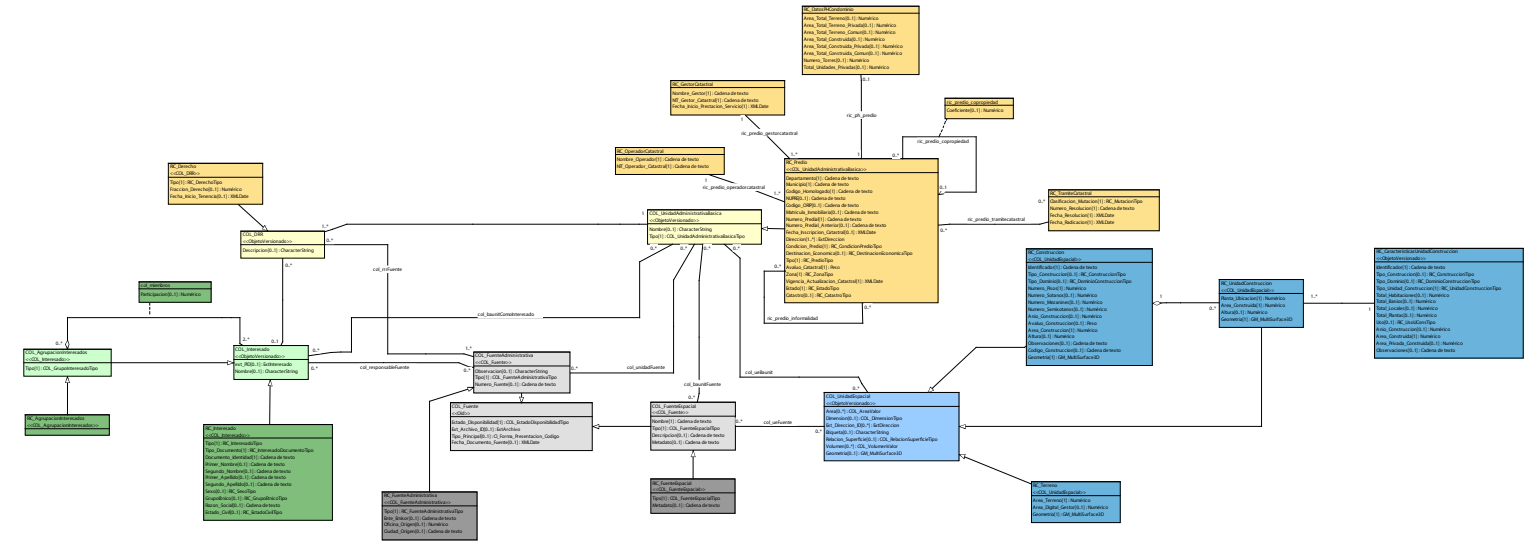

Figure 11. E Structure of LADM-COL Cadastral Information Report Application Model (CIR).
Source:: IGAC (2023).

to submit up-to-date information within their jurisdiction. It establishes a bi-monthly period and specific dates for this purpose. Therefore, it is possible to obtain cadastral management results for each territorial jurisdiction, based on a legal transitory mechanism for information reports.

The SINIC is currently in its initial stages of operation, which is why the IGAC together with the SNR as the system administrators, have been in charge of providing not only the training and tools necessary for its comprehension, but also the access credentials, to each of the cadastral managers, including those who were authorized at a later date to issue the administrative document. In the same way, new cadastral managers are linked to different groups defined by the standard, specifically in a group with the purpose of determining a date range that allows control of the upload process.

Lastly, it is determined that the model was structured based on the Extended Model Cadastre-registration in its version 3.2, following the guidelines provided by the ICDE.

LADM-COL Cadastral Management Transfer Application Model (Figure 12). See Appendix I

The last and most recent LADM-COL application model for cadastral management was structured by the IGAC in 2023. The Purpose of this model, according to Resolution 1040 of 2023, is to define a clear structure for information submission in the following cases:

» By the IGAC, in the qualification process as cadastral manager of a municipality, an association of municipalities or Departments.
» When the SNR, through its functions of inspection, surveillance, and control of cadastral management, determines that a cadastral manager must be disabled, and the cadastral information must be returned to IGAC.
» When a municipality hired a different cadastral manager to carry out the cadastral management in that jurisdiction, and after two years, the cadastral information must return to IGAC.
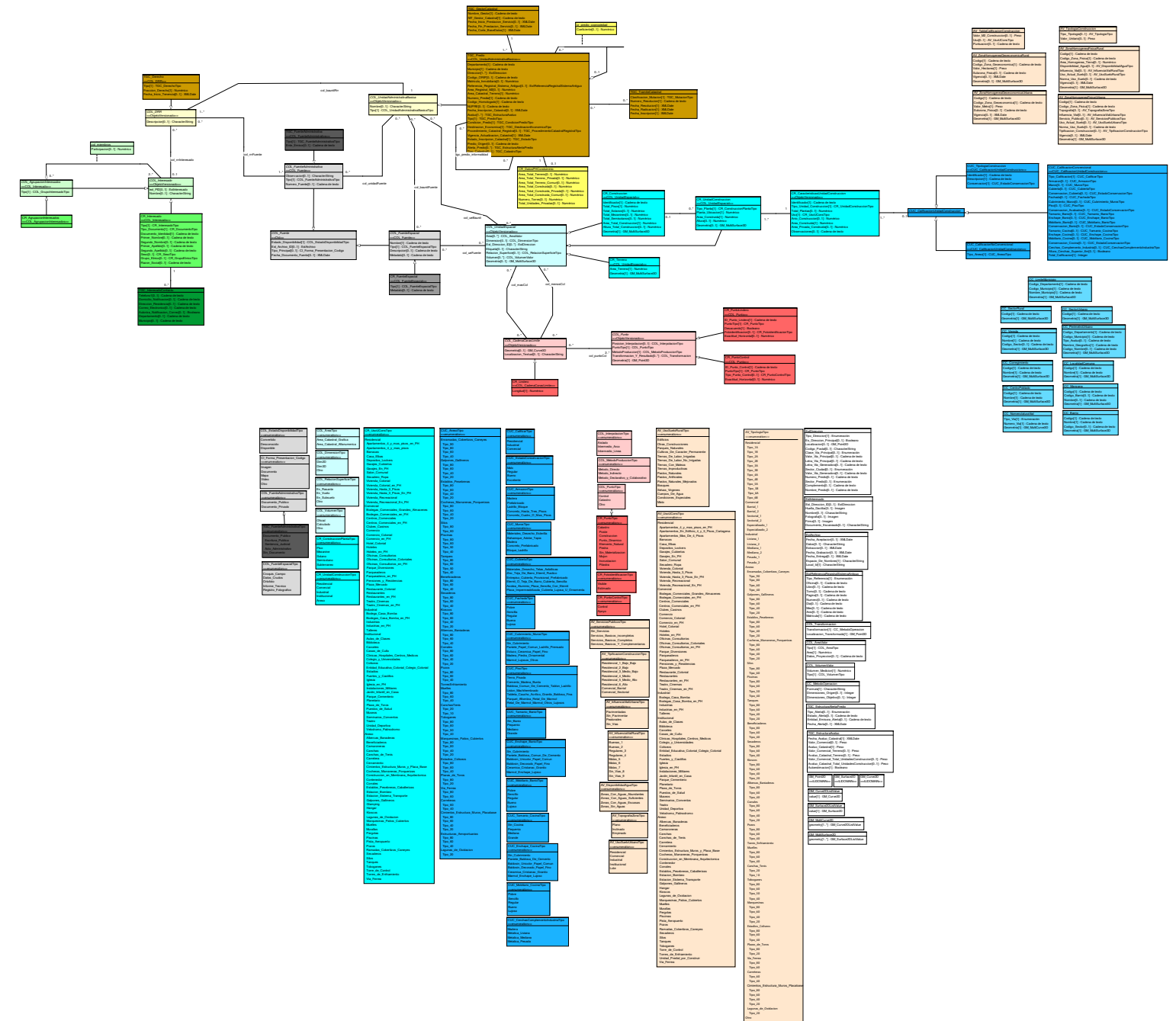

Figura 12. Modelo de aplicación de transferencia de la gestión catastral LADM-COL.
Fuente: IGAC (2023).

Conclusions, Challenges, and Opportunities

Since the Land Administration modernization process started in 2016, the country has been going through a period of transition and adjustment in how to manage geographic information (planning, production, custody, quality, and distribution). This happened because of the adoption of the ISO 19152:2012 standard for the Colombian profile, which establishes a conceptual framework for its implementation in spatial databases using the INTERLIS programming language. This programming language represents a new approach for national organizations, originating from the Swiss government's experience in implementing cadastre. As part of an international agreement, experts in the field came to Colombia to share their knowledge.

On the other hand, the transition process from the traditional cadastral model to the LADM-COL model, including its conformance levels, has proven to be highly complex. One of the reasons is not only the lack of skilled staff to understand new tools for information acquisition but also the lack of knowledge regarding multipurpose cadastre and how to effectively implement it within a public project.

However, one of the biggest challenges is to transform traditional cadastral systems into the LADM-COL framework, as the conventional cadastral approach consists of separating alphanumeric and geographic information. Nevertheless, what is required and defined by the LADM-COL standard is to integrate all cadastral information into a single database, ensuring its interrelation, correspondence, and integration with other systems.

The daily experience of implementing the LADM-COL Model has led to changes to the models, as well as the necessity to create new ones. It is important to highlight that during this process, several changes were identified in the extended and application models, as well as important challenges for the consolidation of a final version that allows the organizations involved in the cadastral process to adapt to a standard and work with it.

Finally, it is important to understand how this volume portrayed the discussion that revolves around the application of the LADM-COL model, not only at a general level but also with its specific conformance levels, all within the land administration framework, following the CONPES 4007 of 2020 guidelines. This document is expected to give readers a better understanding of the moment of application of the different models, their differences, similarities, challenges, and opportunities, since they are crucial to modernizing the land administration system in Colombia, which results in providing real and accurate data quickly and efficiently that could address different territorial sceneries. Furthermore, there is the prospect that the community would be more involved in decision-making processes for the formulation of public policies aimed at improving and promoting Colombia as a global referent for a better life.

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