

An IEEE LOM application profile to describe training resources for agricultural & rural SMEs

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Abstract. Metadata plays an important role in online repositories with learning resources, since it can make search, retrieval and access faster, easier and more effective. In this context, a variety of reasons urge using a recognized metadata standard such as IEEE Learning Object Metadata (LOM). When particularly developing a repository with learning resources for agricultural and rural stakeholders, it is important to take into consideration the variety of special requirements that have to be reflected in the metadata (e.g. linguistic preferences, geographical location, particularity of covered topics, educational level). This calls for the implementation of both standard-based and also context-specialized educational metadata in such repositories. In this direction, the present paper described the metadata schema that has been developed to support an online repository that supports vocational training needs of small and medium enterprises (SMEs) in rural areas. The proposed schema is based on IEEE LOM.

Keywords: Learning object metadata, application profile, SMEs.

1. Introduction

Metadata is usually termed as ‘data about data’ or ‘information about information’ [9,11]. It is generally engaged for describing the properties of information resources, in order to facilitate their categorization, storage, search and retrieval in digital collections. If metadata is stored in a structured and standardized manner, it may generally support the automation of search and retrieval mechanisms, the comparison between descriptions of different resources, the reusability of descriptions in different applications, as well as the interoperability between different storage systems.

Metadata is made up of data items that are associated to the resource, the so called metadata elements. Metadata schemas (or metadata models) are sets of metadata elements designed for a specific purpose, such as describing a particular type of resource [9]. Metadata specifications are well-defined and widely agreed metadata schemas that are expected to be adopted by the majority of implementers in a particular domain or industry. When a specification is widely recognized and adopted by some standardization organization (such as ISO – the International Standardization Organization), it then becomes a metadata standard.

There is no one all-encompassing metadata standard to be used in all applications. Rather, there are various metadata standards or specifications that can be adapted or “profiled” to meet community context-specific needs [8]. This conclusion has led to the emergence of the application profile concept. An application profile is an assemblage of metadata elements selected from one or more metadata schemas, and its purpose is to adapt or combine existing schemas into a package that is tailored to the functional requirements of a particular application, while retaining interoperability with the original base schemas [4].

One area of particular interest for metadata development is the one of digital learning repositories (DLRs). These are online databases in which digital learning resources are systematically organized, classified and published. Many institutions are currently engaged in developing DLRs that can be searchable and accessible from a wide audience [13]. Metadata (termed in this context as educational metadata) play an important role in DLRs, since they make access to the learning resources faster, easier and more effective [7]. Towards this direction, standardization efforts around the world such as the IEEE Learning Technology Standards Committee (IEEE LTSC, <http://ieeeltsc.org/>) and ISO’s sub-committee on "Information Technology for Learning, Education and Training (ITLET)" (ISO/IEC JTC1 SC36, <http://jtc1sc36.org/>) have focused on the implementation of the IEEE Learning Object Metadata (LOM) standard [5,6]. Using such a recognized metadata standard is important for a variety of reasons: metadata descriptions (records) of learning resources may be exchanged among different DLRs; search queries may be propagated among different (and interconnected) DLRs; and generally the integration of data from different sources is facilitated. This is the reason behind the extensive implementation and study of numerous application profiles of the LOM standard in DLRs around the world [13].

When particularly developing a DLR for agricultural and rural stakeholders, an important aspect is to take into consideration the fact that resources for such learners have to reflect and match a variety of special requirements (e.g. linguistic preferences, regional geographical coverage, particularity of covered topics, educational level of addressed audience). This calls for the development of standard-based, but also context-specialized educational metadata. In this paper we discuss our experience from developing such a metadata schema in the context of a DLR that aims to address the lifelong learning needs of small and medium enterprises (SMEs) in rural areas. More specifically, the proposed metadata schema is a LOM application profile that is being implemented in a DLR with digital training objects for rural SMEs.

2. Background

The use of commonly accepted agricultural metadata schemas aims to make it easier to integrate data from different sources, allowing for creation of value added services for the agricultural sector. A variety of metadata schemas have already been proposed and used in the context of agricultural applications. Efforts are being made to make relevant initiatives around the world to join forces, and to coordinate the further involvement of interested stakeholders. This is the vision of clusters such as the

Agricultural Information Management Standards (AIMS) of the Food and Agriculture Organisation of the United Nations (FAO).

The application areas with agricultural interest vary. For instance, in the context of FAO's AIMS initiative, important results have been collected and publicized so far in the following areas of metadata applications:

- Geospatial metadata, with the development of schemas such as the Spatial Standard and Norms (SPATL) of FAO and Geographic information -- Metadata (ISO 19115) of ISO.
- Biodiversity and genetic resources metadata, with schemas such as the Multi-crop Passport Descriptors (MCPD) from FAO and the Darwin Core (DwC) and Access to Biological Collection Data Schema (ABCD) from the Taxonomic Databases Working Group.
- Metadata for document-like resources, with schemas such as the Fisheries Metadata Element Set (FI) and Agricultural Metadata Element Set (AgMES) of FAO.
- Organizations' metadata, with schemas such as the Common European Research Information Format (CERIF/EuroCRIS) of the European Commission and the Web based Information Services for Agricultural Research for Development (WISARD) of WIS International.

For more information about the above and other relevant schemas, as well as the producer organisations, the interested reader is directed to the web site of AIMS (http://www.fao.org/aims/intro_meta.jsp).

Another application area, which is not listed above but has also attracted increased interest by agricultural stakeholders, is the one of educational metadata. There have been several interesting approaches regarding the implementation of educational metadata schemas that will describe learning resources for agricultural or rural stakeholders. A main strand of these approaches includes the ones that are developing application profiles of the IEEE LOM standard. For instance, the CG LOM Core [2] has been created by the Consultative Group on International Agricultural Research (CGIAR) in order to describe its learning resources in a manner that best suits the content, purpose and audience of CGIAR's Online Learning Resources project (<http://learning.cgiar.org/>). This involves the development of a DLR that will support an international community of trainers, educators, researchers and learners in agriculture and natural resources management. CGIAR defined a core set of metadata elements, which describe, document and register the CG learning object metadata core (which is termed as CG LOM Core). The goal of applying a shared set of core metadata elements is to allow the federated search of training related documents across all CGIAR centers, as well as to achieve interoperability across the centers and with external entities. Because most Centers have based the metadata of their Web resources on the internationally recognized Dublin Core (DC) [3] format, the CG LOM core also includes a mapping with the DC metadata element set.

Another interesting LOM application profile is the one that has been developed by the European e-Content project 11293 'Bio@gro' for information dissemination and public awareness increase regarding organic agriculture (<http://bioagro.aua.gr>). This was created in order to categorize online educational resources that are related to Organic Agriculture topics [1]. The Bio@gro LOM application profile has adopted a

number of LOM elements, appropriately selecting vocabularies of values in such a way that the metadata descriptions reflect the particularities of the application area (organic agriculture). It will be also used as a basis for the development of a revised application profile for the description of learning resources for organic agriculture and agroecology [10].

A recent approach, which is developing an application profile mostly based on Dublin Core, is the Agricultural Learning Resources Application Profile (Ag-LR AP) that is developed by FAO [12]. This schema supports FAO's Capacity and Institution Building Portal, which provides structured access to information on FAO's capacity and institution building services and learning resources. It aims to ensure that this portal can be searched by users and that interoperability with other educational repositories is enabled. Since the listed learning resources were already described using the AGRIS application profile¹, (which is based on DC), it has been chosen to base the Ag-LR AP to DC, also borrowing selected elements from LOM.

3. The ReGov LOM Application Profile

Regional as well as centralized authorities around Europe develop and offer an increased variety of online public services, which may be particularly useful for small and medium enterprises (SMEs) in rural areas. Nevertheless, a major barrier towards their adoption has been identified to be the low degree of Information and Communication Technologies (ICT) penetration that is usually recorded in these areas. Addressing such shortcomings, a recently deployed initiative titled 'Rural-eGov: Training SMEs of Rural Areas in using e-Government Services' (<http://rural-egov.eu>) focuses on SMEs in five European regions (namely Wales in UK, Brandenburg in Germany, Aegean islands in Greece, Koscierzyna community in Poland, and Moravske Toplice in Slovenia). It builds on relevant experience from similar initiatives and bases its training activities around an online point of reference (the Rural e-Gov Observatory) which rural SMEs can access to find relevant information and learning resources. Through the Rural-eGov Observatory, rural SMEs will be able to find information on e-Government services in their regions, as well as digital training resources about how to reap maximum benefits from such services.

Under the umbrella of the Observatory, a DLR with training resources for rural SMEs in the targeted regions will also be deployed. An appropriate metadata schema for describing these training resources has therefore to be developed. To facilitate interoperability with other DLRs, it has been decided that the metadata schema should be based on LOM. Since it was not possible to locate other LOM-based schemas that are particularly developed for training resources and rural SMEs, a new application profile was judged necessary.

¹ <http://www.fao.org/docrep/008/ae909e/ae909e00.htm>

3.1 Rural e-Gov Digital Training Objects

The Rural-eGov DLR aims to provide access to the digital training resources that will support the vocational training curriculum of the project. These training resources have been termed as the Rural e-Gov Digital Training Objects (DTOs). A variety of DTOs will be developed to support the training scenarios of the project, including different types of educational material (lectures, best practice guides, self-assessment forms, etc.). These are expected to be stored as electronic files, in the form of Powerpoint presentations, Word documents, PDF documents and others. They will be developed to support the training scenarios of all participating rural areas, and will therefore be available in English, Greek, German, Polish and Slovenian. All DTOs will be uploaded in the DLR of the Rural-eGov Observatory, and will be made available to interested users.

To facilitate searching, locating and downloading appropriate resources, the important characteristics of the DTOs have to be reflected in their descriptions. In this way, users can simply go through the various descriptions and select the most suitable for their needs, instead of downloading each file and checking for their appropriateness. Apart from reflecting the most important characteristics, descriptions have to also be available in the language of the users (that is, multilingual descriptions will be necessary).

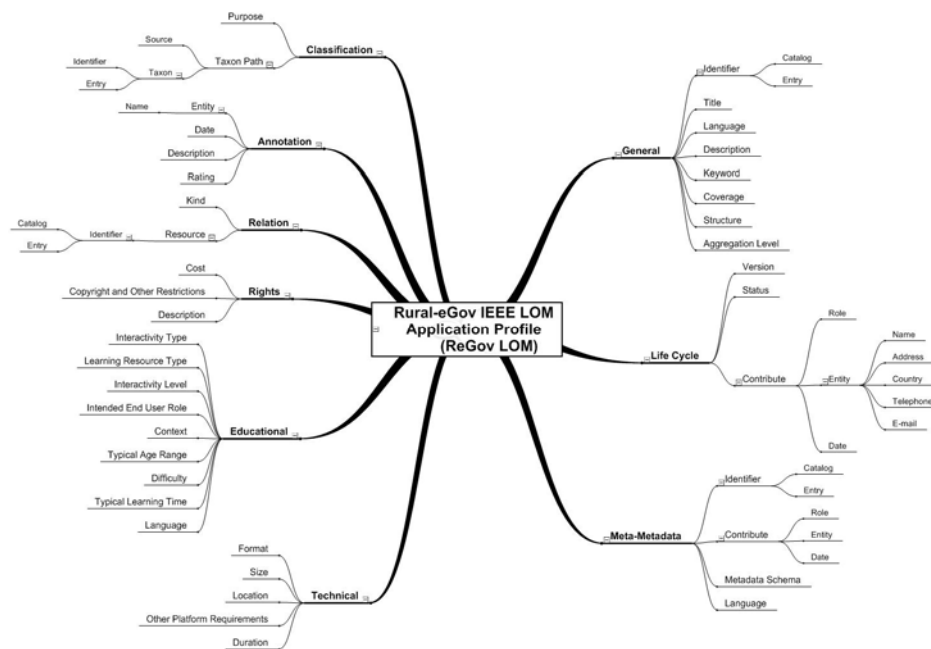


Figure 1 An overview of the proposed ReGov LOM application profile.

3.2 Elements

As explained earlier, the IEEE LOM standard has been chosen as the basis for the metadata schema to be used in Rural-eGov's DLR. The schema is therefore termed as Rural-eGov LOM (or simply, *ReGov LOM*) application profile. It adopts many of the elements of LOM, specializing several of them in order to best match the needs of the particular DLR. In the next paragraph, we will go through the nine (9) categories of elements of LOM, referring to the elements used, and presenting the performed specializations (an overview of the ReGov LOM is presented in Figure 1).

The first category of LOM elements is the **General** one. It includes elements that describe a learning object (in our case, a DTO), and store general information about it. In ReGov LOM, the following elements have been selected for use as recommended by LOM: *ID*, *Title*, *Description*, *Structure* and *Aggregation Level*. In addition, elements *Language*, *Keyword*, and *Coverage* have been specialized as it is presented in Table 1.

The next category **Life Cycle** describes the history and current state of a DTO, as well as the entities that have affected the DTO during its evolution. In ReGov LOM, the following elements have been selected and used as recommended by LOM: *Version*, *Status*, and *Contribute*.

The **Meta-Metadata** category contains information about the metadata record that describes the DTO. It identifies the metadata record in a classification system (i.e. the DLR's database with the metadata descriptions). It contains information about who provided the DTO description and when, which metadata schema was followed to produce the metadata description, and in which language the metadata are in (which can be different than the language of the learning object itself). In ReGov LOM it is used as recommended by LOM, and includes the elements: *ID*, *Contribute*, *Metadata Scheme*, *Language* and their designated sub-elements.

In a similar manner, a set of selected items from the **Technical** category are used to describe the technical requirements and characteristics of a DTO. The elements selected for ReGov LOM are: *Format*, *Size*, *Location*, *Other Platform Requirements*, and *Duration*.

The **Educational** category describes the key educational or pedagogic characteristics of a DTO. In ReGov, the following elements have been selected for use with the vocabulary values that LOM specifies: *Interactivity Type*, *Learning Resource Type*, *Interactivity Level*, *Typical Age Range*, *Difficulty*, and *Typical Learning Time*. In addition, elements *Intended End User Role*, *Context*, and *Language* have been specialized as presented in Table 2.

The **Rights** category describes the intellectual property rights and conditions of use for this DTO. In ReGov LOM it is used as recommended by LOM, and includes the elements: *Cost*, *Copyright & Other Restrictions*, and *Description*.

In the **Relation** category that defines the relationship between the described DTO and other DTOs, all LOM-specified elements are used: *Kind*, *Resource*, *Purpose* and their designated sub-elements. As far as the *Kind* element is concerned, the LOM vocabulary used is extended with the AgMES² proposed relations "IsTranslationOf" and "HasTranslation".

² http://www.fao.org/aims/agmes_intro.jsp

Table 1 Elements of the General category that have been further specialized in ReGov LOM.

Title	Description	Use in ReGov	Vocabulary
<i>Language</i>	The primary human language(s) used within this DTO to communicate to the intended user.	As LOM, focus on languages of Rural-eGov regions.	ISO 639-2
<i>Keyword</i>	Keyword or phrase describing the topic of this DTO.	DTO classification based on agricultural subject category.	AGRIS Subject Categories ³
<i>Coverage</i>	Geography or region to which this DTO applies.	Include coverage of specific European regions.	ISO – 3166-1 & NUTS Codes ⁴

Table 2 Elements of the Educational category that have been further specialized.

Title	Description	Use in ReGov	Vocabulary
<i>Intended End User Role</i>	Principal user(s) for which this DTO was designed, most dominant first.	Extending original vocabulary with “vocational learner”.	Adopted from LOM
<i>Context</i>	The principal environment within which the DTO and use of this DTO is intended to take place.	Extending original vocabulary with “vocational training”.	Adopted from LOM
<i>Language</i>	The human language used by the typical intended user of this DTO.	As IEEE LOM, focus on languages of Rural-eGov regions.	ISO 639-2

The **Annotation** category provides comments on the educational use of a DTO, and information on when and by whom the comments were created. This category enables educators (trainers) to share their assessments of DTOs, suggestions for use, etc. In ReGov LOM, all LOM-specified elements are used: *Entity*, *Date*, and *Description*. Furthermore, an additional element is introduced to store the numerical evaluations (ratings from 1 to 5) that users may provide to the DTOs they use: *Rating*.

Finally, the **Classification** category describes where this DTO falls within a particular classification system. From the ones specified in LOM, two elements are used in ReGov LOM: *Purpose* and *Taxon Path*, as well as their designated sub-elements. To indicate the relation of the DTO with the business area of the SME trained, the classification system used is based on the NACE Codes of Economy Activities (<http://www.top500.de/nace4-e.htm>).

3.3 Example of use

An example of a Rural-eGov DTO is the best practice guide presented in Figure 2. It is a guide that explains step-by-step (using an illustrative example), how a particular e-government service that is offered in Greece can be used. This is a typical DTO in

³ <http://www.fao.org/scripts/agris/c-categ.htm>

⁴ http://ec.europa.eu/comm/eurostat/ramon/nuts/codelist_en.cfm?list=nuts

Rural-eGov. In Table 3, an example description of this DTO is given. Due to space restrictions, not all elements are used.

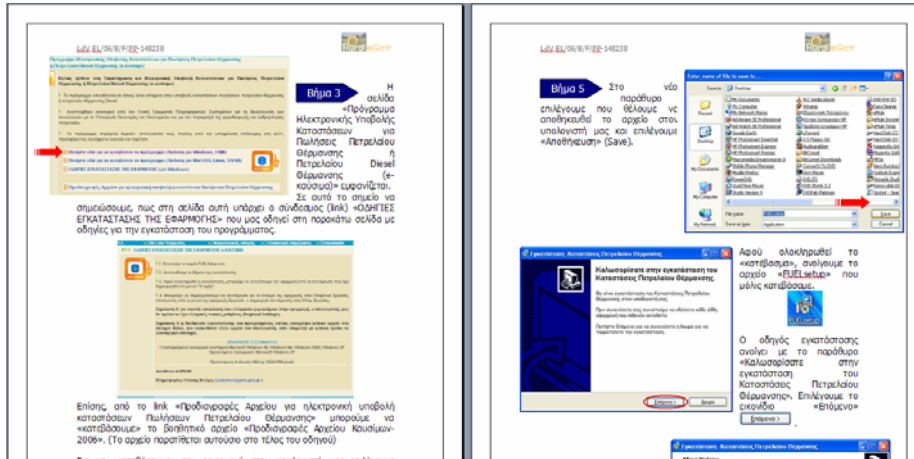


Figure 2 Screenshot of a best practice guide for using a Greek e-government resource.

Table 3 Example of a ReGov LOM metadata record.

Element	Value for selected example
General	-
Identifier	
Entry	"ReGov_EI0001"
Title	"Best practice guide on downloading a financial form from TaxisNet"
Language	"El"
Description	"These training materials have been developed in support of a three-hour seminar on the use of TaxisNet"
Keyword	"Public administration"
Coverage	"GR"
Aggregation Level	"1 (Raw media or document) "
Technical	-
Format	".doc"
Size	4000000
Location	"http://rural-egov.eu/education/guide1.pdf"

Table 3 (continued).

Educational	-
<i>Interactivity Type</i>	"expositive"
<i>Learning Resource Type</i>	" narrative text"
<i>Interactivity Level</i>	"very low"
<i>Intended End User Role</i>	"learner"
<i>Difficulty</i>	"easy"
Rights	-
<i>Cost</i>	"no"
<i>Copyright and Other Restrictions</i>	"yes"
<i>Description</i>	"Unauthorized copy or reproduction is not permitted"
Classification	-
<i>Purpose</i>	"discipline"
<i>Taxon Path</i>	-
<i>Source</i>	"Nace codes of economic activities"
<i>Taxon</i>	-
Id	"751"
Entry	"Administration of the state and the economic and social policy of the community "

4. Conclusions

The development of an appropriate metadata schema can greatly facilitate the search and retrieval tasks of the users that are accessing an online DLR. In addition, the adoption of a well-accepted metadata standard (such as LOM), can promote interoperability between this DLR and others, as well as reusability of the metadata records. On the other hand, in DLRs for agricultural and rural stakeholders, the adopted metadata schema has to be appropriately contextualized in order to better meet user needs and requirements. In this paper we present such a specialization termed ReGov LOM, a LOM application profile for the Rural-eGov project.

Using the IEEE LOM standard is in line with the majority of other DLR efforts [13]. Nevertheless, large repositories such as the ones of FAO include metadata records that are based on Dublin Core [12]. Therefore, further effort is required in order to come closer with different approaches, by developing jointly accepted

mappings between developed schemas, as well as categorizing resources according to a recognized ontology such as FAO's AGROVOC [10].

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