

DEVELOPING SKOS- COMPLIANT MULTILINGUAL THESAURUS: AN ISO 25964 BASED APPROACH

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Standards are being used for construction of thesauri from their inception. Previously thesauri were designed and maintained manually. But the advancement of ICT gives us the opportunity to execute the same through machine-readable environment. To incorporate thesaurus database electronically, the thesaurus standards also changed accordingly over the time. Concept of data model has emerged for efficient utilization of knowledge organization systems like classification schemes, subject taxonomies and thesauri. New standards are capable to guide in designing and maintaining thesaurus in digital environment and also make them interoperable among various platforms by using SKOS as domain model and XML as lingua franca. The SKOS-compatible thesaurus standard also supports multilinguality in Unicode based data processing environment. ISO-25964 standards are designed in two parts for constructing and maintaining a SKOS compliant multilingual thesaurus.

Keywords: Thesaurus, Data model, Thesaurus Standards, SKOS, ISO 25964, Tematres

1 INTRODUCTION

Initially experts recommended that standards are necessary for a thesaurus construction in three areas - structure of an entry, layouts and arrangement. There are many standards that were developed over the years in these three areas of thesaurus construction. British standards such as BS-2954 paved the path of development for other standards in thesaurus construction. Most of the national and global standards in the domain of thesaurus construction mainly cover how these knowledge organization tools can be developed in machine-generated

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environment; and how these tools can be integrated with search interface and indexing interface. But with the advent of Linked Open Data (LOD) data technologies in library services, the needs of interoperability of knowledge organization tools (like classification schemes, taxonomy, subject tree, thesaurus etc) from one retrieval system to another are becoming crystal clear to library professionals. At that time existing thesaurus standards did not support interoperability. As a result, a quest for developing standards for thesaurus construction with interoperability in focus started in the beginning of 21st century. This quest end up with an integration of SKOS (Simple Knowledge Organization System – a W3C standard for knowledge organization in XML format) with existing international standard ISO-2788.

2 MULTILINGUAL THESAURI AS CONTROLLED VOCABULARY

Controlled vocabulary means a list of terms on a particular subject field to be used for information retrieval. Svenonius (1988) has explained the word “controlled” in senses. One in the sense of restrictions in size i.e.it does not include all words in a particular natural language. Another meaning of “controlled” is it restricts the scope of the term by articulating semantic relationships between the terms. In the case of online retrieval the controlled vocabulary structure (e.g. subject heading lists or thesauri) may be used for two purposes-for coherent display and disambiguation of user's search term. Multilingual thesauri provide the opportunity for complete conceptual and terminological inventories for each one of the languages involved. They also display fully developed thesaurus structure in each language, so that a user can search the document without any language barrier.(Hudon,1997).Multilingual thesaurus has another aspect of culture integrity. Multilingual thesaurus should try it's best in finding near-equivalent concepts/ideas in a language as far as possible for another language of other cultural origin (Neelameghan and Raghavan, 2005).

3 OBJECTIVES

The primary objective of the paper is to design a multilingual thesauri by using Tematres based on ISO 25964 (I and II) standard. Let we divide this objective in to some components in a systematic order:

- a) To investigate the features of ISO 25964 standards as a thesauri construction tool;
- b) To construct a multilingual thesauri by Tematres as per the guidelines of ISO 25964; and

- c) To exploit the effectiveness of SKOS platform in thesauri data management.

4 DEVELOPMENT OF THESAURUS STANDARDS: A TIME LINE

Thesauri are being used for information retrieval purpose for a long time. Let us try to trace a history of thesauri in IR field. For our convenience we can categorize the time span of thesauri into two broad groups from their inception-

4.1 Pre data Model Era

Pre data model era related to the time period where thesauri were handled by human brain, no use of computers for thesaurus construction and maintenance in that era. But this era acted as a pioneer for the next generation thesaurus standards. Some notable standards of this era are:

- 1960s-TEST (Thesaurus for Engineering and Scientific Terms)-It was first published in 1967 and played the role of pioneer in thesaurus construction standards. Relevance of the standard is still continuing as the indicators BT,NT and RT(as used by it first time) are now also inseparable for thesaurus lay outs.
- 1970s-ISO 2788 -It was Published in 1974.The objective of the standard states its utility as “there is a need for practical method of representing concept simply and clearly and of ordering them by clarifying their interrelationship”.
- ANSI/NISO Z39.19-This was designed for monolingual thesauri. Firstly it was published in 1974. Subsequent editions of it were published in 1980 and 1993.
- BS 5723:1979-This standard was related to construction of monolingual thesauri and later was replaced by BS 5723:1987
- BS 6723: 1985-It was also related to multilingual thesauri and replaced by BS 8723-4:2007
- 1980s-ISO 5964-First standard for multilingual thesauri that was published in 1985 based on ISO 2788 and which was replaced later by ISO 25964-1.

4.2 Data Model Era

Thesaurus represents the concepts (units of thought) by terms (label of concepts). The human brain can distinguish easily between concepts and terms.

So in the pre- data model era thesauri where the searches were human mediated, the concept of data model was irrelevant. But from 1990 onwards, computers were started to be used as thesaurus development and maintenance tool. Clarke and Zeng (2012) states that data model is necessary to handle and interpret thesaurus data through computers. Data model is also necessary to make thesaurus data inter operable amongst different information retrieval systems.

BS-8723-1 and 2:2005-This standard was released under the title “Structured Vocabularies for Information Retrieval. Guide, Definitions, Symbols and Abbreviations” and replaces by BS 5723:1987 and subsequently replaced by BS ISO 25964-1:2011.

BS-8723-3 and 4:2007-This standard was released under the title “Structured Vocabularies for Information Retrieval. Guide Vocabularies other than Thesauri” and later replaced by ISO 25964-2:2013.

5 ISO 25964: THE NEW STANDARD FOR MULTILINGUAL THESAURUS CONSTRUCTION

The predecessor of ISO 25964 is ISO 2788. ISO 2788-compliant thesauri were used by trained information professionals for storage and retrieval of information from printed media. But in the modern era of ICT there is an urgent requirement for designing vocabularies for retrieving data from electronic databases and they should be capable enough to integrate with other electronic databases like search engines, localized retrieval system like library OPAC etc. The success of a thesaurus is to attain the culminating point when it guides both the indexer and the searcher to express the same concept with the same term. Thesauri also should have three important characteristics-

1. help in making the intuition of common users;
2. enabling to make inferences by the machine; and
3. efficient exchange of data.

ISO 25964 is an effort to make successful transition from the past paper based era to modern world of electronic information management. It recommends

- exchange formats and protocols;
- covers development and maintenance of thesauri rather than their use procedures;

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- adaption of multilinguality and facilitating web compatibility; and
- consistency with clarity and comprehensiveness.

ISO 25964 has two parts:

1. Part 1-Thesauri for information retrieval (published in 2011)
2. Part 2-Interoperability with other vocabularies (published in 2013)

Scope of the standard-part-1 recommends data models and format for import and export of thesaurus data. It has the provisions for both mono-lingual and multilingual thesaurus. It is compatible to various types of databases like texts, sounds, physical objects, multimedias, etc. Back-of-the-book indices are not under the purview of this standard though some of it's recommendations are also applicable for the purpose.

Part-2 deals with the interoperability between multiple thesauri or between thesauri and other type of vocabularies.

5.1 Unique features of ISO 25964

The standard have some common characteristics as ISO 2788 but some newly added to make it more effective at the web environment. Few of them are discussed below:

5.1.1 Term Selection

Preferred terms should be selected with following guidelines:

- General-One concept may be represented by more than one terms in the same language. Here the preference should be given to that particular term which is the most popular among the targeted community for whom the thesaurus is being constructed to avoid ambiguity or offensiveness (if any). In other words it supports user warrant over the literary warrant;
- Spelling-Most accepted spelling of words should be chosen for preferred term, e.g.-Romania is preferred to Roumania. Well established terms in the dictionaries of the thesaurus language should be preferred, e.g. Colour is preferred to Color in India where British English is followed;
- Loan terms-A loan term (borrowed from another language) should be chosen as preferred term if it is well established e.g.-Abattoirs (French) is

preferred to Slaughterhouses. For scientific terms loan terms are non-preferred terms, e.g.-Breaking radiation is preferred to Bremsstrahlung (German); and

- Neologisms, slang terms and jargon-Useful neologisms should be used as thesaurus terms when they are appeared as useful in the community, e.g. - Smart cards. Slang terms are to be used when no other alternative is available, e.g.- Hippies. Jargon should be used in place of well established term when users find it as useful entry point, e.g.- Psychiatrists is preferred to Shrinks.

5.1.2 Common Name vs Trade Name

If both trade name and common name exist for a product, the common name should be used as preferred term to avoid legal problems, e.g. - Soluble coffee should be preferred to Nescafe^R

5.1.3 Popular vs Scientific Name

Popular names should be preferred in general thesauri but scientific name should be used in scientific thesaurus.

5.1.4 Proper Name

- Generic names-Often useful in a thesaurus(but may be excluded if there are so many entities in the group) e.g Mount Everest may be used as NT of Mountains.
- Geographical names-Both popular and official forms may be used, e.g.- Republic of Korea and South Korea both may be used.
- Institution and person's named-Forms should abide by the rules of a standard catalogue code and terms also should be correct, current and unambiguous .

5.1.5 Data Models and Mapping

Data model is an abstract model consisting of representation of data and their use. For multilingual thesauri data model concerned only with those languages having symmetrical structure. If data structures differ among languages then mapping is necessary, at least, for those parts of thesaurus where it occurs. Data models are represented by XML schema and may be used to exchange thesaurus

data electronically. The exchange format should be equally hospitable for both simple as well as sophisticated thesauri.

Mapping is a process of establishing relationships between the concepts of one vocabulary with another (ISO-25964-2). Mapping is the key concept of interoperability among different vocabularies (e.g.-classification schemes, subject heading lists, etc.). Interoperability is a quality for exchanging and using information among two or more systems. Interoperability requires mapping among vocabularies for presenting data in a standard format and also a common computer platform using same protocol. Interoperability also enhances the activities of vocabulary tools by merging multiple vocabularies or using portion of one to extent another.

Mapping has a two-fold purpose, the first in indexing process and the second is searching. In indexing the meta data of documents indexed with source vocabulary are converted to the corresponding term from target vocabulary (e.g. assigning Subject headings to a catalogue database from a Subject heading list).At the time of searching mapping between source and target vocabularies are done in reverse direction.

6 ISO 25964 VS ISO 2788/5964

Now it is the time to mention some differentiating characteristics of ISO 25964 to it's predecessor ISO 2788 in constructing a thesaurus that impressed us to use is. These are as follows

- More distinct analysis between *terms* and *concepts*
- provides more emphasis on facet analysis.(e.g- *action* is classified in to two categories-*transitive* when it acts up on an object i.e. Cutting an apple by a knife and intransitive when it doesn't acts upon an object i.e. Ripening of apple by nature...Sec 11)
- Some changes to the 'rules' for compound terms-Few examples are given below:
 - a) Singularization of two compound terms e.g. Agriculture+industry= Agroindustry
 - b) Use of modifier to narrow the scope of the focus and creating subclasses e.g.-Printed indexes
- More precise instructions on managing thesaurus development and maintenance

- Functional specification for thesaurus management softwares.
- Introduction of Data model and XML schema for data exchange
- Illustrations are provided comprehensively at a very micro level (Dextre Clarke, 2012).

7 SKOS: TOOLS FOR MANAGING THESAURUS IN WEB ENVIRONMENT

Simple Knowledge Organization System (SKOS) was designed by W3C in 2009. It is a tool (not a standard) concerned with concept centric view of vocabulary i.e. Not terms(labels) but concepts represented by the labels. It handles web functions, semantic web in particular. It is a common data model for knowledge organization systems (e.g.-classification scheme, thesauri, subject heading lists, etc.) based on XML.SKOS makes a knowledge organization system “machine readable”. It can exchange data between computers and also publish data in machine readable form in the web.

Why SKOS:

- The SKOS data model views a knowledge organization system as a concept scheme comprising a set of concepts;
- SKOS concepts can be labeled with any number of lexical (UNICODE) strings, in any given natural language;
- SKOS concepts can be assigned one or more notations, which are lexical codes used to uniquely identify the concept within the scope of a given concept scheme;
- SKOS concepts can be documented with notes of various types. The SKOS data model provides a basic set of documentation properties, supporting scope notes, definitions and editorial notes, among others. This set is not meant to be exhaustive, but rather to provide a framework that can be extended by third parties to provide support for more specific types of note;
- SKOS concepts can be linked to other SKOS concepts via semantic relation properties. The SKOS data model provides support for hierarchical and associative links between SKOS concepts. Again, as with any part of the SKOS data model, these can be extended by third parties to provide support for more specific needs;

- SKOS concepts can be grouped into collections, which can be labeled and/or ordered. This feature of the SKOS data model is intended to provide support for node labels within thesauri, and for situations where the ordering of a set of concepts is meaningful or provides some useful information;
- SKOS concepts can be mapped to other SKOS concepts in different concept schemes. The SKOS data model provides support for four basic types of mapping link: hierarchical, associative, close equivalent and exact equivalent; and
- SKOS-XL provides more support for identifying, describing and linking lexical entities.

7.1 Element Categories of SKOS

SKOS categories are of five types-concepts, labels and notations, documentation, semantic relations, mapping properties and collections. Each category has various subcategories as shown below:

Table 1: SKOS categories and sub categories

Concepts	Labels & Notation	Documentation	Semantic Relations	Mapping Properties	Collections
Concept	pref Label	note	broader	broad Match	Collection
Concept Scheme	alt Label	change Note	narrower	narrow Match	ordered Collection
in Scheme	hidden Label	definition	related	related Match	member
Has Top Concept	notation	editorial Note	broader Transitive	close Match	member List
Top Concept Of		example	narrower Transitive	exact Match	
		history Note	semantic Relation	mapping Relation	
		scope Note			

Concept-Unit of thoughts, ideas, meanings, events, etc.

Labels and notations-Labels are the string of Unicode characters associated within a concept. Notation is similar to a label, but the literal string has a data type, like integer, float, or date.

Documentation-Basic information about SKOS “concepts”.

Semantic relations- SKOS semantic relations are intended to provide ways to declare relationships between concepts within a concept scheme

Mapping- SKOS mapping properties are intended to express matching (exact or fuzzy) of concepts from one concept scheme to another.

Collections-The concept collections are labeled and/or ordered groups of SKOS concepts. The items in a Collection cannot be connected to other SKOS Concepts through the Collection node; individual relations must be defined to each Concept in the Collection.

("SKOS simple knowledge," 2009)

7.2 Significance of SKOS in Thesaurus Standards(specially in ISO 25964)

SKOS is not a standard for thesaurus construction but it acts as an intermediary for data conversion in machine readable form. Its significance w r t ISO 25964 are as follows:

- ISO 25964 emphasizes on building and managing a thesaurus but SKOS focuses on publishing the thesaurus in a computer processable form;
- As data models for both standards are concept-based, it is easy to convert between them at a simple level;
- ISO 25964 is dedicated to thesaurus only but SKOS model serves for various vocabulary types(e.g.-thesaurus, classification schemes, subject heading lists, etc); and
- ISO 25964 came into action to exploit SKOS for thesaurus management (analogous to shifting from AACR-I to AACR-II to incorporate ISBD (G), 1977).

8 PRESENTATIONS AND LAYOUTS FOR MULTILINGUAL THESAURI

In a multilingual thesauri terms and their relational structures are available in two or more natural languages. Some basic requirements for presentation of a multilingual thesauri are as follows-

- Conferring equal status to all languages;
- Alphabetical sequences for arranging preferred terms corresponding to each language should be maintained; and
- Cross language equivalents should be mentioned for preferred terms for each language.

Single record display: In this case the Preferred term should normally be displayed first and other fields are under this term should be displayed in the order CC,SN,UF,TT,BT,NT,RT,DEF,HN,SC**

**[CC=Concept code, SN=Scope Note, UF=Used for, TT=Top term, BT=Broader term, NT=Narrower term, RT=Related term, DEF=definition, HN=History note, SC=Subject category]

Alphabetical display: All preferred and non preferred terms should be displayed in a single alphabetical sequence. Both terms should be distinguished typographically for easy identification.

Classified display: It helps in easy browsing through subjects and their related concepts.

9 THESAURUS MANAGEMENT SOFTWARE (TMS): STANDARD SUPPORT

Thesaurus management softwares are those used to create and manage a thesaurus database. It can also import or export thesaurus data or some part of it to another platform.

General features of TMS:

- No of terms included in the thesaurus should be unlimited;
- No character restrictions for thesaurus terms;
- No barrier for number of hierarchical levels;
- Should be Unicode complaint;
- Should be case insensitive;
- No of languages to be included should be unlimited;
- Thesaurus managers should be able to find the full details of a term and also can navigate the term from any of it's BTs, NTs or RTs.

- Provisions of adding, editing and spell-checking should be there without re-keying the whole field;
- Relationships between two existing terms should be provided without retyping the whole term to prevent typing error and enhance efficiency; and
- Switch over from one language interface to another should be done easily.

9.1 Data Safety Checkpoints

In web environment there are a lot of chance for data mis handling. To prevent this some administrative restrictions must be implemented at any DBMS. Some of these restrictions may be-

- password control for editing the database should be provided;
- Simultaneous editing of a particular record should be restricted through an inbuilt mechanism;
- facilities of provisional changes should be provided until final approval by the administrator; and
- back up and restoration facilities should be maintained.

10 TEMATRES AS A THESAURUS MANAGEMENT SOFTWARE

Tematres is an open source vocabulary server for manage controlled vocabularies, taxonomies and thesaurus. Tematres have following features:

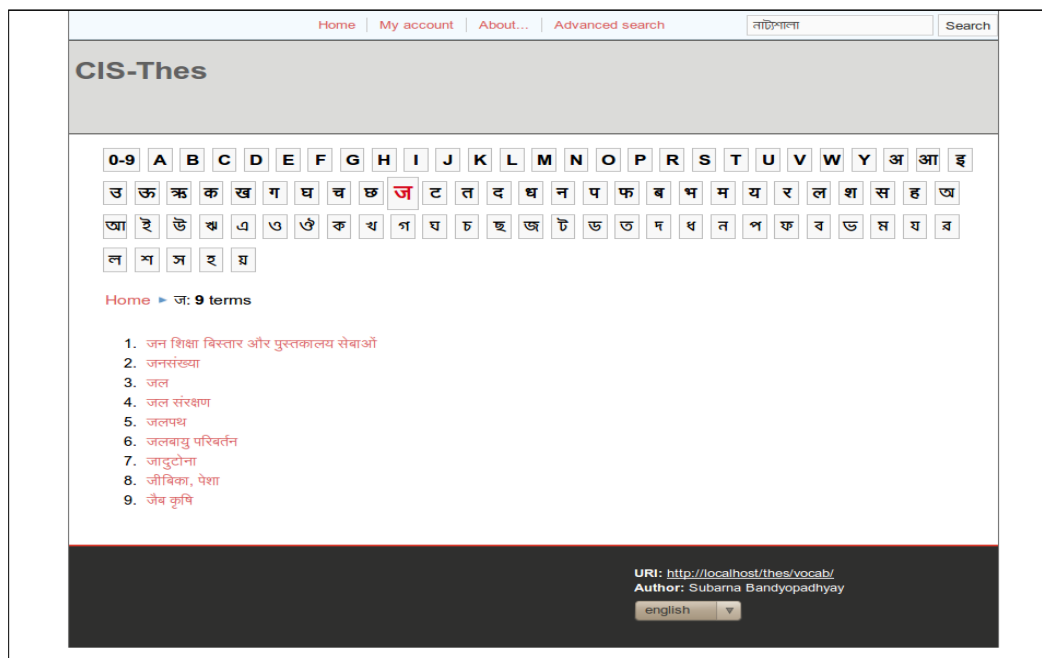
- Supported languages-English, Spanish, French, German, etc.;
- Supported formats-SKOS, Zthes, BS8723-5,Dublin core, MADS, etc.;
- Programming language and database server-PHP and MySql;
- Integration-Can be integrated with Word Press, D space, Open Journal System, etc.;
- Configuration- Varieties of advanced level configuration options are provided;
- Import and export facilities - Tematres can import vocabularies in various formats, even from tagged text. It can export data in Zthes, XML, SKOS, etc.;

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- Display formats-Alphabetical according to top terms. Under top terms each NTs, RTs, etc are also alphabetical; and
- Licensing-GNU/GPL ("Tematres: gestión de", 2007) and ("Tematres", 2015).

11 DESIGN AND DEVELOP A MULTILINGUAL COMMUNITY THESAURUS BY TEMATRES

A community thesaurus serve the purpose of collecting and organizing community information. There are many such vocabulary control list like IPSV (UK), etc, but they are western biased. No significant effort has yet been taken to design such a community information thesaurus in India. Here we have tried to design a community thesaurus through Tematres which is web-enabled, multilingual (so far it covers only Hindi and Bengali apart from English language) and SKOS compliant.



Screen shot 1: Homepage of CIS Thes – a multilingual SKOS-compliant thesaurus

11.1 Method

The method of creating a multilingual thesauri by Tematres consists of several steps. For convenience we are describing the key steps in a systematic manner--

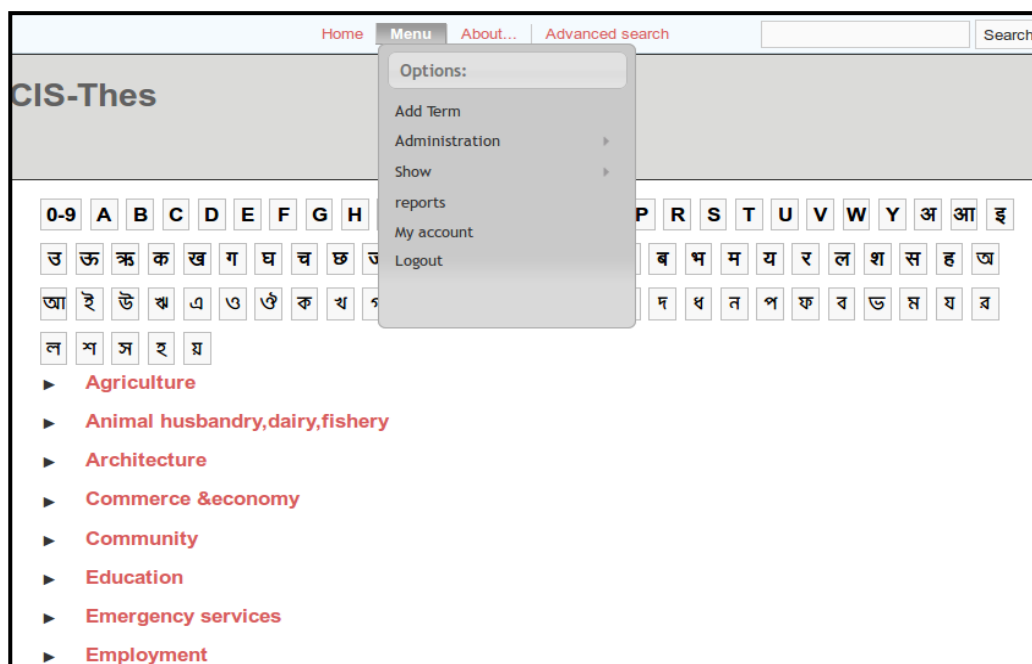
11.1.1 Selection and Addition of Terms

11.1.1.1 Selection of terms

Primarily community information related terms are selected from various community web portals. Terms are then refined through a community survey. The terms are then standardised as per ISO-25964.

11.1.1.2 Adding of term

The homepage of Tematres consists of five options i.e Home, Menu, About, Advanced search and search. For adding a new term we have to click *Menu* then *Option* and then *Add term*.

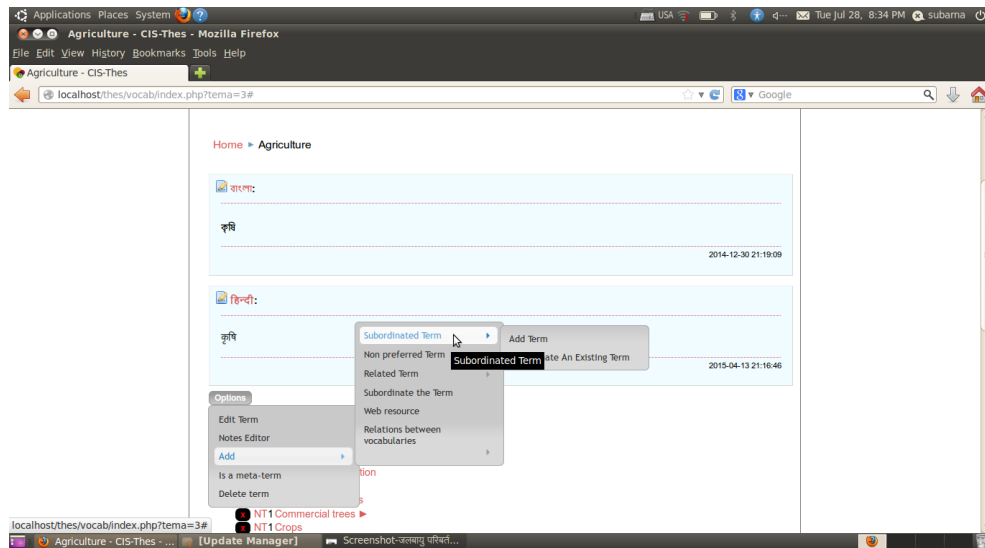


Screen shot 1A: Adding of terms

11.2 Establishment of Relations

A thesaurus term has various relations like BT, NT, RT, USE etc. We can establish relations like Subordinate the term, (i.e. BT) Subordinated term (i.e. NT), Non preferred term (i.e. USE/UF), Related term (i.e. RT). To establish these relations we have to click on the term, then click on *Options* button. From the sub menu under options we have to choose *Add* and then go for proper relation.

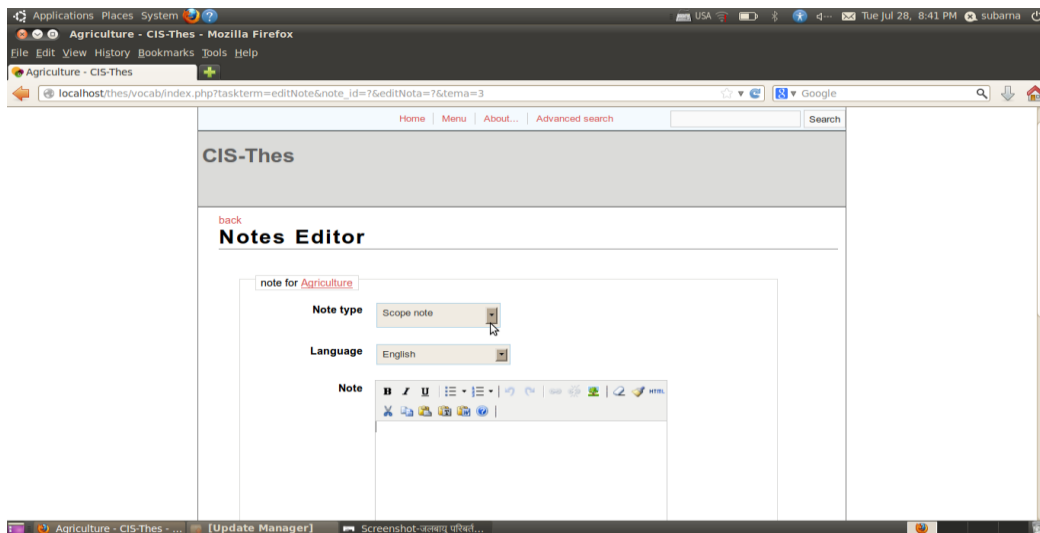
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Screen shot 2: Establishment of relations

11.3 Adding Scope Notes

For adding a scope note (if any) we have to click on the term then options are opened. We have to go for Notes editor and under this submenu go for *Scope note*.



Screen shot 3: Scope note addition

11.4 Adding other language equivalents of terms(for multilingual thesauri)

The notes editor option as described above are customised for the purpose. It was done from *Menu>Administration>Vocabulary configuraion>Configure type notes*. Here the Language is specified in it's own script e.g. For Bengali we entered "বাংলা" and then choose *submit*. For entering Bengali equivalent of a term we have to go on *Options* (under the term)>*Notes editor>Note type* and choose "বাংলা" from dropdown menu and write the Bengali term in note area in Bengali script. Same procedures were followed for other language equivalents.

The screenshot shows the 'Configure types notes' section of the CIS-Thes administration interface. It features a table with columns for 'Note type', 'Alias', 'Orden', and 'Submit'. The 'Submit' column contains the number of notes for each type. The 'বাংলা' (Bengali) row is highlighted, showing an alias of 'LN' and 454 notes.

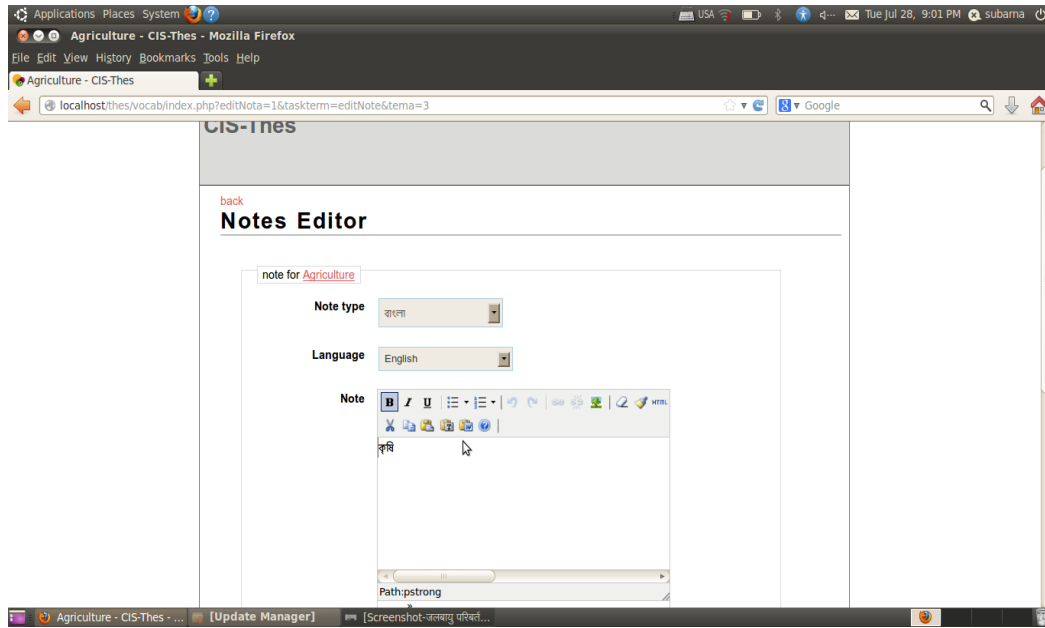
Note type	Alias	Orden	Submit
Scope note	NA	1	2 notes
Nota catalografica	NC	2	0 notes
Historic note	NH	2	0 notes
Bibliographic note	NB	3	0 notes
Private note	NP	4	0 notes
বাংলা	LN	5	454 notes
ইংরেজি	LN1	6	52 notes
English	eng	7	2 notes

Screen shot 4: Configuring notes to input Language label

11.5 Final Display

After configuration, we can input the language equivalent of the term in it's note section for final display.

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Screenshot 5: Inputting data at language label

Here a thesaurus containing Community information related terms are designed and the name of the thesaurus is CIS thes.

A sample entry from CIS thes for term *Agriculture* (कृषि) in three languages are shown below:

कृषि

English

Agriculture

- NT1 आहार, खाद्य ▶
- NT1 उर्बरक
- NT1 ऋण योजनाएं
- NT1 कीडेमकडे
- NT1 कृषि उत्पादनता

- NT1 कृषि एवं सिंचाइ
- NT1 कृषिय जनसंख्या
- NT1 कृषिय बिकाश ▶
- NT1 कृषीय बनबिद्या
- NT1 जैब कृषि
- NT1 फसलें
- NT1 ब्यापारेय पेड़/बृक्ष
- NT1 मिट्टी ▶
- NT1 लाभदाही कृषक
- NT1 सामाजिक एवं कृषीय बनबिद्या
- RT खाद्य आपुर्ति
- RT खेत

11.6 How Multilinguality is Finally Achieved

There are so many approaches of building a multilingual thesaurus as described by Hudon (1997) (as cited in Neelameghan & Raghavan, 2005).

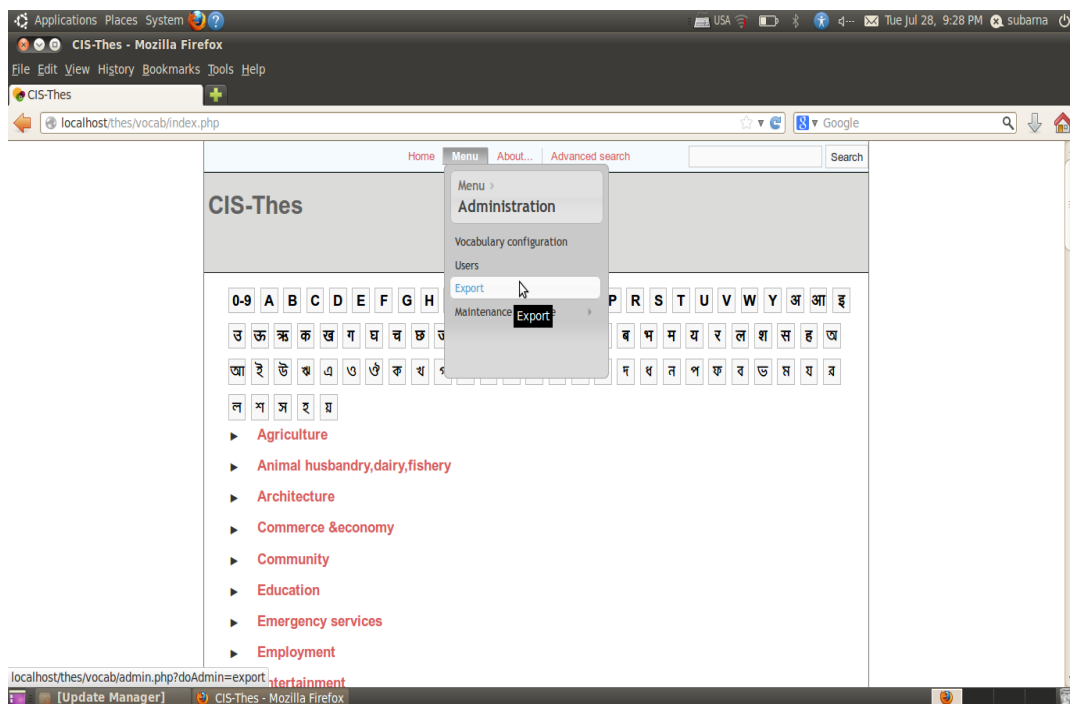
The approaches are:

- Starting with one language and adding other language(s);
- Starting with more than one language simultaneously;
- Merging two or more existing thesauri in two or more different languages into a new multilingual thesaurus;
- Linking to each other two or more existing thesauri; and
- Translating an existing thesaurus in a language into one or more other languages.

We have followed the first approach. We first designed the community thesaurus in English language. The terms of the thesaurus in English were translated in to Bengali and Hindi with the help of standard language dictionaries and technical dictionaries. In some cases language experts were also consulted.

11.7 Interoperability of CIS Thes

Interoperability means the ability of working a database in two or more systems. According to ISO 25964-2 “Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged” (ISO 25964-2, 2013). Interoperability can be achieved through mapping device and presenting data in a standard format and by using systems having common computer protocols. Principle aim of interoperability is to convert data from one vocabulary system to another. Tematres provide the interoperability by exporting it's data in to various standard formats, e.g-SKOS core, Zthes, Hierarchical text, Alphabetical text, etc. To do this we have to go Menu>Administration>Export option. Then the required exportable XML formats may be chosen.



Screen shot 6: Export option in CIS thes

Let we exemplified some exported data from CIS thes in various formats-

SKOS - SKOS is a tool for converting thesaurus data into XML format readable and manageable by the machine for interoperability.

```
</skos:Concept>
-
<skos:Concept rdf:about="http://localhost/thes/vocab/?tema=1143">
<skos:prefLabel xml:lang="en">कृषि</skos:prefLabel>
<skos:inScheme rdf:resource="http://localhost/thes/vocab/" />
<skos:broader rdf:resource="http://localhost/thes/vocab/?tema=1142" />
< dct:created>2015-04-13 17:47:40</ dct:created>
</skos:Concept>
-
<skos:Concept rdf:about="http://localhost/thes/vocab/?tema=1243">
<skos:prefLabel xml:lang="en">कृषि उत्पादनता</skos:prefLabel>
<skos:inScheme rdf:resource="http://localhost/thes/vocab/" />
<skos:broader rdf:resource="http://localhost/thes/vocab/?tema=1065" />
< dct:created>2015-05-09 17:03:32</ dct:created>
</skos:Concept>
-
<skos:Concept rdf:about="http://localhost/thes/vocab/?tema=1150">
<skos:prefLabel xml:lang="en">कृषि एवं खाद्य</skos:prefLabel>
<skos:inScheme rdf:resource="http://localhost/thes/vocab/" />
<skos:broader rdf:resource="http://localhost/thes/vocab/?tema=1148" />
< dct:created>2015-04-13 17:54:06</ dct:created>
```

Hierarchical text format -In this display Terms are presented in a hierarchical form assigned by indentions.

- कृषि
 - . आहार, खाद्य
 - . . खाद्य आबसर
 - . . खाद्य निश्चितता
 - . . खाद्य बिज्डान
 - . . खाद्य सूरक्षा
 - . . खाद्य सेवा
 - . . खाद्य, नागरिक सापुर्ति, एवं उपभोक्ता बिषय
 - . उर्बरक

- . ऋण योजनाएं
- . कीडेमकडे
- . कृषि उत्पादनता
- . कृषि एवं सिंचाई
- . कृषिय जनसंख्या
- . कृषिय बिकाश
- . . प्रदर्शन भुखण्ड
- . . सामुहिक सिंचाई कुंए
- . कृषीय बनबिद्या
- . जैब कृषि
- . फसलें
- . ब्यापारेय पेड़/बृक्ष
- . मिट्टी
- . . आपत्तण
- . . कृषि की किस्में
- . . टाक्टर का रखरखाब
- . लाभदाही कृषक
- . सामाजिक एवं कृषीय बनबिद्या

Zthes format: The Zthes family of specifications facilitate interoperability for applications that deal with thesauri - semantic hierarchies of terms as described in ISO 2788 and ANSI/NISO Z39.19.

(<http://zthes.z3950.org/>)

कृषि

Tipo de término: TT

- NT: आहार, खाद्य
- NT: उर्बरक
- NT: ऋण योजनाएं

- NT: कीडेमकडे
- NT: कृषि उत्पादनता
- NT: कृषि एवं सिंचाई
- NT: कृषिय जनसंख्या
- NT: कृषिय बिकाश
- NT: कृषीय बनबिद्या
- NT: जैब कृषि
- NT: फसलें
- NT: ब्यापारेय पेड़/बृक्ष
- NT: मिट्टी
- NT: लाभदाही कृषक
- NT: सामाजिक एवं कृषीय बनबिद्या
 - RT: खेत
 - RT: खाद्य आपूर्ति

12 CONCLUSION

At the time of selection of term especially in local vernacular (i.e. here Bengali) we considered the recall value of terms as reflected in the local community survey. We followed the guidelines of ISO 25964 as far as possible where the structure of the thesauri is concerned. Computerized thesauri have some advantages over printed ones like they are easily editable, portable, manageable, sharable, search able, safe in handling, output may be printed in various formats and many others. The ISO 25964 not only guides for designing a multilingual thesaurus but also make it computer readable and exchangeable. Tematres may be utilised as a useful thesaurus management tool because it has almost all the essential qualities as described in ISO 25964, discussed earlier. It is also SKOS-compliant so that this database is interchangeable globally. Moreover it is a open source software. Tematres therefore may be used as an effective tool for digital multilingual thesaurus construction.

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