

DEVELOPMENT OF A CLASSIFICATION SCHEMA FOR THE DISCIPLINE OF GEOGRAPHICAL INFORMATION SYSTEMS (GIS) BASED ON THE DEWEY DECIMAL CLASSIFICATION (DDC) SYSTEM

Ananda Karunarathna

Department of Geography, University of Colombo.
E mail: ananda@geo.cmb.ac.lk

INTRODUCTION:

Digital Library is an important concept of modern technological and digital knowledge era. The term 'digital library' is a source of much debate and confusion. The term is used to mean a distributed library information service, located either in a physical or a virtual space, or a combination of both, in which a significant proportion of the resources available to users of that service exist only in digital form (Rowlands and Bawden, 1999). Thus distinguish the digital library from the 'electronic library', which simply provides access to a range of material in digitized form within the framework of a traditional library.

There are several advantages of a digital library over a conventional library (Sood and Chandrasekharan, 2004). These include minimizing storage space and cutting down costs of library maintenance and resource distribution. A digital library is also not merely an automated conventional library, where the resources are electronically catalogued and are available only for browsing purposes although conventional libraries do preserve socio-cultural ambiances within their spaces, a digital library can provide more equitable and widely distributed access at lower costs. Moreover, it may be most appropriate means of organizing intellectual artifacts that cannot be represented or distributed in printed formats, such as audio/video multimedia content. Thus a digital library may evolve into a complex system that makes information available in hard copy, on magnetic tape and discs, CD-ROMs and videodiscs, including those from online sources.

In this context, the knowledge classification schemas play a vital role in managing digital libraries. According to the Encyclopaedia Britannica, Classification is a System of arrangement adopted by a library to enable patrons to find its materials quickly and easily (The New Encyclopaedia Britannica, 2007). While cataloguing provides information on the physical and topical nature of the book (or other item), classification, through assignment of a call number (consisting of class designation and author representation), locates the item in its library setting and, ideally, in the realm of knowledge. Current predominating systems include the Dewey Decimal

Classification (DDC), Universal Decimal Classification (UDC), The Library of Congress Classification, the Bliss Classification, and the Colon Classification (CC) etc. The instances for the most common classification approaches are Hierarchies, Trees, Paradigms, Faceted Analysis. However, those systems provide a structure for organizing knowledge and bringing related items together in a helpful sequence from general to specific. It makes the access easy for user from a heterogeneous collection. General components in a classification scheme include:

- Verbal description
- Arrangement in a logical order
- Notation

Indexing is also very impotent in the context of creation of Knowledge Structure. In general, the indexing process can be divided in to three main categories. They are Familiarization, Analysis and Translation. Rahmatollah has pointed out that the way in which data elements are correctly stored and manipulated in online library systems is very important for the various functions of the bibliographic record, especially in a global online environment. In relation to the requirements of the bibliographic record for searching, retrieval and display, agreement needs to be reached nationally and internationally regarding the coding of certain data elements to allow for their indexing. This is a necessary requirement and a principle for large catalogues and for databases in shared environments. The treatment of some fields and subfields for indexing and display does not, at present, follow a uniform approach (Rahmatollah,1997).

OBJECTIVES:

- The main objective of this study is to develop a knowledge Structure on the discipline of Geographical Information Systems (GIS) for a digital library.
- To develop a precise classification schema for the selected discipline
- To construct a simple Indexing System for the classification schema

GEOGRAPHICAL INFORMATION SYSTEMS (GIS):

GIS is a powerful *set of tools* for collecting, storing, retrieving, transforming, and displaying spatial data for the real world (Burroughs, 1986).

“A GIS is a computer-based system that provides the following four sets of capabilities to handle geo-referenced data:

- Input
- Data management (storage and retrieval)
- Manipulation and analysis
- Output.” (Aronoff, 1989).

According to the Rhind , “ A system of hardware, software, and procedures designed to support the capture, management, analysis, modeling, and display of spatially referenced data for solving complex planning and management problems” (Rhind, 1989). Above authors have noted that the “Spatially Referenced” as the core or uniqueness of GIS data.

Kang-tsung Chang defined GIS is as a computer system for capturing, storing, querying, analyzing, and displaying geographic data. Like any other information

technology, GIS can be divided into the four components (Kang-tsung Chang, 2002). As follows,

- i. Computer System; the computer system includes the computer and the operating system to run GIS. (e.g. Windows 2000).
- ii. GIS software; the GIS software includes the program and the user interface for driving the hardware.
- iii. Brainware; the Brainware refers to the purpose and objectives, and provides the reason and justification, for using GIS.
- iv. Infrastructure; this refers to the necessary physical, organizational, administrative, and cultural environment for GIS operations. This includes requisite skills, data standards, data clearinghouses and general organizational patterns. 'Chang' offers very broad definition on GIS and its functionality.

THE DEWEY DECIMAL CLASSIFICATION SCHEME:

The Dewey Decimal Classification (DDC) is an [enumerative](#) system of [library classification](#) developed by [Melvil Dewey](#) in 1876. In 1876, Melvil Dewey published a landmark book on "*A Classification and subject index for cataloguing and arranging the books and pamphlets of a library*".

According to the *Foskett* (1996), Dewey's first edition consisted of 12 pages of introduction, 12 of tables and 18 of index, and its novelty lay in three main areas: the first of these was the assignment of decimal numbers to books rather than shelves; the second was the specification of relatively detailed subjects; the third, the provision of relative index. It is possible to argue that these three principles were in fact a greater contribution to the progress of library classification than the scheme itself, despite its wide acceptance throughout the world.

Dewey did not introduce subject arrangement into libraries; many libraries had previously been arranged by subject. What he *did* do was to introduce the idea of relative as opposed to fixed location. It was the practice to allocate certain areas of the library to various subjects, arranging the books within each area by accession number and giving them a *shelf mark* which identified their exact position: room, bay, tier, shelf, place on shelf. (Foskett, 1996). This idea was more important to the library users to find their information in a short time.

The Dewey Decimal Classification (DDC) system is the world's most widely used library classification system that organizes books on library shelves in a specific and repeatable order that makes it easy to find any book and return it to its proper place. www.oclc.org (2011) says that the system is used in nearly 200,000 libraries in at least 135 countries.

The DDC divided the whole body of existing knowledge into [ten main classes](#). The ten main classes are each further sub-divided into ten divisions, and each division into ten sections, giving ten main classes, 100 divisions and 1000 sections.

The DDC schema consists of four volumes as follows;

- i. Introduction and Tables
- ii. Schedules 000 – 599
- iii. Schedules 600 – 999
- iv. Relative Index and Manual.

As instances, the second volume begins with the Summaries. The first summary lists the "Ten main Classes". These are as followings,

- 000 – Computer science, information & general works
- 100 – Philosophy & Psychology

200 – Religion
300 – Social Sciences
400 – Language
500 – Science
600 – Technology
700 – Arts & recreation
800 – Literature
900 – History & Geography

The Second Summary the Hundred Divisions; (as instances);

300 – Social Sciences, Sociology & Anthropology
310 – Statistics
320 – Political science
330 – Economics
340 – Law
350 – Public Administration & Military science
360 – Social problems and Social services
370 – Education
380 – Commerce, Communications & Transportation
390 – Customs, etiquette & folklore

The Third Summary the Thousand Sections; (as instances);

910 – Geography & travel
911 – Historical Geography
912 – Atlases, maps, charts, & plans
913 – Geography of & travel in ancient world
914 - Geography of & travel in Europe
915 - Geography of & travel in Asia
916 - Geography of & travel in Africa
917 - Geography of & travel in North America
918 - Geography of & travel in South America
919 - Geography of & travel in other areas

The DDC has been greatly modified and expanded through 22 major revisions, the most recent in 2003. The [22nd edition of the DDC](#) enhances the efficiency and accuracy of library.

According to the www.oclc.org (2011), the new print edition of the Dewey decimal classification, DDC 23 (23rd edition), is now available in the U.S.A. The DDC print edition is scheduled for delivery to locations outside the Americas in July 2011. Highlights of the new edition include several major changes held for simultaneous publication in the print and Web versions of the DDC plus many interim updates already distributed to users in Web Dewey 2.0.

Dedicated to Dewey users worldwide, DDC 23 features:

- Many new topics and significant updates to selected fields
- Numbers informed by interaction with the worldwide community of Dewey users
- A complete overhaul to the representation of groups of people
- Revisions to several standard subdivisions
- Elimination of dual headings and unbalanced spans
- A minimal price increase
- As a result, DDC 23:

- Better reflects the changing world
- More accurately reflects regional differences around the world
- Greatly increases classifier efficiency
- Is more intuitive for the way classifiers work
- DDC 23 also features:
- New provisions in 004-006 Computer science and elsewhere to reflect changes in technology
- Updates to provisions for the Orthodox Church and Islam in 200 Religion
- Improved provisions in 340 Law for legal systems based on civil law
- Significant updates to 370 Education resulting in an improved international framework for levels of education, kinds of schools, policy issues and specific subjects in primary education
- Updated provisions for food and clothing
- Updates to 740 Graphic arts and decorative arts
- A new location and expanded development for cinematography and videography at 777
- Significant expansions throughout 796 Athletic and outdoor sports and games
- Significant expansions in Table 2, with parallel provisions in 930-990, for the ancient world, Italy, Switzerland, Sweden, Finland, Turkey, Indonesia, Vietnam and Canada
- Updated historical periods throughout 930-990
- (www.oclc.org, 2011).

METHODOLOGICAL BACKGROUND

Following criteria and steps were considered to develop the knowledge structure on GIS for a digital library (figure 01).

MAJOR USERS:

Following users were identified as major users of the selected discipline.

- Geography Undergraduates Students
- Geography Post Graduate Students
- Geology Undergraduates Students
- Geology Post Graduate Students
- Academicians and Researchers
- Geographers, Geologists, Economists, Engineers, Planners, Project Managers etc.

CONTROL VOCABULARIES:

- **Collected existing vocabularies from various sources**

E.g. ▪ Text Book and other reference materials:

- Dewey Decimal classification scheme
- Universal decimal classification scheme
- Library of Congress Subject Headings

✓ Related Organizations

- Environmental Systems Research Institute (ESRI), USA
- Geo Informatics Society of Sri Lanka (GISSL)
- Department of Geography, University of Colombo, Sri Lanka.

- Related Databases
- www.colorado.edu/geography
- [www.ESRI](http://www.ESRI.com). Online GISDatabase

✓ **Created new vocabularies based on followings:**

- Feedback from working groups of domain specialists
- Review of key words from existing documents

✓ **Evaluation of Vocabularies**

Following criteria were used to evaluate vocabularies;

- Intended user
- Current usage
- Satisfaction of User needs
- Whether documented or not
- Any machine processable forms
- Level of scientific detail
- Whether scientifically appropriate or not etc.

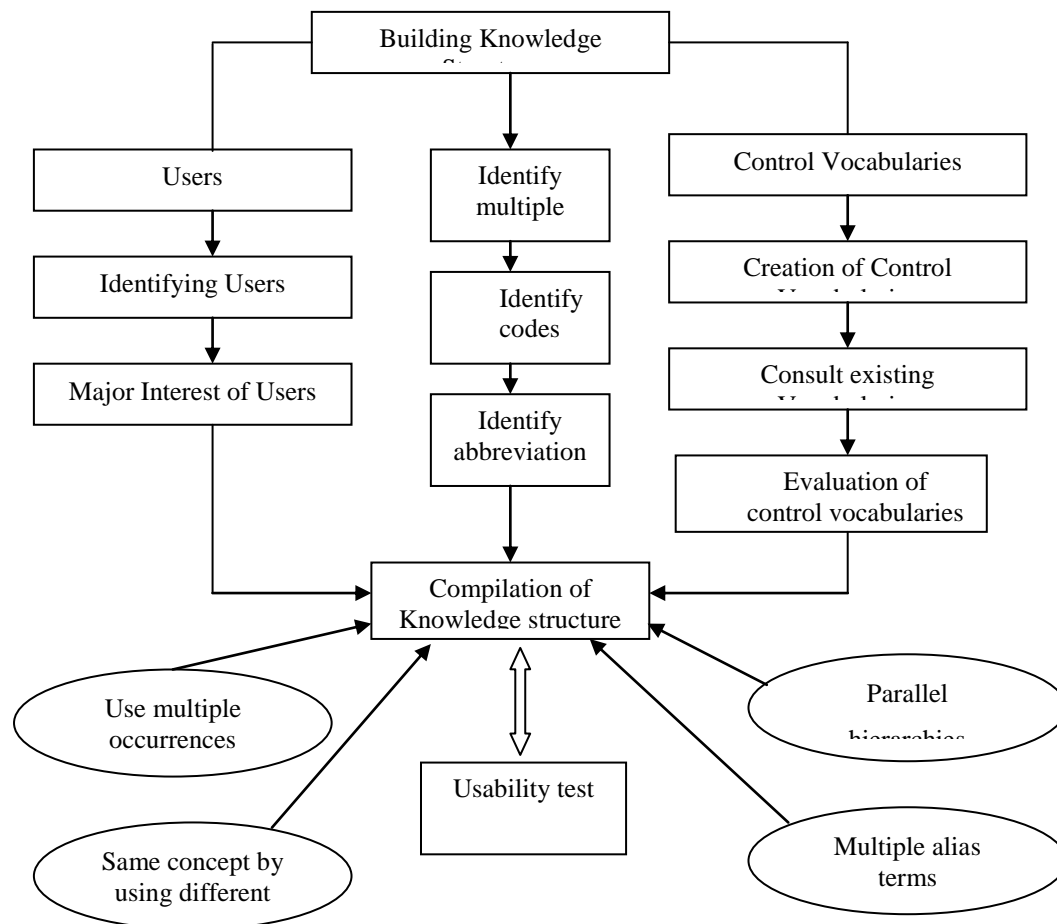


Figure 01: Methodological Background
Source: Compiled by the author, 2011.

✓ **Multiple Alias terms**

Within a vocabulary a single concept is described using different words
E.g. 912.224 Coordinate Systems (Reference System)

✓ **Multiple occurrences of the same term**

E.g. By using same terms in different ways.

References

“*See also*” term is used to guidance users to refer related headings

✓ **Usability test**

Usability test will be conducted using followings,

- To detect whether the user will utilize multiple occurrences and multiple alias during indexing
- To detect whether the user utilize multiple occurrences and multiple alias during searching

COMPILATION OF KNOWLEDGE STRUCTURE:

In this section will discuss the ‘Classification Schema’ and ‘Relative Index’ that used for finalized the Knowledge Structure.

DEVELOPED CLASSIFICATION SCHEMA

According to the DDC 22nd edition, the notation 910 has classified for the discipline of Geography, the notation 911 for the Historical Geography, and the notation 912 for the “Graphic representations of surface of earth and of extraterrestrial worlds”. Hence, the developed classification schema has been based on the notation of 912.

Sub divisions, sub-classes and relevant terminologies of Classification schema did not include for this paper due to the reduction of no of pages of article.

912.1 Areas, regions, places in general

912.2 Geographical Information Systems (GIS) or Geographic Information Systems (GIS)

Class here GIS theories and Environmental System Research Institute (ESRI)

912.201 Components of GIS

Class here Computer Systems, GIS Software, Brainware and Infrastructure Including ARC/INFO, ArcView, ArcGIS, MapInfo

912.2012.1– 912.208 Standard Subdivisions

912.209 Historical and Persons’ treatments of GIS

912.21.1 GIS Models

Standard Subdivisions are added for Binary Models and Index Models together

912.22 Map Projection and Coordinate Systems in GIS

Class here all types of Cylinder and Cone (Conical) projections

912.23 Vector Data Management in GIS

912.24 Spatial Data Editing

912.25 Aspatial (Attribute) Data Management in GIS

912.26 Raster Data Management in GIS

912.27 Cartographical Analysis in GIS

912.28 Data Exploration and Data Display in GIS

912.29 Network Analysis, Dynamic Segmentation and Data Quality in GIS

RELATIVE INDEX FOR THE CLASSIFICATION SYSTEM:

All the terms / terminologies that are classified under the develop schema included in this index.

The developed indexes were not included for this article because to limit the number of pages according to the guidelines.

ABBREVIATIONS USED IN THE INDEX

1 to M – One to Many

M to M – Many to Many

M to 1 Many to One

CONCLUDING REMARKS:

According to the developed Classification Schema, it was based on an enumerative (considered Arabic numeric) system and consists of a hierarchical approach. The developed Knowledge Structure enclosed all the existing knowledge on Geographical Information Systems in the world. The selected discipline was classified as a sub-discipline of the main discipline of Geography. Furthermore, user community, major topics of interest, controlled vocabularies, existing sources on discipline, codes, abbreviations, multiple occurrences, parallel hierarchies etc. were considered.

Finally, analyzed information were included in the developed Knowledge Structure and it mainly consists of Classification Schema and Relative Indexes. According to the reference relative information, the analysis were revealed that the developing of such a knowledge structure for a digital library on a dynamic discipline is more significant for the academic and research world. Therefore, the compiled knowledge structure will play a vital role in providing valuable spatial information for the users.

ACKNOWLEDGEMENT:

I would like to express my grateful thanks to our Chief Librarian, University of Colombo and also the lecturer in Knowledge Structure at the Faculty of Graduate Studies, University of Colombo, Mrs. Sumana C. Jayasooriya for her excellent supervision, guidance, support, and encouragement offered throughout the working period.

REFERENCES:

- Aditya Dev Sood and Uma Chandrasekharan (2004), A Report Commissioned by EDC, Educational Development Center Center for Knowledge Societies India. CKS Working Paper
- Aronoff, S. (1989). *Geographic Information Systems: A Management perspective*. WDL publications, Canada.
- Burrough, P. A. (1986). *Principles of Geographical Information Systems for Land Resources Assessment*. Oxford University Press, United Kingdom.
- Dewey, Melvil (1851-1931, 2003), *Dewey Decimal Classification and Relative index*, 22nd edition, Dublin, Online Computer Library Centre (OCLC) Inc.
- Foskett, A.C. (1996), *The Subject Approach to Information*, 5th Edition, London, Library Association Publishing.
- Hunter, J. Eric (1988), *Classification Made Simple*, England, Gower Publishing.
- Ian Rowlands and David Bawden, *Building the digital library on solid research foundations*, *Aslib Proceedings* Vol 51, No.8, September 1999 – 275
- Kang-tsung Chang, (2002). *Introduction to Geographic Information Systems*. Published by McGraw-Hill companies Inc. New York. USA.
- Kumar, Krishan (1988), *Theory of Classification*, 4th Edition, New Delhi, Vikas Publishing House.
- Library of Congress Subject Headings (LCSH), (2005), 28th Edition, Washington, Library of Congress.
- Rahmatollah Fattahi (1997), A uniform approach to the indexing of cataloguing data in online library systems, *Library Review*, 46 (5), 339-343.
- Rhind, D. (1989), Why GIS?. *Arc News*, Redlands, CA: Environmental Systems Research Institute 11: 1- 3.
- Singh, Gopal (1996), *Map Work and Practical Geography*, New Delhi, Vikas Publishing House PVT Ltd.
- The New Encyclopaedia Britannica (2007), 15th edition, London, Encyclopedia Britannica, Inc.
<http://www.oclc.org/dewey/> , Accessed: 25- 04-2011.