Metadata for Digital Topographic Maps of Vietnam

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Key words: Metadata standard, metadata management tool, topographic map.

SUMMARY

The topographic map is considered as a very essential document, and used as the base map for any geographical application. However, metadata the information about data of digital maps, of each feature layer is not yet designed and built up in an adequate and sufficient way. Consequently, end-users are facing with many difficulties when using digital products without a metadata. Moreover, the digital topographic map is produced and distributed in-efficiently. Together with providing a metadata management tool to facilitate the process of gathering, managing, distributing metadata for the whole process of making topographic map and the topographic map itself, our research also proposes a Metadata standard for Topographic maps of Vietnam.

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1. INTRODUCTION

Distributing digital topographic maps cannot be efficient without the supporting of metadata. The metadata plays a very important role in terms of marketing and instruction. It provides users information of the map such as whether it is existed or not, how good it is, options on map scale, who is the producer and who is the approver, and the instruction how to get the maps, etc. In Vietnam, metadata, the information about data of digital maps, of each feature layer is not yet designed and built up in an adequate and sufficient way. Consequently, end-users are facing with many difficulties when using digital products without a metadata. Moreover, the digital topographic map is produced and distributed in-efficiently. That is the reason why the research of metadata on the digital topographic maps becomes pressing in the domain of geographical databases.

The objectives of this research are to propose a set of metadata for describing digital topographic maps, and to develop a tool for managing this metadata database.

2 REVIEW OF CONCEPTS AND APPROACHES

2.1 Concepts of Metadata

In general, metadata are defined as the background information that describes the content, quality, condition, and other characteristics of data (FGDC, 2000). For different perspectives, metadata can solve different user-oriented problems.

2.1.1. For end-users

Metadata help a user to locate and understand data. It facilitates the process of querying, selecting and retrieving data. In case of digital topographic maps, a metadata database can answer an end-user the following questions:

- Questions about the existence of data. For example, at the working area, are the digital topographic maps existed or not? Where is it stored? Name and the contact information of the manager and distributor of these maps…
- Questions about the suitability of data. The suitability of a topographic map to a specific purpose can be measured by the map scale, accuracy and precision, time of updating data, data sources, data format, map projection, and data completeness. In addition, information of price and procedures for retrieving data also helps users to assess and determine which maps are most suitable to their works.

2.1.2. For data managers

Metadata play a very important role in the administrating of the topographic map's databases.

- In the process of making digital topographic maps, metadata encode all the information of who is doing what and when it is finished as well as the status of produce at each phase. These information help the manager monitors the rate of progress, and makes appropriate solutions to keep the plan. In addition, when the time passes or the personnel changes, information of the content, the status, the environment and the technological process of making topographic map database will help the later one easier to take over the tasks.
- For investment in developing databases, metadata help the organization to avoid redundant investment in data. The descriptions of the content, the status and other characteristics of each topographic map in the database may help the decision makers have ideas or solutions of using data for the appropriated projects instead of creating a new one.

2.1.3. For data providers

Metadata is acting as a tool for marketing, advertising, distributing, and sharing data. Currently, the metadata approach is trending towards making information available to the public on Internet. Thus, it facilitates data providers publish all information of what they have in their databases, how users can get it, the restrictions on accessing or using the data.

The data provider uses the metadata information system not only for serving the end-users but the other data providers. In fact, the metadata information system has been used as a tool for the connection between geographical databases, data providers, data managers in the model of data bank, data clearing house, data warehouse, etc. In order to facilitate data sharing, metadata provide information to aid data transfer such as data format, data process, data media, environment and technologies of building data.

2.2 Approaches of Handling Metadata

There are two basic approaches to handling metadata (Smith,1991):
- *Self describing databases*: Metadata is a part of the database. It is derived from the entity itself, and becomes a part of the entity. It is automatically moved, copied, and deleted along with the entity. Metadata in ArcCatalog (ESRI) is an example of this approach.
- *Separate metadata layer*: Metadata is managed in a deductive metadatabase above the database and answers queries about the organization, structure and functionality of the underlying database.

In additional, the GIS approach for managing and accessing the digital spatial libraries is introduced by ESRI in 1994 (ESRI, 1994). This approach used advanced GIS tools, GIS capabilities and coordinate information for a general purpose indexing system to library collections. This approach affects most directly to people who produce and archive spatial data. But it is cost by using GIS methodology.

2.3 Information of Digital Topographic Maps of Vietnam

Currently, information of a topographic map sheet and of the process of making that map is recorded in a document. This document is named "The curriculum vitae of a Map" and managed by the producer. The content of this document included (ATC, 2003):

General Information
- Name and Map sheet Number
- Map scale and geo-reference system
- Name of the producing organization
- Name of people are in charge in the process
- Producing Duration
- Name of the approving organization
- Approving Duration

Technical Problems have been solved
- Source maps
- Referential documents
- Approaches
- Specific problems have been solved during the process of making map
- Verification: Name of verifiers and levels of verification

2.4 Current Metadata Standards

Many researches have been done to metadata and some metadata standards have been accomplished overseas. Some of them are very useful and used as reference standards for developing metadata standards of digital topographic maps. They are included:
- The geographic spatial metadata standard of American Federal Geographic Data Committee (FGDC, 2000). In June 1998, the FGDC endorsed the 2nd version of the FGDC Content Standard for Digital Geospatial Metadata (FGDC-STD-001-1998). This standard included seven main subsets, such as identification, digital quality, spatial data organization, reference system, entity and attribute information, distribution, metadata reference.
- The metadata standard draft of ISO/TC211 (ISO/FDIS 19115:2003). This standard is developed based on the standard of FGDC and according the rudder of ISO. The ISO 19115:2003 defines mandatory and conditional metadata sections, metadata entities, and metadata elements; the minimum set of metadata required to serve the full range of metadata applications; optional metadata elements, a method for extending metadata to fit specialized needs.
- The core element metadata standard of ANZLIC (ANZLIC, 2001). This standard consists of 41 elements and grouped into ten different categories such as dataset, custodian, description, data currency, dataset status, access, data quality, contact information, metadata date and additional metadata.

3 THE PROPOSAL OF METADATA STANDARD FOR TOPOGRAPHIC MAPS

The objective of this proposal is to design a structure for describing digital topographic maps as well as the process of making topographic maps. It is intended to:

- Investigate all information that may be required by users, managers, and providers in order to understand, retrieve, search, publish, and manage the digital topographic maps as well as the process of producing.
- Structure these required information in a logical and consistent metadata schema in order to avoid the duplicate, redundant, and impossible gathered data.

In the first draft proposal, the content of metadata is grouped into 6 categories, including:

Map sheet: provides general information of a digital topographic map for the purpose of searching data such as Name, Sheet number, Contour's interval, map Scale, Names of administrative units are covered, Geographic position, Geo-reference system, Time of updating data, Time of publishing, Name of the producing organization, Name of the approving organization, Name of the publishing organization.

Map Content: provides detail information for discovering data such as Data format, Theme of map layers, Attribute, Data status (verified and approved, need to be continued, etc.), Data storage.

Data source and Material: describes data sources and material have been used during the process of making maps such as Name of material, Form of material (digital or hard copy), Type of material (map, image, document, etc.), Date of material, Name of provider, Purpose of using, Capability of using. In case of maps and images, more detail information are provided such as scale, resolution, data format, …

Lineage: describes the history of a digital topographic map. Lineage data provides detail information of any stage of the process of making map such as the Data sources, Procedures, Approaches, Data quality statements, People in charge, and Criteria applied, etc. Metadata of this group can be used for the managers to monitor the rate of progress and for the users to determine the fitness of data for their purposes.

Storage: provides information for maintenance and retrieval such as File name, Path name, Data format, File's size, Media, Name of archives organization.

Distribution: gives an instruction to obtain data such as Name of distributors, Required official documents, Contact's information, Price of data, Media or approach to obtain data (online, by post…), Restrictions on accessing or using data.

This proposal has been sent to the data users and data producers such as Cartographic Publishing House, Arial photogrametry Topography Company to get comments and recommendations. This draft also is used to develop the tool for metadata management.

4 A TOOL FOR MANAGEMENT OF METADATA

Nowadays, a large number of digital topographic maps of Vietnam have been built up at varied scales. The approach of handling metadata associate with the data entities seems be not feasible in this case when data now are stored in different types of media. In order to document information of all digital maps have been produced as well as maps are producing, designing a separate metadata database would be the suitable solution.

A metadata database management system is designed to facilitate the process of collecting, managing, and distributing metadata for the topographic maps as well as the process of making map. The functionalities required for this system are illustrated in Figure1.

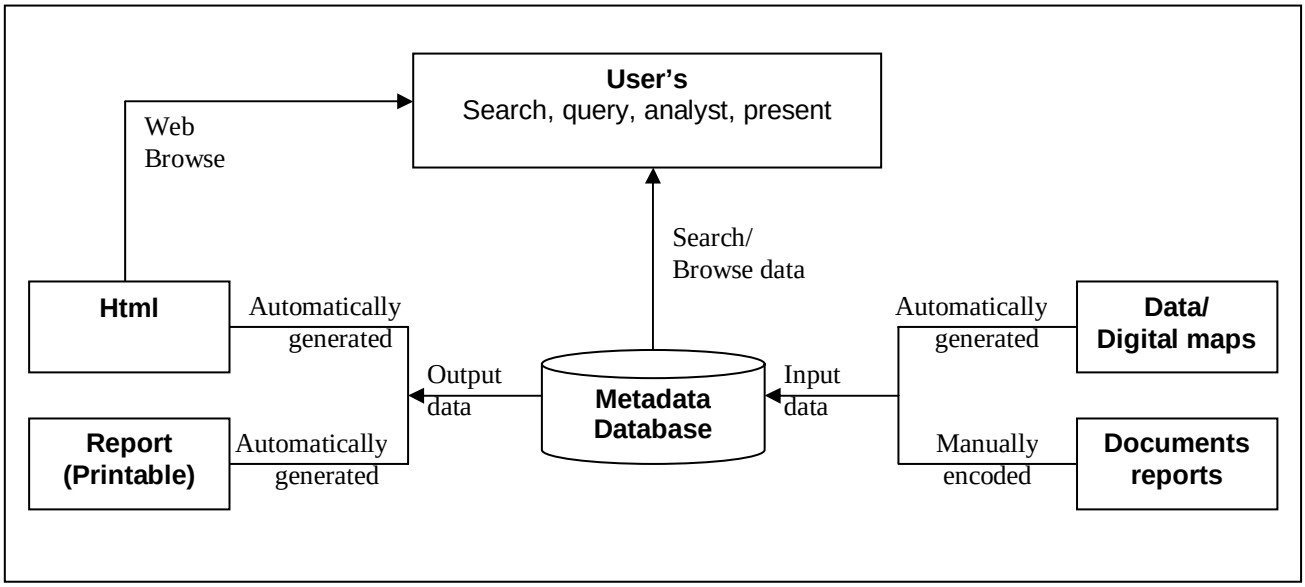
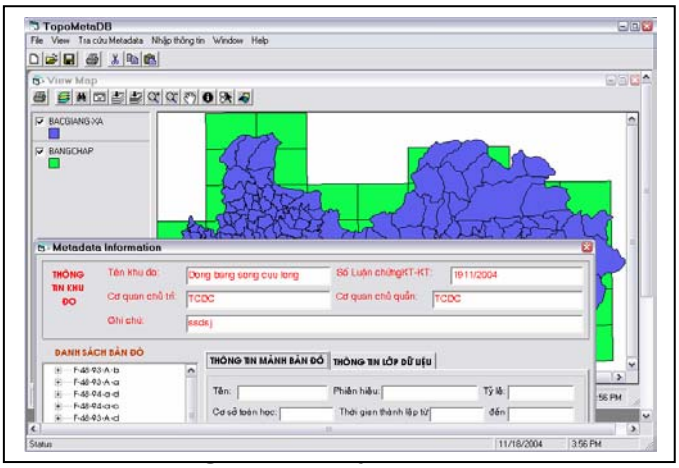


Figure 1: Functionalities required for Topographic Metadata Database Management System

Search and Browse Data Functions: users can search and query maps based on metadata items such as map sheet number, map scale, administrative units, geo-reference system, and time of updating data… User can use both SQL and spatial queries; for example, select maps that map scale equals 50000, or which maps are contained within this district boundary? In addition, users can browse, analyst, and present metadata in the database in both attribute data and map (see Figure2)



Input Data Functions: to facilitate the collecting and input metadata process, system provides (Figure 3):

- A function to automatic generate some metadata items from the data file such as map sheet number, map scale, map name, working area, contour's interval, names of administrative units are covered, geographic position, data format, and map layers.
- The rest of metadata items describe the specific information of each map such as data sources, name of producing organization, or name of people in charge, etc. are encoded manually.

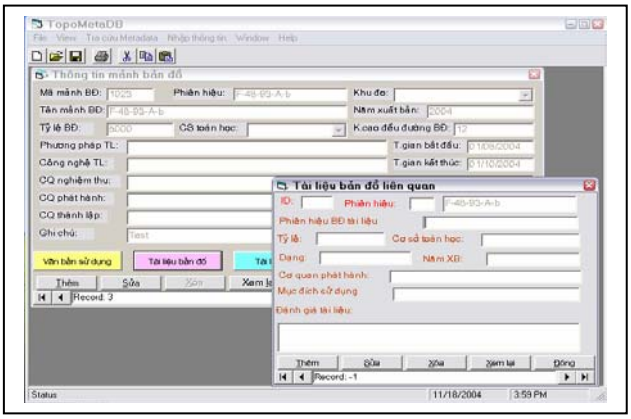


Figure 3: Input data Interface

Output Data functions: provide options for user to export metadata to a report and an html file that can be used for web browse. The metadata report satisfies the requirement of making the curriculum vitae of a map in the Regulations of making topographic map (GDLA, 2000). The Html files are used for distant users searching and browsing the metadata database through Internet.

5 CONCLUSION

Developing a metadata database together with the topographic map database is a very essential task for the Mapping and Surveying Agencies. By developing a tool for metadata management, the process of collecting, manipulating, and distributing metadata is facilitated. However, this is just the first step of developing a metadata standard applied for topographic

map databases. The content of metadata and the tool for managing metadata need to be tested, verified and get comments and recommendations from users to optimize themselves before implementing.

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