Establishing a Standard Metadata Web Portal to Support Discovery of Spatial Data in State Organizations

A dissertation submitted for the Degree of Master of Computer Science

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Declaration

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute.

To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

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ABSTRACT

At present, Spatial data sets are collected by a number of government organizations in isolation and only serving individual organizations' purposes but not for considering the expectations and requirements of other stakeholders. These data sets are managed in closed systems and this has created a large information stack. As a result, these data systems collected by organizations cannot be accessed by other organizations. Also, It is difficult to understand what information is available and where it is stored etc. This has led to repetitions and several organizations collecting the same information because they are unaware of the types of information that already exist. Manual data sharing procedures contribute to delay in sharing, and the effort required to manually integrate updates from one agency to another is labour intensive and time consuming. General public should be able to access geographic information required in government institutions. Therefore, it was decided to develop a common platform to share geospatial information.

When considering about metadata, there are a number of standards to maintain metadata. It was very difficult to compare metadata due to lack of having standards,. Hence research was carried out to understand already available data and metadata. International standards such as ISO19115, FGDC standard, ISOTC etc were examined. For research purpose Survey Department, Disaster management and LUPPD and RDA data was collected and compared with ISO standards.

Standard metadata web portal was developed to produce as a solution to this problem. It was designed based on the management and administrative requirements of selected government organizations. Most of the time, the system produced maximum support to the user. The developed Standard metadata web portal has the ability to upload datasets of different organizations, define mapping based on ISO classification for uploaded datasets and for the department data sets. The system provides facility to manage users and verify uploaded datasets with the ISO classification. This also provides strategies to view core metadata records, detailed view and provides comparison of mapped data with the original dataset

This Centralized standard metadata web portal has been developed using some modern open sourced tools and software. PHP, which is a powerful server side scripting language, has been used for server side scripting along with the Apache web server and PostgreSQL which is an object relational database management system with an emphasis on extensibility and standards compliance

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LIST OF ABREVIATIONS

Term	Description
NSDI	National Spatial Data Infrastructure
SDI	Spatial Data Infrastructure
FGDC	Federal Geodetic Data Committee
OGC	Open Geospatial Consortium
CSDGM	Standards for Digital Geospatial Metadata
GIS	Geographic Information Systems
ISO	In Search Of
NAP	North American Profile
ESRI	Environmental Systems Research Institute
FOSS	Free And Open Source Software
LUPPD	Land Used Policy Planning Division
RDA	Road Development Authority

CHAPTER 1 – INTRODUCTION

1.1 PROBLEM DOMAIN AND MOTIVATION

With the development of information technology, information is considered as the main resource to make correct decisions. In Sri Lanka, there is no effective mechanism for effectively sharing geospatial information across various government institutions, people, commercial and non-commercial basis. Lack of coordination has resulted in duplication of spatial data at different government institutions and it is difficult to share available information. General public should be able to access geographic information required in government institutions. Therefore, it is necessary to have a common platform to share geospatial information.

Spatial data infrastructure is the key indicator to share manage and publish spatial data and it is the "technology, policies, standards, human resources and related activities necessary to acquire, process, distribute use and preserve spatial data" [1] .

Different organizations collect the same data repeatedly overtime, by not knowing the fact that the data they require are already available. This is mainly because of the non-availability of metadata information of spatial data maintained by government organizations and other private agencies for easy access through a catalogue based search that would enable to explore the right information for the right purpose, saving time and cost.

When considering metadata there are number of standards to maintain metadata. Without having standards, it is very difficult to compare metadata. It is required to understand the suitability of metadata standards for available geospatial data. What standards used in the government departments.

1.2 PROJECT OBJECTIVES

Developing a platform to make metadata public so that anybody can access metadata available in different organizations (Survey department, Disaster Management centre, LUPPD, RDA) online through a common web portal.

Following are the specific objectives to find the information requirements.

- Investigating how metadata are maintained
    - What type of architecture is used by government organizations to keep metadata?

  - How do organizations that handle spatial data maintain metadata?

- Explore what software is used to create metadata.
  - What GIS software do support metadata?
  - What metadata models do present GIS software have?

- Design and implement a prototype to handle metadata efficiently and effectively.
  - Which architecture is most appropriate in developing a metadata portal?
  - Which type of metadata is highly important for geospatial users and the general public?

1.3 RELATED PROJECTS

Geospatial information hub by Hong Kong Government which is an information sharing platform to support government services to the community [2]. Wet-win Project enhances the role of wetlands in integrated water resource management for the twinned river basin. [3]. The Netherlands has established registers for cadastral and topographic information, [4]. by establishing working setup of system and regulations including an agreement with the Dutch government and legal approval developing and constructing the necessary database infrastructure and financing mechanisms

Publishing metadata of geospatial indicators as Linked Open Data is a policy-oriented approach [5]. which elaborated a profile of the Data Catalog Vocabulary (DCAT) for describing geospatial indicators, including additional information on the related policy assessments, spatial characteristics, the provenance, and the measurement variables and dimensions of indicators. Federal Geographic Data Committee (FGDC) The Geospatial Platform is an FGDC initiative that provides shared and trusted geospatial data services, and applications. Where users can search a massive catalog of geospatial data and tools provided by a multitude of federal agencies [6].

European Spatial Data Infrastructure which enables the sharing of environmental spatial information among public sector organizations, facilitate public access to spatial information across Europe and assist in policy-making across boundaries [7]. Singapore has established a national repository of land data called Land Data Hub (LDH) to

facilitate sharing of data across the public sector. All spatial data are collated and presented in SLA's Land Information Network and clearinghouse, which was its Land Net system[8]. Qatar implemented nation-wide GIS is to ensure that everybody uses a common geospatial framework. Identified the data needed for decision-making at all levels, A National Database has been developed. Meta Data and Data Standards have been developed [9].

1.4 PROJECT SCOPE

Scope of the research is as following.

- Obtaining details of the types of spatial data used in three key government organizations.
- Literature review of existing metadata standards for spatial data.
- Identification of what data to be represented as metadata.
- Identify and document technology components such as hardware, software, databases and standards, which are needed to build Spatial Data Infrastructure.
- Implement a metadata model to describe geospatial data, adopting to local context.
- Organization of populating metadata to the prototype.
- Testing and evaluation of metadata prototype.

1.5 DOCUMENT STRUCTURE

Chapter 1-Introduction

The problems faced currently and how to overcome these problems with the proposed system is described. Explains the user expectations and describes objectives of the project.

Chapter 2-Analysis

This chapter describes the fact-finding techniques used in gathering user requirements. Functional and non-functional requirements of the proposed system also be included.

Chapter 3-Design

Initial design diagrams and the methodological approach used in the system designing will be discussed. This part explains how the system meets those functional requirements.

Chapter 4-Implementation

This chapter provides appropriate codings, implementation techniques and development Tools will be used in the project. Explains the hardware and software requirements of the system.

Chapter 5-Evaluation

Developed system will be tested against the user requirements which are gathered at the beginning.

Chapter 6-Conclusion

Discussed about the future improvements which can be done in the future. Will also provide an outcome of the project.

CHAPTER 2 : BACKGROUND

2.1 SPATIAL DATA INFRASTRUCTURE

Spatial data infrastructure is the framework of geographic information that implements data. Metadata, users and tools in terms of data infrastructure. This provides efficient and flexible use of data. The spatial data infrastructure was made by the US national research council to define standardized geographic information access. SDI is described as "the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data." [10]. The major use of SDI is to make the rules of data sharing which helps in saving time and reduce the effort by different departments [11]. Main advantage of using SDI is the avoid duplication of data and it helps to maintain data integration with other datasets [12]. Hence, many SDI projects have been made in different countries which are differ from local departments to the national level [13 - 17]. Main components of NSDI are geospatial data, and partnerships. These components act as a foundation of maintaining consistency and structure for documenting spatial data and provide a network for data sharing [18]. This research mainly focuses on creating metadata model, which supports NSDI.

2.2 METADATA

Metadata is data about data. This is a term used to describe structured information or characteristics of a set of data. This term widely used over decades and increased popularity with the use of Web. But the concepts of the metadata have been used form the day of information and data collection and organization of those data. Metadata catalogues have been used to denote various metadata. It supports collection, management of spatial information and Act as a metadata discovery tools [19]. Metadata concepts are more familiar to people who use spatial data.

Metadata helps to find and understand how to use spatial data. Not only people but also organizations that use spatial information and produce spatial data are benefit from metadata. Major component of NSDI is metadata. It allows users and organizations to find metadata from different servers. There are two principal users of metadata catalogues mainly for spatial data producers and for spatial data users. For spatial data producers it provides a framework for documenting and recording of spatial data and putting forward its content to users. For users

Spatial data has many essential uses such as browsing and viewing spatial data, determining whether spatial data meet application requirements, and the way to find spatial records by searching metadata [20].

Main reason for creating metadata is finding of relevant information, if spatial data in digital format organize those electronic resources, provide interoperability of resources, allow digital identification, support downloading metadata and data preservation. Resource discovery of metadata function as finding resources based on different criteria, identification and make similar resources together, provide location information and differentiate unrelated resources [21].

There are three main types of metadata [21].

Descriptive Metadata – Describes a discovery and identification information of resources. It provides the basic information about the content and nature of data sources. This answers what, why when who, where and how questions about spatial data.
And elements of title, abstract, originator, geographical extent.

Structural metadata - This defines how to put compound objects collectively. Fitness of data for a given purpose. After the discovery of metadata more detailed and more specific metadata is needed. Structural metadata provides properties required to allow the prospective end user know whether the data will meet general requirements of a given problem. Ex- how pages are ordered to form chapters.

Administrative Metadata – This provides information of short term and long term management and processing of digital resource. Such as technical resource creation, methods of creation, access control and facilitates information about data dictionary, application schema and other parameters which are required by users of spatial data
Administrative metadata can be further divided into two
Rights Management Metadata - Supports intellectual property rights.
Preservation Metadata – Covers information needed to record and preserve resources.

Even though there are different types of standards it is necessary to select correct metadata types based on user requirements.

2.3 METADATA STANDARDS

Metadata should refer to a standard. These standards were developed through the consultative process. Since these standards are used in wider community software programmes developed to implement standards. Without having proper standards it is very difficult to compare metadata. This provides facilities to share data and it ensures restrictions enforced by methods. Without these standards it is difficult to understand what spatial data exist, quality of data, contact person of data, suitability of data for particular users [22].

There are different international metadata standards such as

ISO 19115 Geographic Information – Metadata

ISO / TC 211

United States Federal Geographic Data Committee (FGDC) standard, the Content Standards for Digital Geospatial Metadata (CSDGM)

Dublin Core – Online Computer Library Centre

Open Geospatial Consortium (OGC)

ISO 19115 Geographic Information

The official standards of metadata are published by the ISO. Through the work of its Technical Committee 211(ISO/TC 211) the ISO has performed a principal role in the standardization of geographic information. The ISO/TC 211 has created a comprehensive set of standards for vector data that integrates all most important developments within the subject.

ISO 19100 standards encompass ideal solutions. Other departments which include OGC have already defined requirements for the implementation level. Those already implemented solutions were well formed in current formats or in updated situations. [23].

ISO 19115 "Metadata Standard" gained great popularity in the ISO 19100 series. It gives a large number of metadata elements and attributes which are needed for geographic applications. The ISO 19115 joins with the well-known standard of Federal Geographic Data Committee (FGDC) which provides sources for metadata listing. Well knows geographic information software providers have started to integrate ISO 19115 standards in the GIS systems which supports automated metadata generation of geographic information [24].

ISO 19115 was circulated as an international standard in 2003. The metadata-model of the ISO 19115 consist with 20 core metadata elements and 400 elements [25].

Federal Geographic Data Committee (FGDC) standard

FGDC standard was established in the United States in 1994.This acts as a clearinghouse of geospatial data. FGDC supports usage sharing, dissemination and coordination of geospatial data across the nation. Standard documentation development was established in 1998 which was defined as Content standard for Digital Geospatial Metadata (CSDGM). FGDC standard only focuses on standardization of spatial data which does not covered by other standards. This data standard helps to share information with the federal agencies it supports interoperability of data.

FGDC standard consists of 200 elements it was composed as an order of compound elements. These compound elements consist of different data elements and those are mapped into 39 domains. Data types of each element can be categorized into integer, date time, text, and real.

FGDC metadata consists of 7 compound elements and two mandatory elements as displayed in Figure 2.1 other elements are mandatory if applicable. Compound elements describe the content information of metadata and define in a higher level. FGDC-STD-001-1998 consist of 12 elements which are logically primitive type of data.

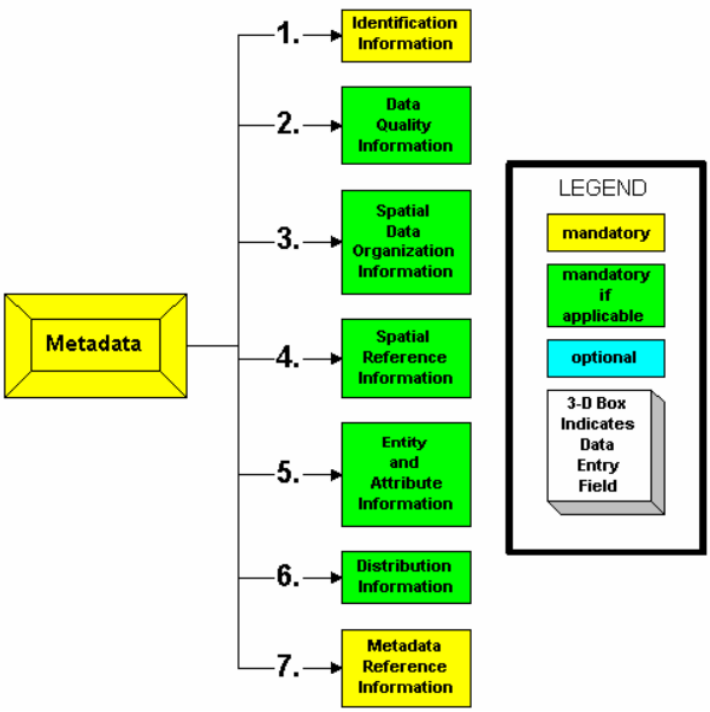


FIGURE 2. 1 FGDC Standard Classification

2.4 EXISTING METADATA TOOLS

2.4.1 Proprietary software

ArcGIS10

Arc GIS supports full metadata creation and it compliance with multiple standards such as, Federal Geographic Data Committee's (FGDC) Content Standard, ISO 19139 standard, ISO 19115 a metadata content standard for describing data, ISO 19119 standard which defines services, The North American Profile of ISO 19115:2003 (NAP) and others. Esri ArcGIS is an easy to use metadata editor which provides web forms and facilitates metadata content validation, reusing of contact information. Proprietary metadata storage is provided by arc GIS and uses XSLT transformation for import, editing, synchronization, and export of metadata.

It allows to understand the objectives of metadata and save content snippets. New approach of metadata provides facilities to search datasets accurately. Arc GIS desktop application supports to search metadata records related to each spatial data sets and helps to get an idea of an objective of metadata [26].

Geo Media Catalogue

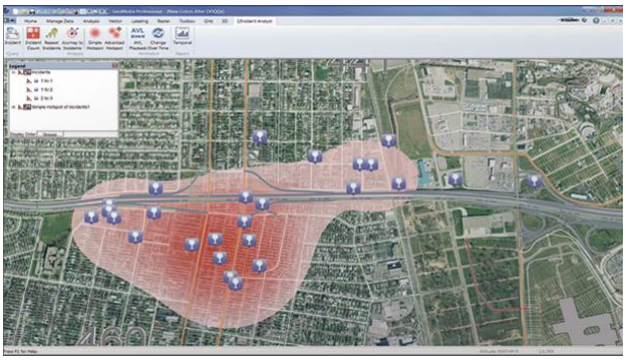


FIGURE 2. 2 Geo Media Catalogue

Geo Media Catalogue, displayed in Figure 2.2 is the fully functional GIS solution which captures intelligent information from geospatial data and incorporates it to a current information. This is a very productive system which captures correct, reliable and topologically clean data. The system has efficient procedures for validation and error detection and correction of external data sources.

Core system consists of main functionalities for capture, validate and analyse geographic spatial data. Innovative data server architecture of this product supports users to directly connect to different sources simultaneously and analyse contents accordingly. Catalogue supports connection with live data and makes queries for extracting information from dynamically varying sources. It enables users and organizations to capture rich information timely manner [27].

MapInfo Manager

Map info manager is a metadata management web application which provides management of organizational spatial data by enabling access, search and application of data available in various organizations. Metadata library offers comprehensive description about available data and facilitates editing of available spatial metadata. It supports metadata harvesting and compliance with ISO 19115/19139 (ISO/GMD) schema. This is a product with flexible map displays, advanced analytics and customization which is an ideal product for diversified potential users. [28].

2.4.2 Freeware/Shareware Tools

USGS Online Metadata Editor

This tool helps to record metadata of the dataset by questioning about the data in a simple language. It provides facility to Add, edit records, upload data, view previous records and save records for future review and view those on the desktop. The product offers XML output in the Federal Geographic Data Committee (FGDC) Content Standard for Digital Geospatial Metadata [29].

USGS Metadata Wizard

USGS metadata wizard is a product for Arc Desktop system to provide a semi-automated process for create, update metadata records in ESRI ARC system. The product supports CSDGM metadata standard. It automatically populates some metadata elements as an input such as spatial reference, extent of the dataset, spatial data representation format, date of metadata creation, vector and raster data information. Once these elements are automatically uploaded to the system users can define attributes and metadata information using a GUI [30].

Geo Network

Geo Network is a free and open source catalogue application to manage spatially referenced resources. It provides a user-friendly interface for search, view and edits metadata across various catalogues. The product has a powerful and interactive map viewer.

Geo network is a dominant and low cost tool which use a new architecture to link geospatial data sharing communities together and it was developed based on the Open Standards for services and protocols (from ISO/TC211 and OGC). Metadata editor supports ISO19115/119/110 standards and provide multilingual metadata editing, validation and provide improvements for metadata quality [30].

2.5 GIS RELATED TECHNOLOGIES

2.5.1 Vector Data

Vector data is a coordinate based data model. It comprises of points, lines and polygons as displayed in Figure 2.3.

- Points – A pair of X and Y coordinates (Used to represent non-adjacent features and represent discrete data points)
- Lines - A sequence of points (Used to represent linear features such as rivers, trails and streets)
- Polygons – A closed set of lines (Represent areas such as boundary of city, lake or forest)

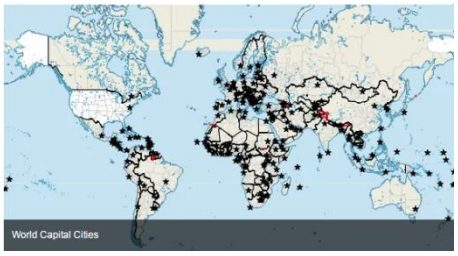


FIGURE 2. 3 Vector Data

2.5.2 Raster Data

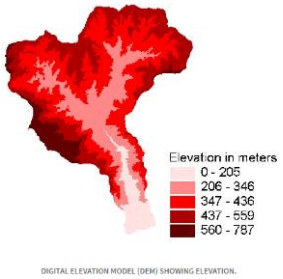


FIGURE 2. 4 : Raster Data

Raster is a method of storage, processing and displaying of data. Area is divided into rows and columns, which forms a rectangular mesh of square cells as displayed in Figure 2.4. There are two types of raster data such as continuous and discrete data and three types of raster datasets such as thematic data, spectral data and pictures. Raster structures may lead to increase storage in certain situations, since they store each cell in matrix whatever it is a feature or empty space.

CHAPTER 3 : ANALYSIS & DESIGN

3.1 INTRODUCTION

Analysis phase is the most significant phase. It is necessary to get a clear idea about the problem domain and what are the user's requirements. The main objective of the analysis was to identify and discover the user requirements clearly and accurately. The analysis phase also identified the expectation of the new system and combination of methods used to gather the user requirements of the proposed system.

3.2 ANALYSIS OF EXISTING PROCESS AND CURRENT PROBLEM

Survey Department, LUPPD and Disaster Management Centre have collected a vast amount of spatial data. It is very difficult to share this information between these government institutions. Spatial data could not access to border community. Currently spatial data are collected by each organization in order to carry out their processes without thinking about the use for other departments or organizations.

Data collected by different organizations are not accessible. It is difficult to know what information is available and which department produce that data. This leads to a collection of duplicate data.

These organizations have their own data sharing policies. Because of these policies, it is necessary to have written agreements between organizations to share data. Currently they share data manually and it is time consuming and labour intensive.

Since these data are not integrated properly evidence based decision-making is not possible. There are few links between spatial data spread across these departments. Hence, in the users' perspective these data are not meaningful. It is necessary to find a method to integrate spatial data spread across these government organizations.

METHODS ADOPTED

3.3 REQUIREMENT GATHERING TECHNIQUES

Requirement gathering was an essential part of the analysis and was the initial stage of the system analysis. Since that is the most difficult, considerable time has to be spent here. Should take wise decisions to make the analysis phase a success. If client's requirements were not gathered and identified accurately, the final prototype would not have met the user's expectation, and the costs of maintaining and enhancing the system would have been excessively high. Finally prototype would have become meaningless.

Requirement is a very important part of any software project because the system requirement is a description of the needs and desires of a system. Badly managed requirement analysis, the system may not meet the users' expectation and that dissatisfaction may cause to delay or even cancellation of the project. Therefore understanding what is on the client's mind is important here.

Following techniques have been used for gathering requirements.

- Observation.

  Day to day work was observed and notes made of the actual task in which participants are involved.

- Interviews.

  Most of the details of the system were gathered through interviews with the stakeholders.

  Collect information from the staff members through face-to-face interaction. Analyst can carry out unstructured interviews or structured interviews according to the situation. Mainly Structured interviews were carried out using structured questionnaire.

- Inspection of existing documentation.

Details of the organization documents and reports were used to collect information.

3.4 COLLECTED DATA

Requirement analysis was carried out from Survey department, Land Use Policy Planning Department(LUPPD), Disaster Management Centre (DMC) and Road Development Authority(RDA). All geospatial metadata was collected from the area of Topographic 10K tiles 6608, 6609, 6613, 6614. Although the area was selected as tiles different organizations maintain data in a seamless manner.

Based on above mentioned techniques primary data and secondary data were gathered for analysis. As a primary data structured questionnaire (APPENDIX B the requirement gathering questionnaire) was used to gather data and interviews with each department individuals was carried out. As secondary data, data dictionaries of Survey department and feature classification of LUPPD was collected and already gathered data in each organization was observed.

Since the research is on finding a solution to share available metadata in selected state organizations, the main focus of questions was based on standards, policies, technologies and general information. Available data was collected based on FGDC and ISO 19115 standards.

3.5 DATA ANALYSIS

Development of metadata was influenced by the size of the department, patterns of the data management within organization and size of data holdings. The convention is to store metadata in separate documents by using software such as spreadsheets, word documents and databases. Selected departments maintain files of documents or digital formats to store information generated by the departments. They collect duplicate data and do not adapt to metadata standards. These departments can share their spatial information by adapting to standards.

Officers agreed that it is important to have knowledge about what metadata exist and it is the path to have what metadata standards to be used and adapting to those standards. Many departments didn't think of having more complex systems to manage metadata. When departments get expanded and data production gets larger it is necessary to adapt to standards and use software to manage metadata.

Officers interviewed agreed to provide informal, unstructured documentation, but they may not need to go through the rigors of fully structured formal metadata. Based on the review it was identified that they record a small amount of metadata daily. Most GIS and image processing software are capable of collecting and reporting quantitative metadata for the user rather than expecting human input. It saves a significant amount of time and effort of metadata preparation.

3.5.1 SIGNIFICANCE OF ANALYSIS

Following are some of the vital findings of the requirement gathering process. Those were finalized after analyzing responses from stakeholders of each organization and based on knowledge gathered from available literature.

- Currently any of these organizations do not have proper mechanism to maintain metadata of their available data sets.
- Main provider of base data is Survey department. Survey department also act as a user of the base data. Many other organizations are users of base data but at the same time organizations like LUPPD and RDA generates base data on top of survey department data.

  More details on base data usage is given in Table 3.1 and Figure 3.1

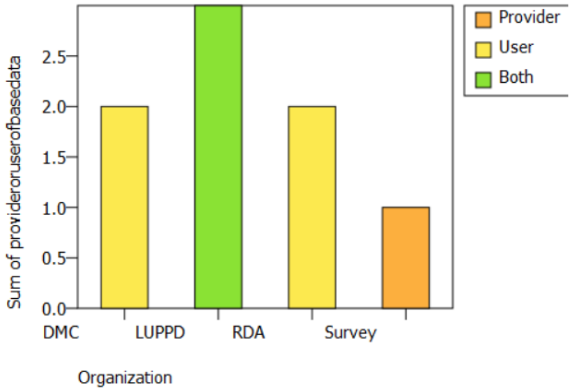


FIGURE 3. 1 Base Data Usage

Organizations	Provider/User	Providers	Users
Survey Department	Provider	Raw data only, google, stat data stereo data providing companies	Government departments, UDA, RDA, Municipalities, private companies, PM office, ministries and individual use etc..
LUPPD	Both	Survey Department, Forest Dept, Wildlife	Irrigation, Agriculture Dept, DMC, CEA, Megapolis, UDA, NBRO, Universities
DMC	User	Survey Department, LUPPD	
RDA	User	Survey Department	Forest Dept, Agriculture Dept, Wildlife,

TABLE 3. 1 Base data usage

- All selected organizations are generating spatial data.
- Many organizations are using some web applications to publish data and people can find the availability of data only by an inquiry as displayed in Figure3.2.

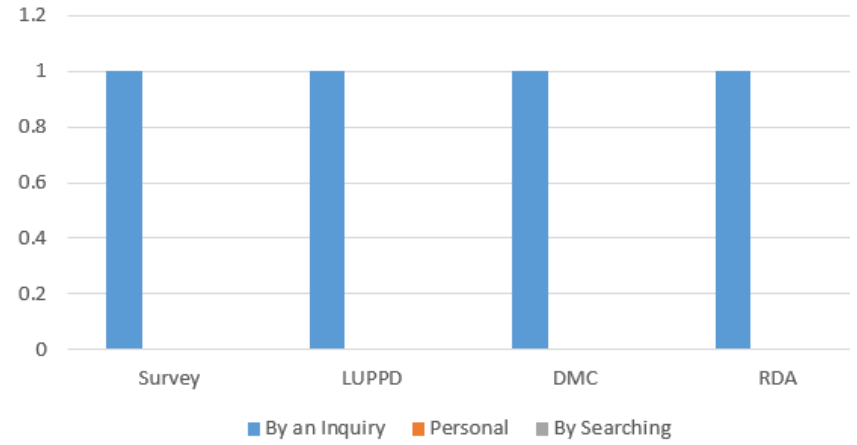


FIGURE 3. 2 Search availability of data

- Currently available base or thematic data can be accessed from external sources by manually as requested or through DVD, email.
- Many state organizations do not maintain international standards for data modelling, Metadata representation, Metadata publication and sharing as displayed in Figure 3.3.

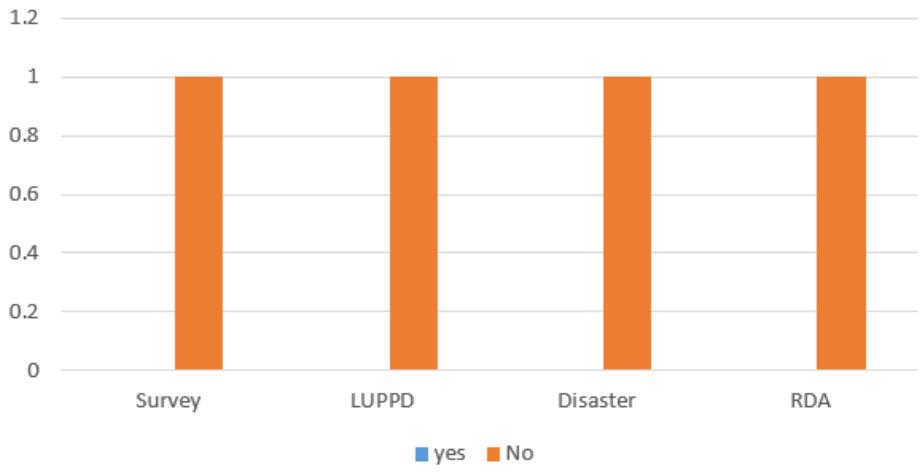


FIGURE 3. 3 International Standard Usage for metadata

- Survey department maintains local standards for above categories and all the other organizations adheres to those local standards for maintaining data. Apart from that LUPPD and RDA maintain their own local standards as displayed in Figure 3.4.

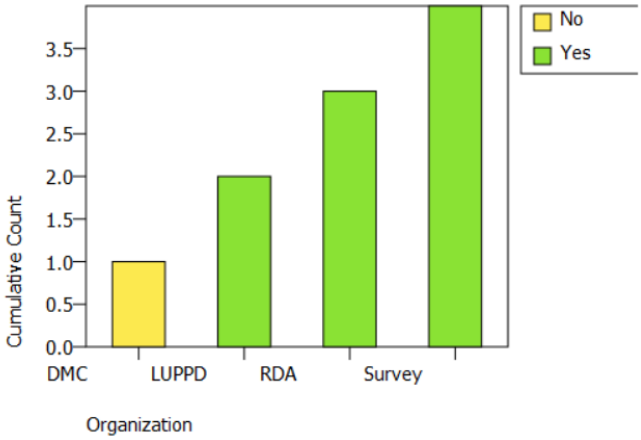


FIGURE 3. 4 Local Standard Usage

- State organizations have different types of information management processes and have long term strategies to manage geospatial information.
- Policies were established for administration of geospatial information and exchanging data.
- Many organizations do not have web platform for storing, updating, dissemination and sharing geospatial data.
- Based on the gathered questionnaire responses it was identified that there is an architecture in survey department for database models with coding and classifications but no appropriate architecture for overall data management. An architecture was not used by other state organizations to maintain metadata.

Selected state organizations maintain various metadata. Details of the recorded metadata are given in the following Table 3.2.

Survey Department	DMC	LUPPD	RDA
S_No	Title	Object ID	Route No
GFCode	License	Shape	Name of Road
V_1 Data source	Abstract	Luse_Code	Province
V_1 year of DB creation	Publication Date	Main_Category	CE Region
V_1 scale of source	Type		EE code
V_1 Year of Source	Keywords	Sub_Category	EE division
Data_Source	Category	Method of updating	Length From
Y_Photo	Regions	Year of updating	Length To
Scale of Photography	Owner	Shape Length	Total Length
Update Source	Maintenance Frequency	Shape area	District
Update Year	Restrictions		Class
Google Year	Edition		Type
Old_Data	Purpose		Link ID
Prep_Status	Language		Start
Y_Compiled	Data Quality		End
Field_Revision	Supplemental Information		TL_Lb_Addi
Map_Prepared	Spatial Representation Type		GFCode
Y_Databased			
LL_X_Coord			
LL_Y_Coord			
NP_Data			
Source_DB			
New_Source			
Y_New_Source			
Month			
GIS_Operator			
GIS_Progress			
Work_Type			
ABMP_Date			
TDB_Status			
Format			
Sheet_Cov			
Remarks			
Province			
District			
DSDivision			
P_Location			
SH			
No. of Version			
Area_Sqkm			
Progress_New			
Method of Creation			
Version 1			
Shape Length			
Shape Area			

TABLE 3. 2 Metadata records captured by state organizations

Although other departments share base data from Survey Department, According to above data it was identified that Organizations record various metadata and there is no interoperability between those records. It was difficult to identify available datasets and share data based on these records. State organizations do not maintain proper standards for recording metadata. Hence it was decided to create standard metadata profile to store metadata records in a proper manner.

When data production gets larger access to those data is difficult. Hence it was decided to create centralized architecture to maintain metadata where each organization maintains their geospatial metadata according to standards and develop common portal to integrate all data available in these departments. Customer can access any information available in these departments through common portal.

3.6 METADATA PROFILE CREATION

Throughout the study existing metadata standards and requirements of the selected government organizations were examined. During the process metadata standards such as FGDC standard and ISO19115 metadata standards were examined separately. Those standards were used for creation of metadata portal. Based on the ISO 19115 classification main metadata elements are categorized into packages as displayed in Figure 3.5. These packages were taken as base for this portal and based on the requirements of selected government organizations some packages and elements were selected.

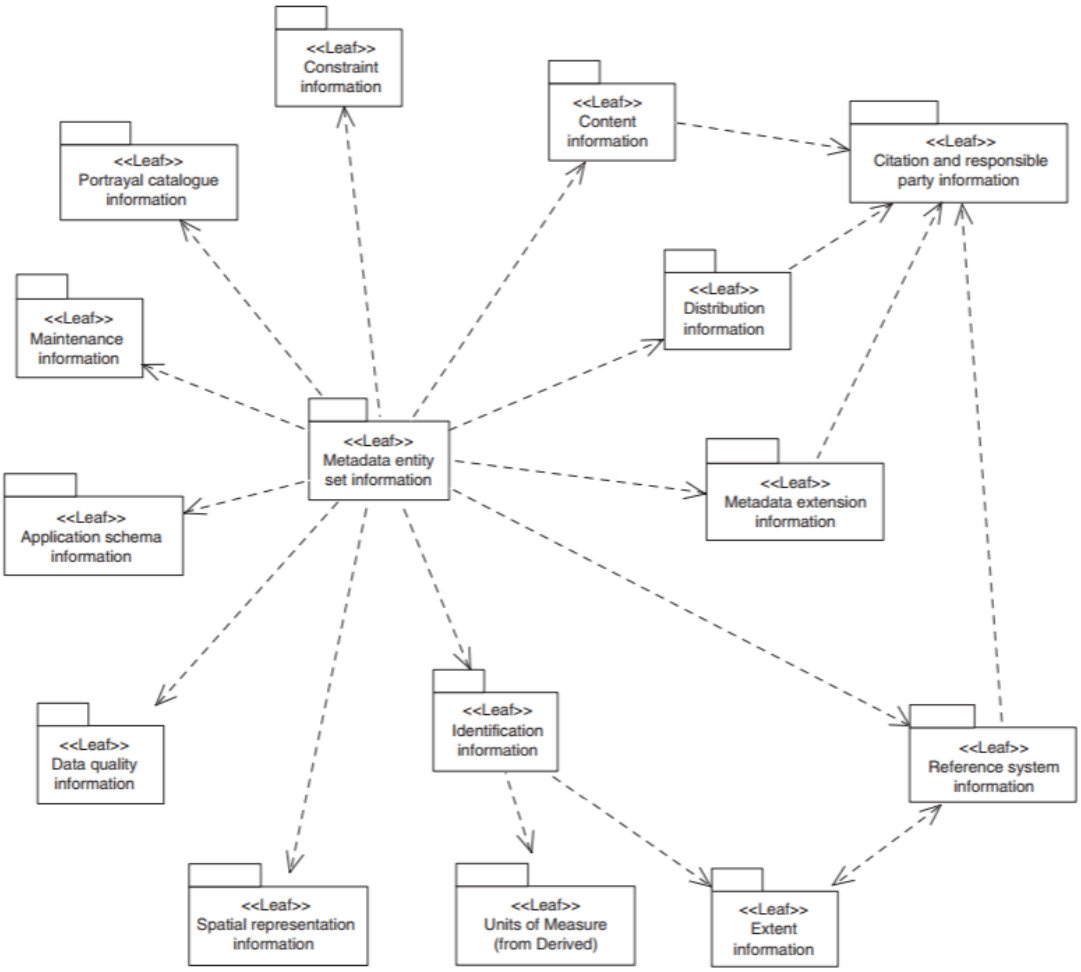


FIGURE 3.5 ISO Metadata Packages

Geospatial metadata can be categorized into two based on ISO 19115 classification as displayed in Figure 3.6.

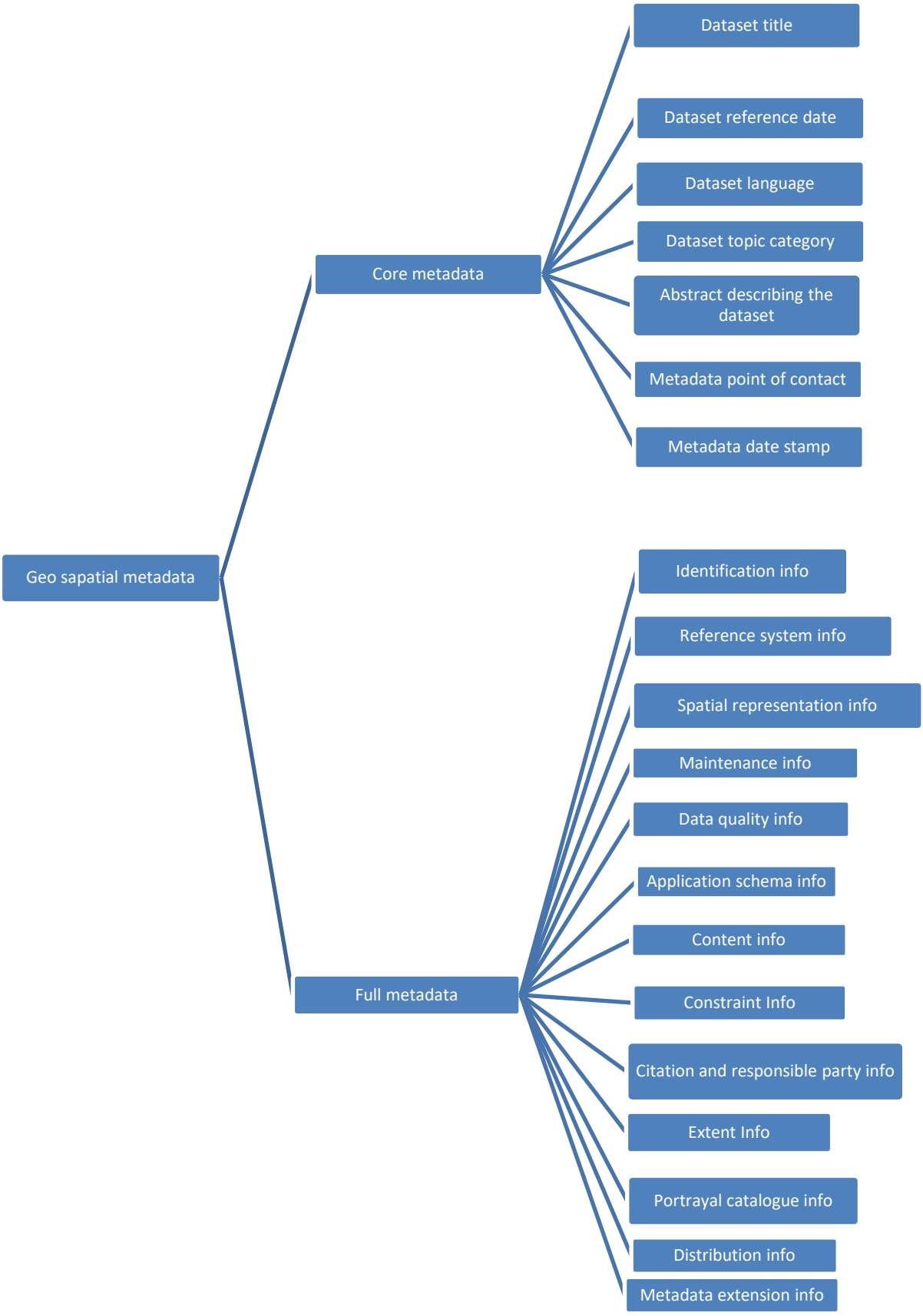


FIGURE 3. 6 Metadata Categorization

Based on ISO classification only mandatory core metadata was selected for the main view of the portal

1. Dataset title
2. Dataset reference date
3. Dataset language
4. Dataset topic category
5. Abstract describing the dataset
6. Metadata point of contact
7. Metadata date stamp

As the elements of the metadata packages all the sub-elements of packages are created as classes and attributes of it in logical model as displayed in Figure 3.7.

Since many organizations use base data from survey department it was decided to maintain data classification based on survey department data dictionary (APPENDIX C).

Main classes of ISO classification was identified and according to the examination these classes can be mapped into main themes of survey department. Class themes and category mapping list is attached in the APPENDIX D.

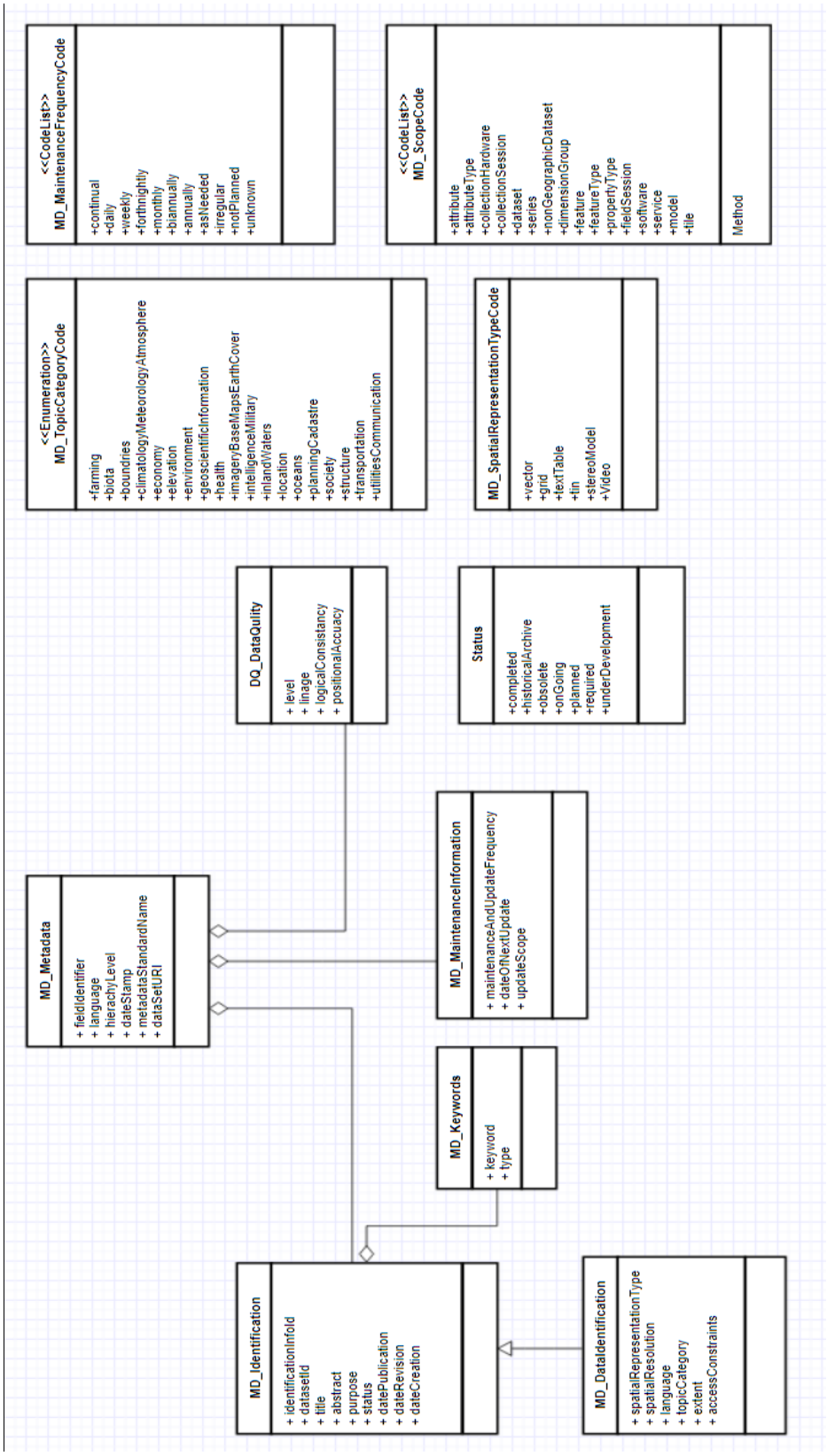


FIGURE 3. 7 Logical Model of the ISO classification.

3.7 SYSTEM USERS

System users are displayed in Table 3.3

User Type	Role
System Administrator	Institute and user management Verify mappings
Authorized persons from the departments	Manage dataset information. Define mappings.
General Public	View datasets and request required datasets
Department users	Dataset entry.

TABLE 3. 3 System Users

3.8 FUNCTIONAL REQUIREMENTS

No	Description of the Functional Requirements
01	Department user should be able to register with the system.
02	Department user should be able to enter department information
03	Department user should be able to enter contact details
04	Admin user should be able to verify registered use and approve users.
05	Admin user should be able to add institute abbreviation.
06	Department user should be able to add metadata of data set based on ISO classification.
07	Department user should be able to view matched and unmatched fields of ISO classification.
08	Department user should be able to define their own mapping
09	After define mapping department user should be able to upload CSV.
10	Admin user should be able to verify mappings submitted by different departments.
11	System should be able to generate dataset ID based on the logged in department.
12	Department user should be able to upload CSV.
13	Public user should be able to view datasets by topic categories.
14	Public user should be able to view datasets under each topic category.
15	Public user should be able to view core elements of the each data set.
16	Public user should be able to view detailed view of each dataset.

17	Public user should be able to view original dataset and respective mapped dataset.
18	Public user should be able to contact dataset owners and request datasets.
19	If one admin user has defined a mapping other users in the same department should not be able to define mapping again.
20	If dataset includes different data than saved dataset mapping department user should be able to define that.
21	Upload available dataset metadata into the system through common web service

TABLE 3. 4 – Functional Requirements

3.9 NON-FUNCTIONAL REQUIREMENTS

The requirements, which are not directly concerned with the functions of the system, are called non-functional requirements. Define system properties and constraints eg. Reliability, response time and storage requirements. They define constraints such as input / output device capability, data representations used in system interfaces. Process requirements (non-functional) may also be specified mandating a particular CASE system, programming language or development method.

Numbers of non-functional requirements are associated with the system as whole rather than the individual features. Therefore, these non-functional requirements are more vital than functional requirements.

3.9.1 Non-functional requirement classification

- **System Requirements**

  Requirements which specify the behaviour of the delivered system.

  Eg: Reliability
  Portability
  Accessibility

- **Organizational Requirements**

  Requirements which are consequences of organizational policies and procedures.

  Eg: Standard Processes Used
  Organizational policies for data sharing
  Implementation requirements

- **External Requirements.**

Requirements which arise from factors which are external to the system and its development process.

Eg: Interoperability requirements,
Legislative requirements, etc.

Metrics for specifying non-functional requirements

- **Speed**
  - Processed transactions/second
  - User/event response time screen
  - Screens refresh time.
- **Ease of use**
  - Training time
  - Number of help frames
- **Reliability**
  - Mean time to failure
  - Probability of unavailability
  - Rate of failure occurrence
  - Availability
- **Robustness**
  - Time to restart after failure
  - Percentage of events causing failure
  - Probability of data corruption on failure
- **Portability**
  - Percentage of target dependent statements.
  - Number of target systems.

3.10 NON-FUNCTIONAL REQUIREMENTS IN DEVELOPED PROTOTYPE

Functional requirement of the client were successfully achieved by the introduced system prototype. Non-functional requirements of the prototype as follows.

- Fast response time
- Reliability
- Simplicity of the application.
- Handle high amount of data
- Maintainability
- User friendliness

These requirements were essential in the operation of the system and those were achieved successfully.

Final prototype was implemented and provided different departments to use the prototype. Acceptance testing was done by each department. Non-functional requirements should be expressed quantitatively using metrics that can be objectively tested. Measurements can be made during system testing to determine whether or not the system meets these requirements.

3.11 SELECTED SOLUTION JUSTIFICATION

Considering the operational environment and client requirements of the system it was decided to use web-based system with centralized architecture, so that anyone can access the system from any location. System is used by different users such as a general public, Authorized person from selected government organizations, government organizations and non-government organizations and other organizations who are interested about available datasets in state organizations. It will be more convenient if all users can access the same database of datasets. It enables effective and timely communications within different organizations and enables greater sharing of information and collaboration across the different organizations and general public. Metadata of datasets can be stored centrally and accessed by authorized users. Hence, we concluded that a web based system is more appropriate for the metadata portal.

3.12 DATABASE DESIGN

Database is a collection of related data. Database plays an important role in all areas where information technology used such as business, management.

3.12.1 Entity Relationship Diagram

The relationship of different entities in the database is illustrated graphically by the entity relationship diagram. The formulation of the ER diagram is an important phase in design process, which helps to design system in a robust manner. By normalization it can be converted to physical data. ER diagram of the system is displayed in Figure 3.8.

Description of Notations used

Entity Relationship Diagrams uses three major abstractions to describe data.

- **Entities** – Distinct objects in the system
- **Relationship** – Meaningful interaction between objects
- **Attributes** – Properties of the entities and relationships.
- **Cardinality** – Number of records participate in a relationship
    - o One to One – (1:1)
    - o One to Many – (1:M)
    - o Many to Many – (M: N)

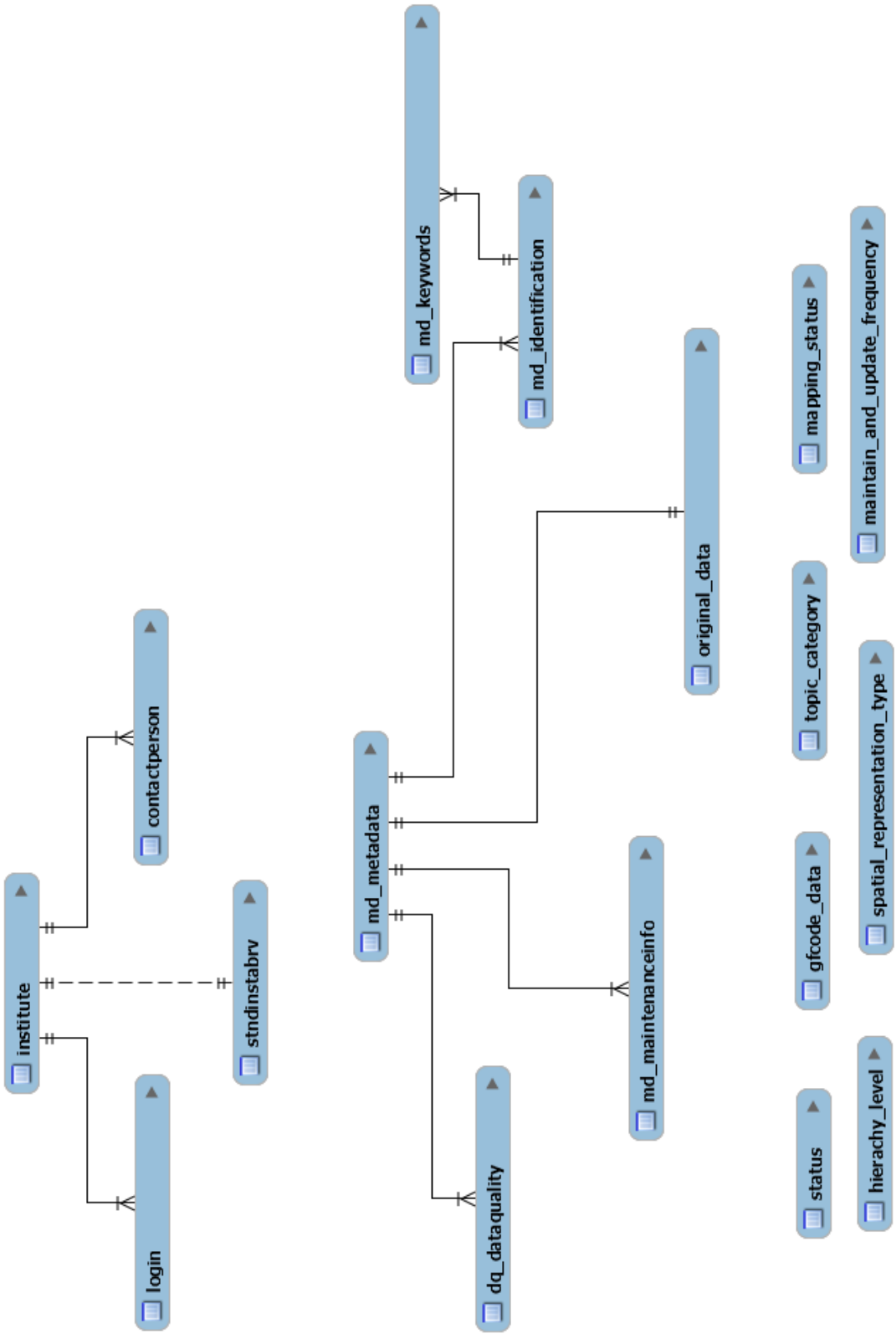


FIGURE 3. 8 Entity Relationship Diagram

3.13 USE CASE DIAGRAM

Following Figure 3.9 includes the identified main use cases of the system.

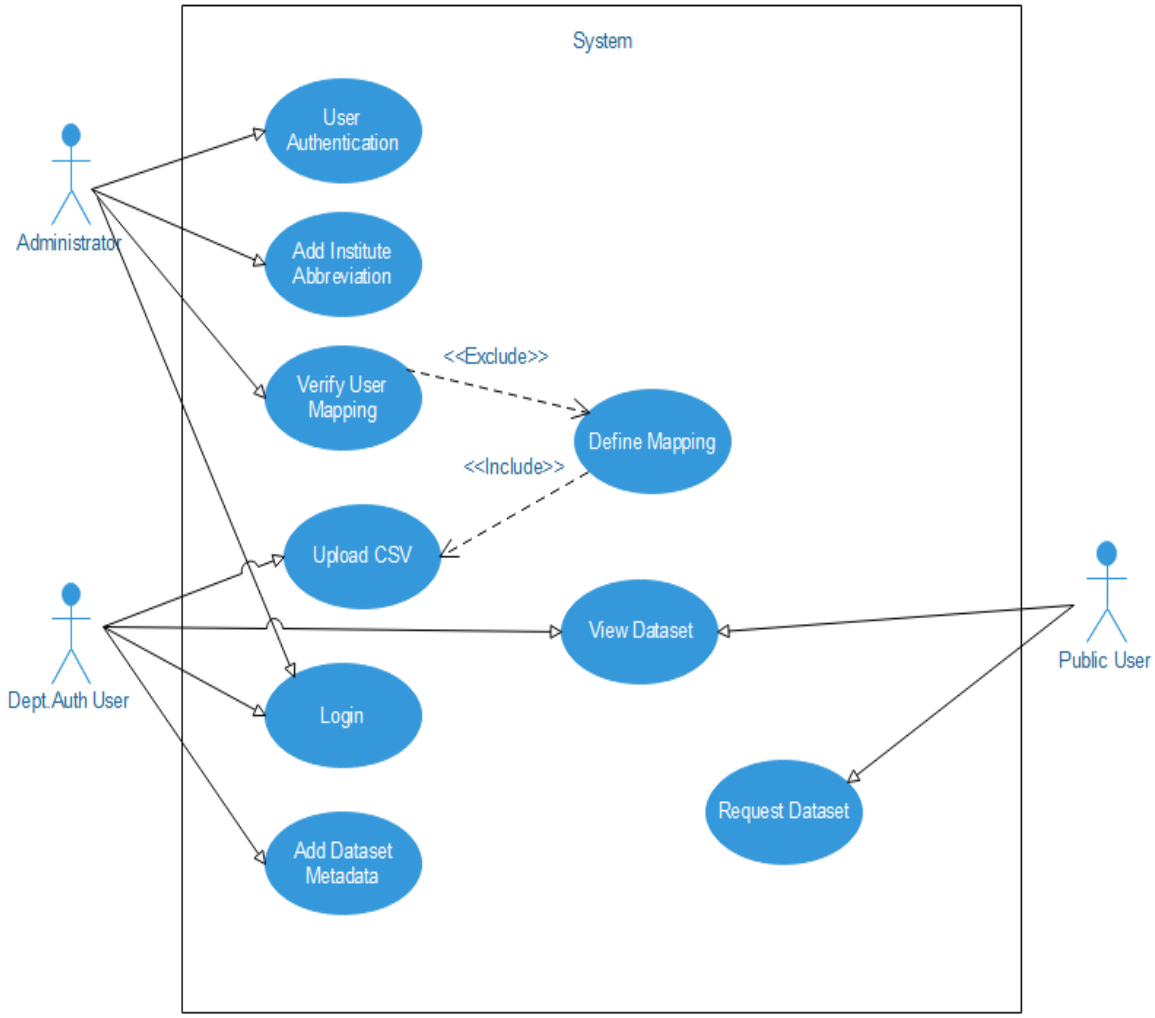


FIGURE 3. 9 Use Case Diagram

Main user functions describe in detail in below mention Table 3.5, Table 3.6, Table 3.7, Table 3.8, Table 3.9, Table 3.10, Table 3.11, Table 3.12

3.14 Use Case Description

Use Case	**Login**
	Describes the user login process of the system.
Actor	Authorized users of different departments
Pre Conditions	The user should have been added to the system by an administrator
Main Flow Description	• User should enter username and password • Verify username and password with the database • Enter details to system log
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• If correct navigate user to home page • Else display error messages

TABLE 3. 5 User Login

Use Case	**User Authentication**
	Describes the user authentication process of the system.
Actor	Administrator
Pre Conditions	New user should have been registered with the system
Main Flow Description	• Use case will be start when the actor wants to authenticate registered users. • Administrator will be approve registered users. • Approved users will be submitted to the system by the actor • These details will be stored to the database by giving a successful message
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• If success display success message and navigate user to home page • Else display error messages

TABLE 3. 6 – User Authentication

Use Case	**Add institute Abbreviation**
	Describes the add institute abbreviation process of the system.
Actor	Administrator
Pre Conditions	Institute should have been registered with the system
Main Flow Description	• Use case will be started when the actor wants to add institute abbreviation. • Actor will add institute abbreviation to each registered institute. • Update institute abbreviation.
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• If success display success message and navigate user to home page • Else display error messages

TABLE 3. 7 Add institute abbreviation

Use Case	**Verify user mapping**
	Describes the user mapping verification process of the system.
Actor	Administrator
Pre Conditions	Metadata CSV should have uploaded to the system Authorized person from each department should define the mapping for dataset
Main Flow Description	• Use case will be started when the actor wants to verify mapping of each organization • Actor will select a specific institute to verify the mapping • System will load the mapping screen of the selected organization. • Actor will check mapped fields with ISO classifications and department standards, verify mapping. • Mapped records will be submitted to the system by the actor • These details will be stored to the database by giving a successful message.
Alternative Flows	Non Filled Required fields • Error message will be displayed.

Post Conditions	• User mapping is verified. • If there are any error in the mapping, display an error message and prompt user to verify the details again.

TABLE 3. 8 Verify User Mapping

Use Case	**Add Metadata**
	Describes the add metadata process of the system.
Actor	Authorized users of different departments
Pre Conditions	User should have been logged in to the system
Main Flow Description	• Use case will be started when the actor wants to add metadata of different datasets. • System will auto generate dataset ID based on logged in department. • Actor will add metadata based on categories. • Metadata records will be submitted to the system by the actor. • These details will be stored to the database by giving a successful message.
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• Database successfully updated • If there are any error in the entered data, display an error message and prompt user to enter the details again.

TABLE 3. 9 Add Metadata

Use Case	**Upload CSV**
	Describes upload CSV process of the system.
Actor	Authorized users of different departments
Pre Conditions	User should have been logged in to the system
Main Flow Description	• Use case will be started when the actor wants to add bulk metadata records. • Actor will upload CSV file with bulk metadata records. • Metadata records will be submitted to the system by the actor.

	• These details will be stored to the database by giving a successful message.
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• CSV successfully uploaded. • If there is any error in uploaded CSV, display an error message and prompt user to upload the CSV again.

TABLE 3. 10 – Upload CSV

Use Case	**Define mapping**
	Describes define mapping process of the system.
Actor	Authorized users of different departments
Pre Conditions	User should have been logged in to the system User should have uploaded the CSV
Main Flow Description	• Use case will be started when the actor wants to add bulk metadata records. • Actor will upload CSV file with bulk metadata records. • Actor should check matching and mismatch records with the ISO classification • Actor should define new mapping based on the organization • Metadata mapping records will be submitted to the system by the actor. • These details will be stored to the database by giving a successful message.
Alternative Flows	Non Filled Required fields • Error message will be displayed.
Post Conditions	• Database successfully updated • If there are any error in the mapping, display an error message and prompt user to define the mapping again.

TABLE 3. 11 Define mapping

Use Case	**View metadata datasets**
	Describes metadata viewing process of the system.
Actor	Public users
Pre Conditions	User should have been access the system.
Main Flow Description	• Use case will be started when the actor wants to view metadata datasets of different organization. • Actor can view metadata topic categories in the main screen • Actor will click selected topic category to view available dataset. • System will load the available datasets for selected topic category • Actor will click detail view to view detailed dataset. • Actor will be able to compare the dataset with the original dataset.
Alternative Flows	None
Post Conditions	• Selected data will be displayed on the screen

TABLE 3. 12 View metadata dataset

3.15 USER INTERFACE DESIGN

When designing a user interface should consider about user requirements and functional requirements. The main aim of the user interface is that it will furnish user the best ways of how to interact with the system. Good User interface design can be achieved through following principals

User familiarity – the interface should use the terms and concepts that are familiar to the system users and should not be forced to adapt to an interface because it is convenient for implement.

Consistency – System commands and menus should have the same format, parameters should pass to all commands in the same way and command punctuation should be similar. Consistent interfaces reduce user learning time.

Minimal surprise – users should never be surprised by the behaviour of the system. Users get very irritated when a system behaves in an unexpected way. If an action in one context causes a particular type of change it is reasonable to expect that the same action will cause a similar

change in a different context. Surprises cause of the fact that the interfaces are modelled (Eg: Viewing mode and Editing mode). It is very important in designing interfaces to include a visual indicator showing the current mode.

Recoverability – Interfaces should include mechanism to allow users to recover from errors. Confirmation of Destructive Actions that is system should ask the user to confirm the action if a user specifies an action which is destructive.
Provision of an Undo facility – undo restores the system to a state before the action occurred and multiple levels of undo are useful as users do not always realize the mistake immediately.

Check pointing – This involves saving the state of the system at periodic intervals and allowing the system to restart from the last checkpoint.

User Guidance – Interfaces should have built in user assistance or help facilities in different levels. Levels should range from basic information on getting started to a full description of system facilities.

User Diversity – Interface should provide appropriate interaction facilities for different types of system users [31].

3.16 MAIN INTERFACES

System interface has to be user-friendly as some of the users are not very computer literate and some users are prone to physical inabilities like forgetfulness, making mistakes. Because of the above physical setbacks system was introduced with standardized fonts colour themes and template which are pleasing to the user and can get familiar with the system easily.

Data Mapping Interface

Once user upload csv user will redirect to data mapping screen of the web portal as displayed in Figure 3.10. It will display main ISO categories.

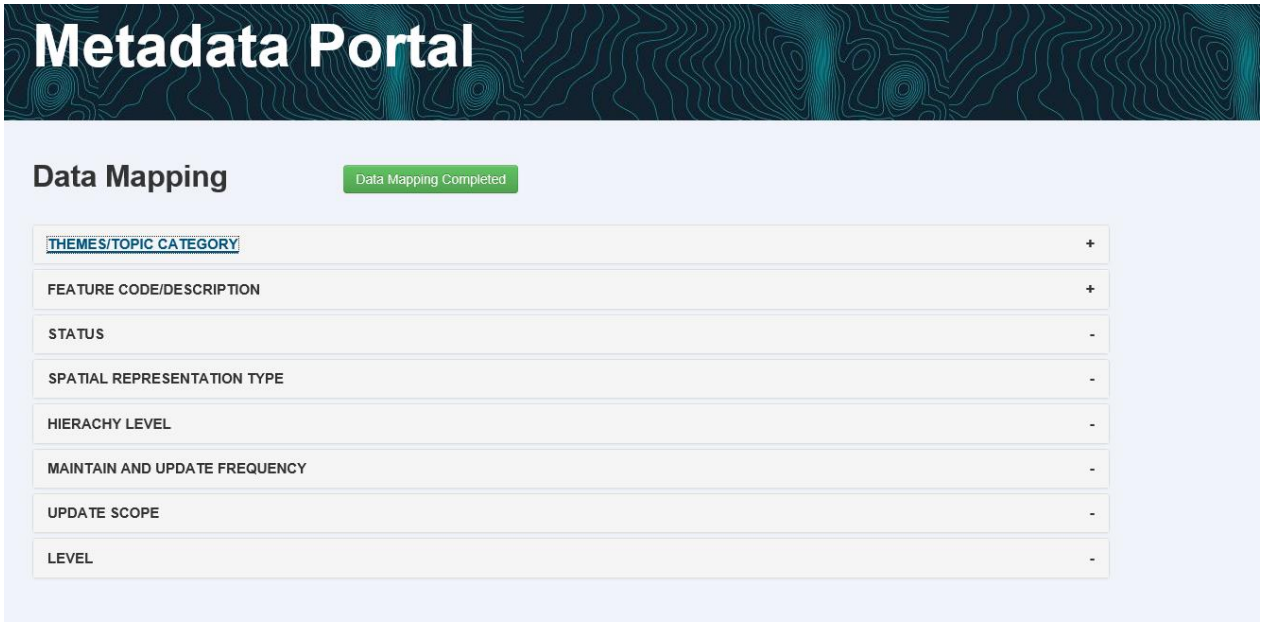


FIGURE 3. 10 Main Mapping Screen

Uploaded data are matched with ISO classification metadata elements and display matched and mismatched fields of each data record as displayed in Figure 3.11. This screen allows users to define their own mapping.

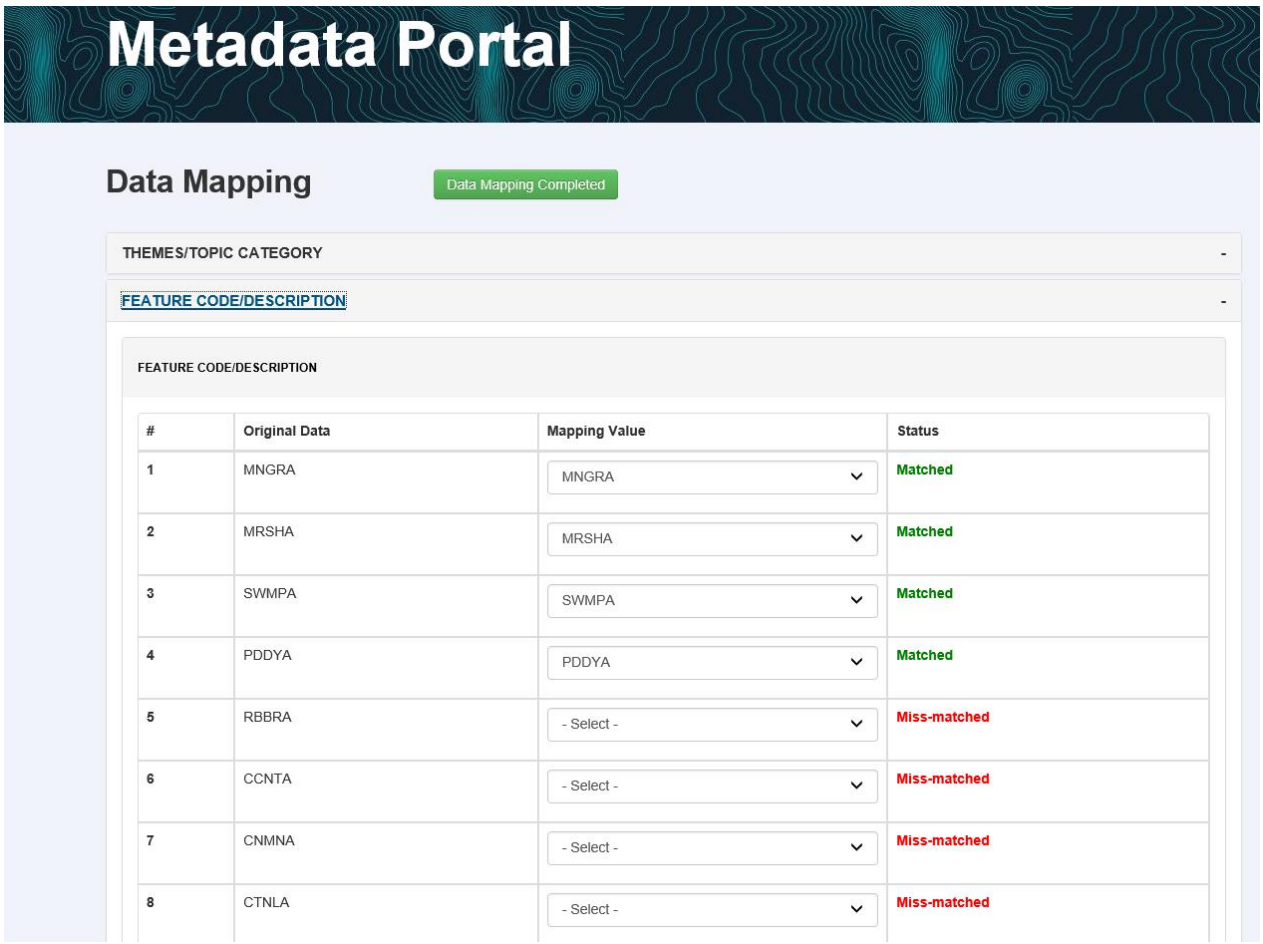


FIGURE 3. 11 Detailed Main Mapping Screen

File Upload Interface

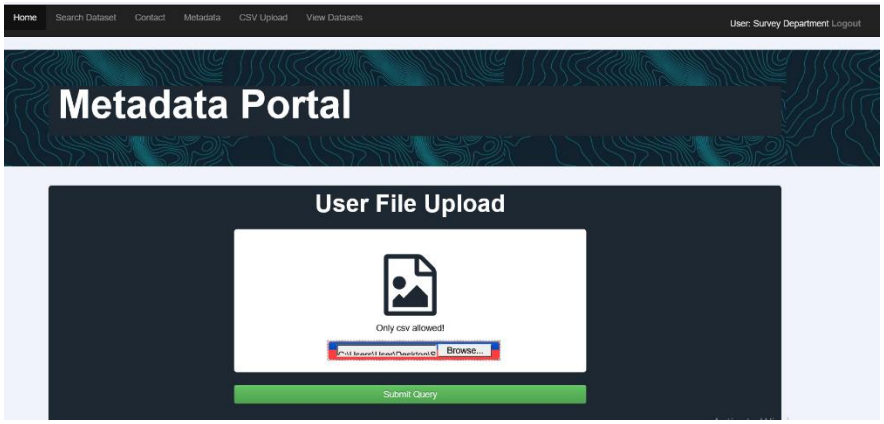


FIGURE 3. 12 Upload CSV

Above interface Figure 3.12 allows user to bulk upload metadata records as a CSV file.

Remaining user interfaces are included in the Appendix A

CHAPTER 4 – IMPLEMENTATION

4.1 INTRODUCTION

Implementation is the most important stage of the project, which converts the design into a working system. Hardware and software requirements to implement the system and important codes in the project will be discussed in this chapter.

Objective of this phase is to reduce the cost of development by optimizing resources and having understandable and readable codes to produce more maintainable product. This will increase the rapidity of the work and improves the quality of the work.

4.2 HARDWARE AND SOFTWARE REQUIREMENTS

Following Hardware and software were used during the development.

Hardware Requirements

- Intel(R) Core(TM) i7 processor 3.1GHz
- 8GB RAM
- 15 GB free space in the hard disk

Software Requirement

- Microsoft Windows 10 Professional
- WAMP version 3.1.0
    - W-Windows(version)
    - A-Apache(version 2.4.27)
    - M-MySql(version 5.7.19)
    - P-PHP (version 5.6.31)
- pgAdmin (Version 4)
- Visual Studio Code
- Microsoft Office Project Professional 2013

4.2.1– WAMP Server

In order to execute the PHP script WAMP SERVER has been used with above mentioned features. WAMP is an acronym for Windows, Apache, MySQL and PHP. It provides four key elements of a Web server: an operating system, database, Web server and Web scripting software. WAMP is a free and open source software bundle, which is downloadable through the internet under the GPL licenses.

4.2.1 TECHNOLOGIES

- PHP (Hypertext Pre Processor)
- PostgreSQL used to handle all the database components
- XHTML was used to build the base Interfaces of the system and CSS used for styling.
- JavaScript was used to do all the client-side validation

4.3 REUSED MODULES

To make software development easier developers use already developed existing codes. Following reusable codes were included in the prototype.

• **DHTMLX Calendar** - is a lightweight cross-browser JavaScript calendar which can be configured as a popup date picker or a flat calendar. The component is easy-to-use and fully customizable. It can be attached to any text input field and provides fast and intuitive date selection in web-based applications. [31]

• **JQuery Accordion** - UI provides abstractions for low-level interaction and animation, advanced effects and high-level, themeable widgets, built on top of the jQuery JavaScript Library, that you can use to build highly interactive web applications.[32]

Major code segments are included in Appendix G

CHAPTER 5 –RESULTS & EVALUATION

This chapter mainly focuses on the evaluation of the proposed prototype system. Testing is an important phase in a software development lifecycle. It is a formal process to check whether the system meets the users‟ requirement specification. Testing is a dynamic verification and validation technique because it works with an executable section of the system. Testing ensures the quality of the software.

5.1 SOFTWARE VERIFICATION AND VALIDATION

This is a process of checking that the system conforms to its specification and fulfils its intended purpose.

Verification: - process of checking that the software conforms its specification.(Are we building the right product?)

Validation: - process of checking whether the system satisfied all the user requirement (Are we building the product right?)

5.2 LEVELS OF TESTING

5.2.1 UNIT TESTING

Unit testing was used to test smallest unit of the software component or module. This was carried out parallel with the software development process. Unit testing complements integration and system level testing.

5.2.2 INTEGRATION TESTING

Integrated testing is the activity of software testing which individual software modules are combined and tested as a group. This was begun as soon as usable versions of the system components were available.

5.2.3 SYSTEM TESTING

System testing was carried out at the completion of the integration testing. The purpose of system testing was to ensure that the system conforms to its specifications and meets the user requirements correctly.

5.3 TEST PALAN

Test planning is one of the most important factors in successful software testing. It gives detailed testing information regarding the system test. These plans include Acceptance, Integration and Unit test plans. Test plan concern with setting out standard for testing process rather than describing product test. It maps with the system requirements and define entries to the system test.

5.4 TEST CASES

Test case design is the most important part of the test plan. Objective of the test case design is to develop test case for each and every component or module. Test cases were used to detect program defects of each unit and to detect whether the system meets its requirements. In order to reduce the complexity system was divided into modules and those modules were tested separately.

Test cases were designed based on following approaches.

Black Box testing -takes an external perspective of the test object to derive test cases. These tests can be functional or non-functional, though usually functional. The test designer selects valid and invalid input and determines the correct output. There is no knowledge of the test object's internal structure. [31]

White Box testing- uses an internal perspective of the system to design test cases based on internal structure. It requires programming skills to identify all paths through the software. The tester chooses test data to exercise paths through the code and determines the appropriate outputs. The tests are based on the actual implementation if the implementation changes the tests probably will need to change. [32]

Acceptance testing At this stage system developer is not involved and it is generally carried out by the client. The primary goal is to ensure that the system meets the client requirement specification. In acceptance testing client, select real data of short period. During this process client has to test security and response time. Therefore, minor errors in the system will be detected and the acceptance testing criteria was revalidate with the earlier tests. This will enable the client to ensure that system meets their requirements.

5.5 TEST CASES

5.5.1 User Login

User login test case is shown in Table 5.1

No	Test Description	Expected Output	Actual Output	State
01	Select username and enter valid password	Load the system	Load the system	Pass
02	Select user name and enter invalid password	Display an error message	Display an error message	Pass
03	Select username and leave empty password	Display an error message	Display an error message	Pass
04	Leave empty username and leave empty password	Display an error message	Display an error message	Pass

TABLE 5. 1 User Login Test Case

5.5.2 Institute Registration

Institute registration test case is shown in Table 5.2

No	Test Description	Expected Output	Actual Output	State
01	Enter valid data to required fields	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty institute name	Display an error message “Please enter institute name”	Display an error message “Please enter institute name”	Pass
03	Leave empty address	Display an error message “Please enter address”	Display an error message “Please enter address”	Pass
04	Leave empty designation of the head	Display an error message “Please enter designation of the head”	Display an error message “Please enter designation of the head”	Pass
05	Leave empty telephone no	Display an error message	Display an error message	Pass
06	Leave empty fax	Display an error message	Display an error message	Pass
07	Leave empty email	Display an error message	Display an error message	Pass
08	Enter invalid email	Display an error message	Display an error message	Pass
09	Leave empty web link to institution	Display an error message	Display an error message	Pass

TABLE 5. 2 Institute Registration Test case

5.5.2 Contact Person Registration

Contact Person registration test case is shown in Table 5.3

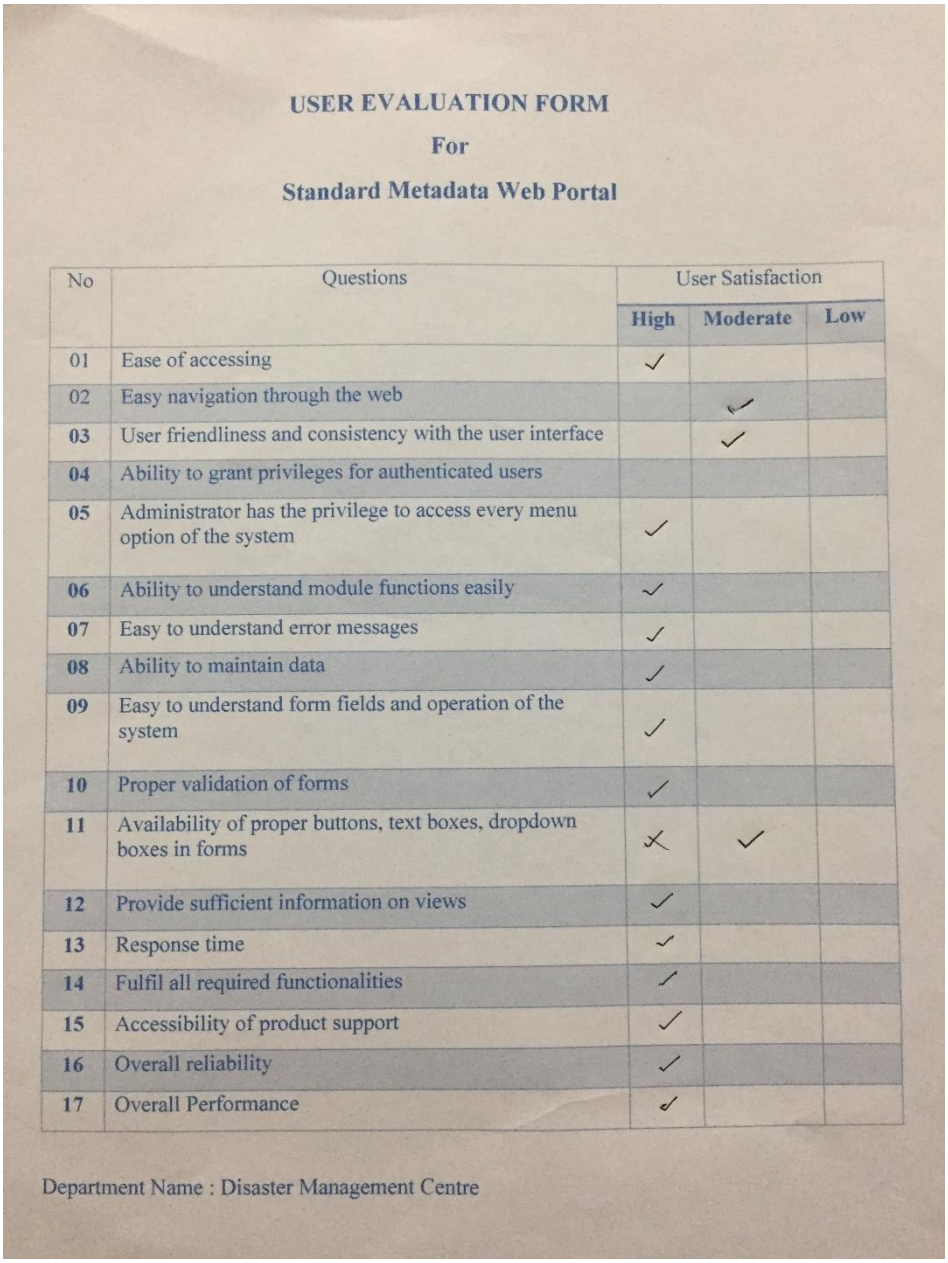
No	Test Description	Expected Output	Actual Output	State
01	Enter valid data to required fields	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty user name	Display an error message “Please enter user name”	Display an error message “Please enter user name”	Pass
03	Leave empty designation	Display an error message “Please enter designation”	Display an error message “Please enter designation”	Pass
04	Leave empty telephone no	Display an error message	Display an error message	Pass
05	Leave empty fax	Display an error message	Display an error message	Pass
06	Leave empty email	Display an error message	Display an error message	Pass
07	Enter invalid email	Display an error message	Display an error message	Pass
08	Leave empty password	Display an error message	Display an error message	Pass

TABLE 5. 3 Contact Person Registration Test case

Remaining test cases are included in the Appendix E

5.6 ACCEPTANCE TEST RESULTS

User evaluation form is shown in Figure 5.1



USER EVALUATION FORM

For

Standard Metadata Web Portal

No	Questions	User Satisfaction		
		High	**Moderate**	**Low**
01	Ease of accessing	✓		
02	Easy navigation through the web		✓	
03	User friendliness and consistency with the user interface		✓	
04	Ability to grant privileges for authenticated users			
05	Administrator has the privilege to access every menu option of the system	✓		
06	Ability to understand module functions easily	✓		
07	Easy to understand error messages	✓		
08	Ability to maintain data	✓		
09	Easy to understand form fields and operation of the system	✓		
10	Proper validation of forms	✓		
11	Availability of proper buttons, text boxes, dropdown boxes in forms	✗	✓	
12	Provide sufficient information on views	✓		
13	Response time	✓		
14	Fulfil all required functionalities	✓		
15	Accessibility of product support	✓		
16	Overall reliability	✓		
17	Overall Performance	✓		

Department Name : Disaster Management Centre

FIGURE 5. 1 User Evaluation Form

Remaining acceptance test results are included in the Appendix F

5.7 PROTOTYPE ASSESSMENT

Evaluation was carried out at three phases (a) conceptual modelling, (b) logical modelling and (c) metadata content evaluation at the physical level in the prototype. Unified Modelling Language (UML) was used to modelling the first two phases. Then the model validated defining validation constraints.

Prototype usability was tested by selecting a few users (eight users); two each from four organizations and enable users to explain their interpretation of the presentation and organization of menus and functions of the prototype and reasons for making their answers/feedback, using a questionnaire.

Since it was difficult to gather participants from four organizations at the same time it was decided to carry out content evaluation of metadata portal in each organization separately which involves participants from the three main stakeholders. In this testing, the developed prototype was presented and manipulated online by the researcher, allowing to get the feedback in terms of completeness, relevance of query functions, efficiency of retrieval of results, clarity, user friendliness, presentation and organization of the content, from the of participants using a structured questionnaire. This approach was basically a qualitative evaluation.

The response illustrated users of government departments are define the Accessibility of the prototype.

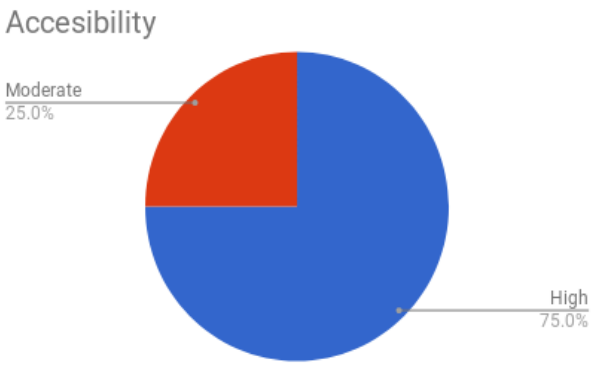


FIGURE 5. 2 Accessibility of the prototype

The System is focused on to provide better maintainability of metadata. User responses on this with regarding to satisfaction level was collected and following graph figure 5.3 shows the results

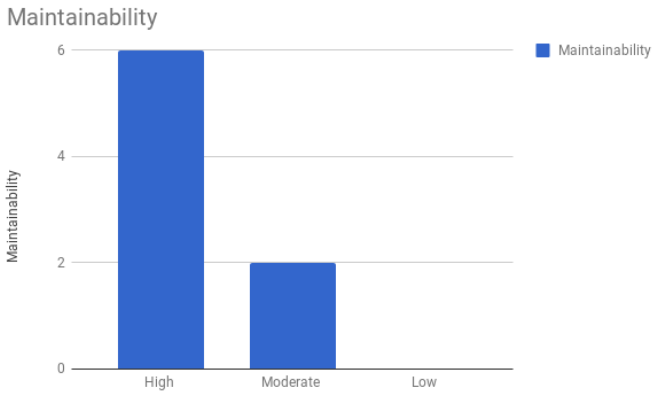


FIGURE 5. 3 Maintainability of the prototype

Overall Prototype performance and reliability was measured through the collected questionnaire responses. Results of this is shown in the figure 5.4

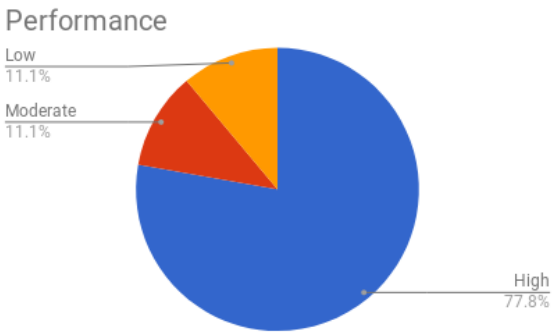


FIGURE 5. 4 Performance of the prototype

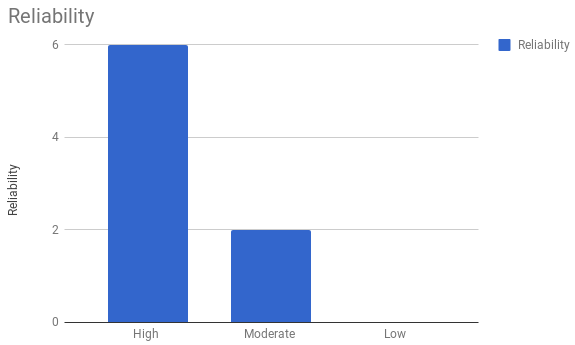


FIGURE 5. 5 Reliability of the prototype

Exploratory data analysis method was used to analyse data and answers were weighted as table 5.4

High	Moderate	Low
5	3	1

TABLE 5. 4 Weight for an answer

Prototype usability was tested using understandability, user-friendliness, operability, compliance with user guides and etc.. Research collected user feedback on those factors following table 5.5 shows their responses.

	Mean
Easy navigation through the web	4.25
User friendliness and consistency with the user interface	4.5
Ability to understand module functions easily	4.5
Easy to understand error messages	4.5
Easy to understand form fields and operation of the system	4.25
Proper validation of forms	4.25
Availability of proper buttons, text boxes, dropdown boxes in forms	4
Provide sufficient information on views	4.5
Response time	4.5
Fulfil all required functionalities	4.5
Accessibility of product support	4

TABLE 5. 5 User Responses

Then, the results of this user testing further cross-validated by recording the behaviour of some participants from the three stakeholders, who did not participate in the previous user testing, in surfing the developed web-based metadata prototype. The recording of data contains types of queries mostly used, types of data mostly retrieved, efficiency of queries, how long did they surf the web, types of data frequently searched and types of functions mostly used etc. It was a mix of qualitative and quantitative evaluation.

Types of queries mostly used - The system elaborate that highest ratio of users visiting is to Search data set by topic category section, this may be happen due to unfamiliar with this kind of prototype system before. After 2 weeks it shows that, there is a significant improvement to users are visiting to "upload information" and" Data mapping" pages. Where it is a clear evidence for users familiarity with the system and the system is actively using. This is the second highest ratio of overall system. When things consolidate into one basket, we can identify that, these records imply the users are gaining advantage of the system after 2 weeks a time for generating and analysis of data in production basis.

Types of data mostly retrieved - During the evaluation process, The system imply that users would most likely to browse dataset viewing pages. It can be reason for users need some detail information of data sets available in different organizations, and see how they are recorded. The data mapping section is the core area of this system. Where users can define mapping according to their data sets. Also users can see the same data in different dimensions. It might be helpful for the public users, Users from different state organizations, non-government organizations and administrators to take necessary decisions based on the data availability. Mostly retrieved base data of survey department. This may be a good finding for administrators to manipulate data and improve the existing product.

Efficiency(Accuracy) of queries - According to the evaluation results, users respond that, data mapping is 97% accurate. For that they have compare the mapped records with raw data. There can be some mistaken/omission while doing the data uploading to the system. This data uploading section also planned to improve in the future. By automating the data feeding part it could be bring up to 100% accuracy of data. At the moment user satisfying with current data mapping and uploading facility.

How long did they surf the web - Initially the duration of surf the prototype web system is about 5-10 minutes per day. It can be user might not much familiar with the system. But after

some time there was a significant improvement of usage. It's about 1 - 2 hours per day. Therefore it can be assumed that user might heavily using the system for search availability of data sets. As a concatenation it can be find that, the system is actively using currently

The functionalities provided by the above described prototype were critically evaluated in order to assess the prototype. It ensured that the main objectives of the research were successfully met at the completion of the research.

Under user management several functionalities have been implemented user authentication, Add institute abbreviation are handled by the system. As main functionality, administrator Can verify mappings of each registered organization. Apart from that if defined mapping is not related to the ISO specification admin can also change the mapping. View mapping of each organization is also provided by the system.

When considering the functionalities of department authorized users system provided users to add metadata of datasets based on ISO19115 classification. For bulk dataset uploading system provided facility to upload CSV. Since different organizations maintain different standard for datasets system provides facility to map each department datasets with ISO classification.

As a requirement different organizations and general public requires to identify datasets available in different organizations. System provided facility to view datasets by topic category and detailed view of the datasets. Users can request datasets.

All the above mentioned functionalities were implemented according to the selected different departments' requirements. Therefore this system is successful in meeting all user requirements.

CHAPTER 6 - CONCLUSION

6.1 CONCLUSION

All requirements desired by the client have been met by the system. The interface was designed in a user friendly manner by using standardized formatting, limited colour range and a common template.

Prototype system was developed using client-server architecture using PHP PostgreSQL, HTML, CSS and JavaScript and is a web based system.

This system provides greater convenience and time saving to the users, by integrating all required functionalities into one system. The proposed system provides updated and accurate information to perform daily operations and decision making in an improved manner.

User documentation was given to the user of the system and the system was quickly learnt by the user since it was a user friendly document. The system highly secured and user accounts were needed to logging to the system. All the interfaces were simple and user friendly.

6.2 CRITICAL APPRAISAL

For the system analysis, different facts gathering methods were used. There were interviews, questionings and referring existing documents in the organization. Main fact-finding method was done through interviews because it served as the main reference to next stage of the research. Regular requirements reviews were carried out to ensure the accuracy of the requirements gathering.

Accuracy of the requirements was very useful for the correct system prototype design. It was decided to develop separate feature catalogue, since different organizations identified different features using not only by metadata but also using field surveys. Hence couldn’t map features using a separate feature catalogue. Rational unified process was used to system design strategy. Class diagrams were created to provide a view of all the classes in the model and define ISO model. The use case diagram represented the functionalities provided by the system. ER diagram was used to manage database design correctly. Entities were normalized according to the database normalization rules. And also user interface was designed and test case was developed in the prototype.

System was tested using the test cases. The test results were documented and compared with the expected results. All the test results agreed with expected results.

6.3 PROBLEMS ENCOUNTERED

The requirement gathering stage, the end users were faced difficulties to give requirements clearly .Therefore identification of problem domain took a considerable time.

6.4 FUTURE WORK

Metadata is the key element of a SDI. It is used for mainly searching and comparing datasets in order to find the required data when available. Since the collection of metadata is as important as metadata standards, metadata tools are inevitable to be used for geospatial data.

Currently prototype system is developed for four main state organizations, Prototype can be further extended based on requirements of other state organizations.

Since the system is developed based on ISO classification the metadata can be extended further based on required elements or packages.

Dataset visualization also can be implemented for this prototype.

Ontology can be defined for mapping of the data sets.

REFERENCES

[1] Spatial Data Infrastructure (n.d) (Online). Available: https://en.wikipedia.org/ wiki/ Spatial_data_infrastructure (Accessed 25th April 2017)

[2] Sharing of Geospatial Data within Hong Kong Government. Presented at the United Nations Global Geospatial Information Management. Hangzhou Forum 2012.

Available: (Accessed 23rd April 2017)

[3] Wetlands in integrated water resources management (Online)

Available: (Accessed 26th April 2017)

[4] Establishment of Spatial Data Infrastructures - Kadaster. Available: http://www.kadaster.nl (Accessed 26th April 2017)

[5] Diederik Tirry Ann Crabbé, Thérèse Steenberghen (2014) Publishing metadata of geospatial indicators as Linked Open Data: a policy-oriented approach

[6] Advancement of the National Spatial Data Infrastructure -FGDC

Available: https://www.fgdc.gov/nsdi/nsdi.html (Accessed 29 th April 2017)

[7] Infrastructure for spatial information in Europe . Available : http://inspire.ec.europa.eu/ (Accessed 29 th Apri 2017)

[8] Geo spatial world Available: https://www.geospatialworld.net/article/sdi-in-singapore (Accessed 11 th July 2017)

[9] Geo spatial world forum Available : http://geospatialworldforum.org/2012/ppp_abs.htm (Accessed 11 th July 2017)

[10]Advancement of the national spatial data infrastructure (online)

Available: (Accessed 2nd May 2017)

[11] Hendriks, P. H., Dessers, E, and Van Hootegem, (2012). Reconsidering the definition of a spatial data infrastructure. International Journal of Geographical Information Science Vol.no.pp.1479.1494.

[12] Boes, U., Lapaine, M, and Cetl, (2010).Learning from thers. Capacity Building for GIS and SDI in South East Europe. In 3rd International Conference on Cartography and GIS, Nessebar, Bulgaria

[13] Masser, I. (1998).Governments and geographic information. London: Taylor & Francis.

[14] Lachman, B. E., Wong, A, Knopman, D, and Gavin, (2001). Lessons for the global spatial data infrastructure: international case study analysis. Global Spatial Data Infrastructure Secretariat,

[15] Craglia, M., and Masser, (2002). Geographic information and the enlargement of the European Union: four national case studies. Journal of the Urban and Regional Information Systems Association (URISA)
[16] GINIE. 2003. GI in the wider Europe.
Available: .
[17] VanLoenen, B., and Kok, B. C. (2004). Spatial data infrastructure and policy development in Europe and the United States.Delft, The Netherlands: DUP Science.
[18] Components of NSDI Availlable : (Accessed 18th May 2017)
[19] GSDI, Technical Working Group Chair (2004), Developing Spatial Data Infrastructures: The SDI Cookbook, Version 2.0, .
[20] Government of India Department of Space (ISRO), 2003. NSDI Metadata Standard, Indian Space Research Organization NNRMS Secretariat, Version 3.0, India
[21] National Information Standards Organization (NISO) (2004), Understanding Metadata, NISO Press, USA.
[22] Salgé F. (1999), National and International Data Standards, In: P. Longley, M. Goodchild, D. Maguire, and D. Rhind , Geographical Information Systems.
[23] Kresse W., 2004, Standardization of Geographic Information, In: Proceedings of the XXth ISPRScongress, Istanbul, 2004.
[24] ISO/TC 211, 2005, ISO Technical Committee Web Site, Available: .
[25] ArcGIS Available : (Accessed: 12th July 2017).
[26] Geo Media Catalogue Available : (Accessed: 12th July 2017)
[27] Map info manager. Available : (Accessed: 12th July 2017).
[28] USGS online metadata editor. Available : (Accessed: 20th July 2017).
[29] Metadata wizard.
Available : https://www.sciencebase.gov/catalog/item/50ed7aa4e4b0438b00db080a
(Accessed: 20th July 2017).
[30] Geo Network Available : http://www.osgeo.org/geonetwork(Accessed: 23rd July 2017).
[31] Software Engineering -Summerville

APPENDIX A - USER DOCUMENTATION

User Documentation

Type in the browser and user will direct to the main screen of the web page. In the index page of the site all users can view available datasets based on topic category. User can view how many datasets are available in each topic category.

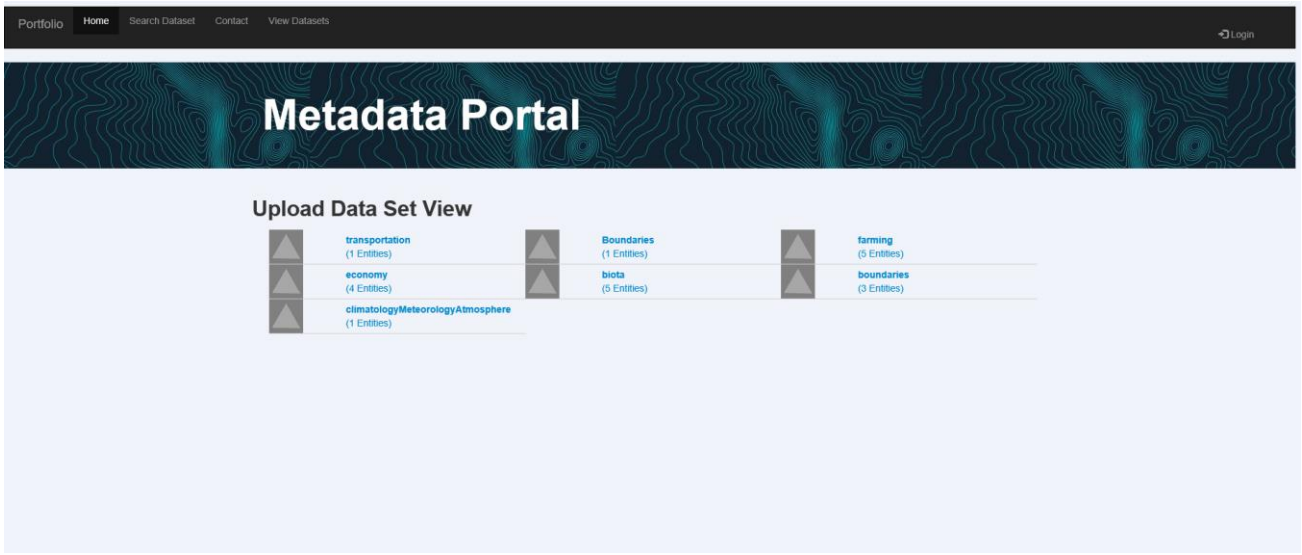


FIGURE A. 1 Dataset View Interface

Once user click on a topic category user can view available dataset titles.

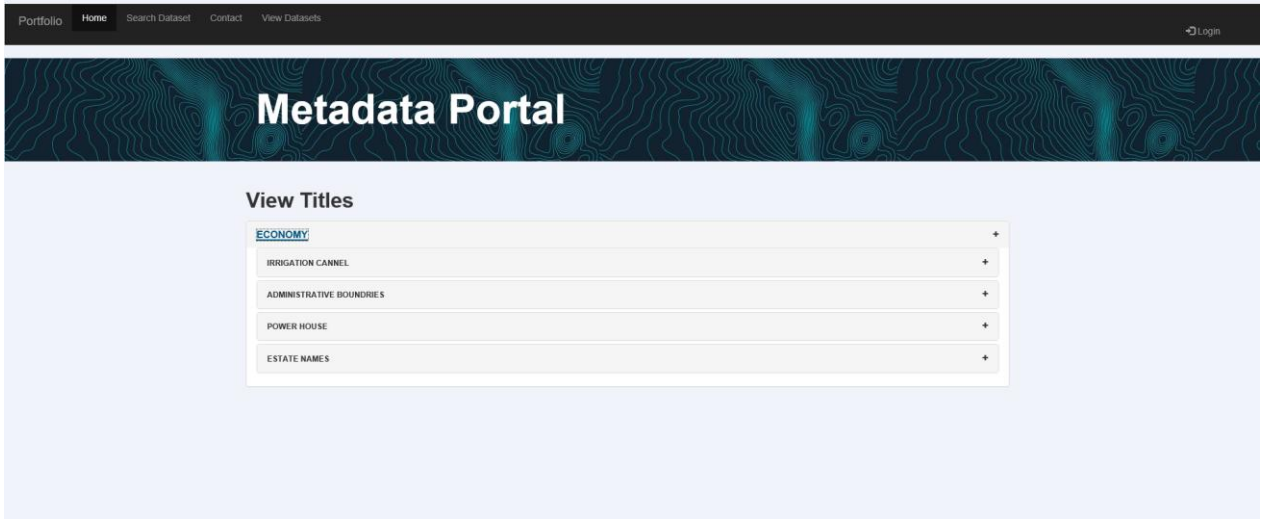


FIGURE A. 2 Dataset Title View Interface

Under each data set title user can view main metadata of each data set.

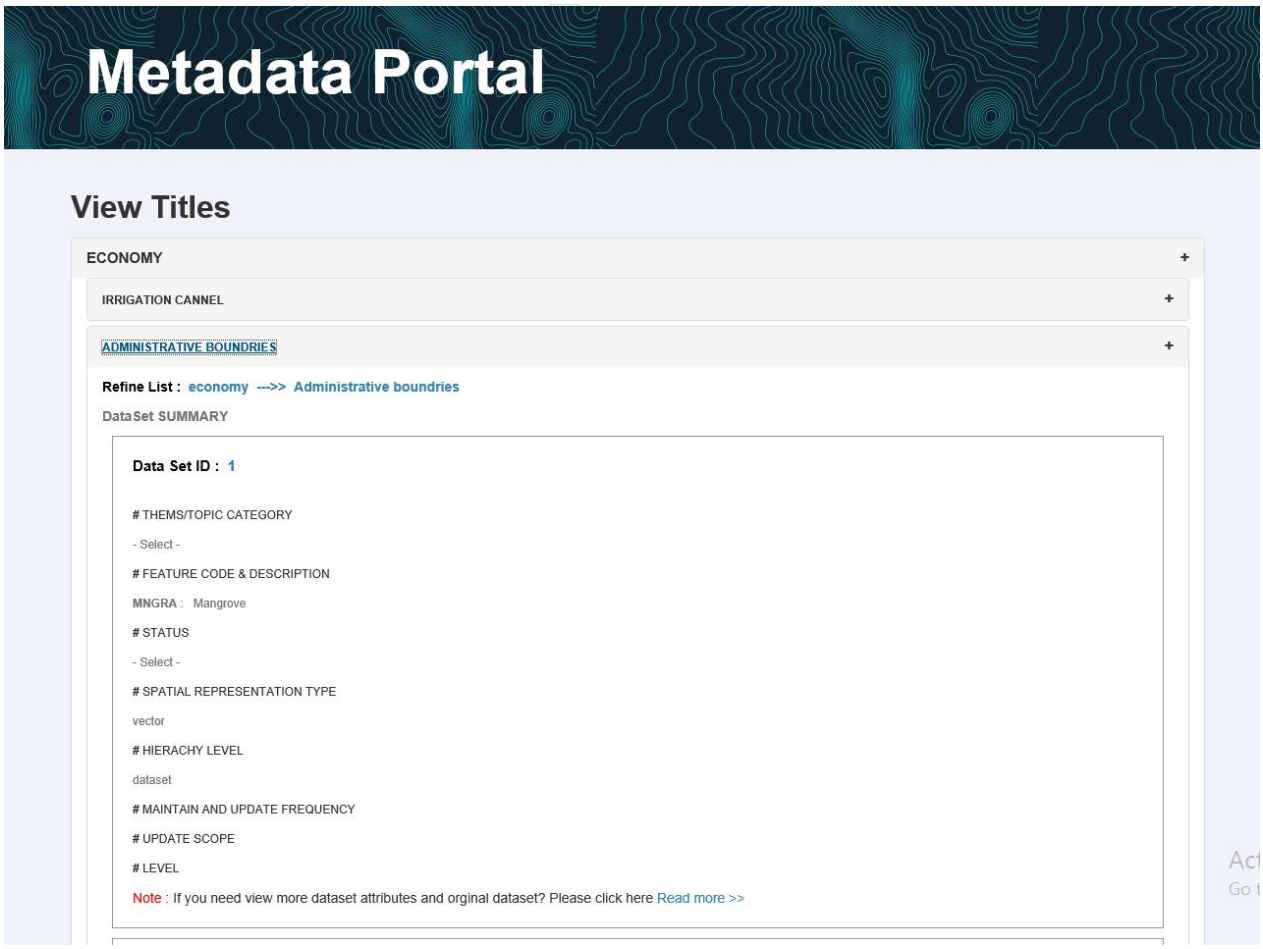


FIGURE A. 3 Dataset Detail View Interface

By clicking Read more user can view detailed converted dataset based on ISO classification and original dataset of the converted data. For easy comparison it views in a tabular form.

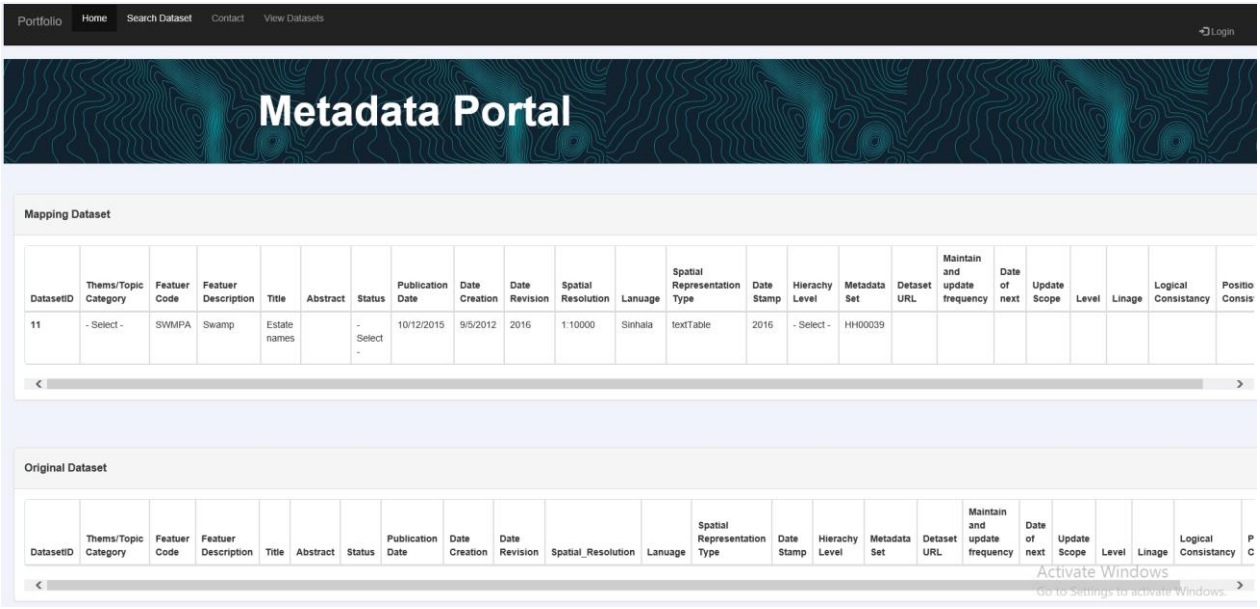


FIGURE A. 4 Mapping and original dataset view interface

User Registration

Authorized users from each department should register with the system.

Follow the link below to get the initial screen shown below.

In the **main menu > Login >** In **user login Screen** > **Register as new user**

Then figure – A.1 will be displayed on your screen.

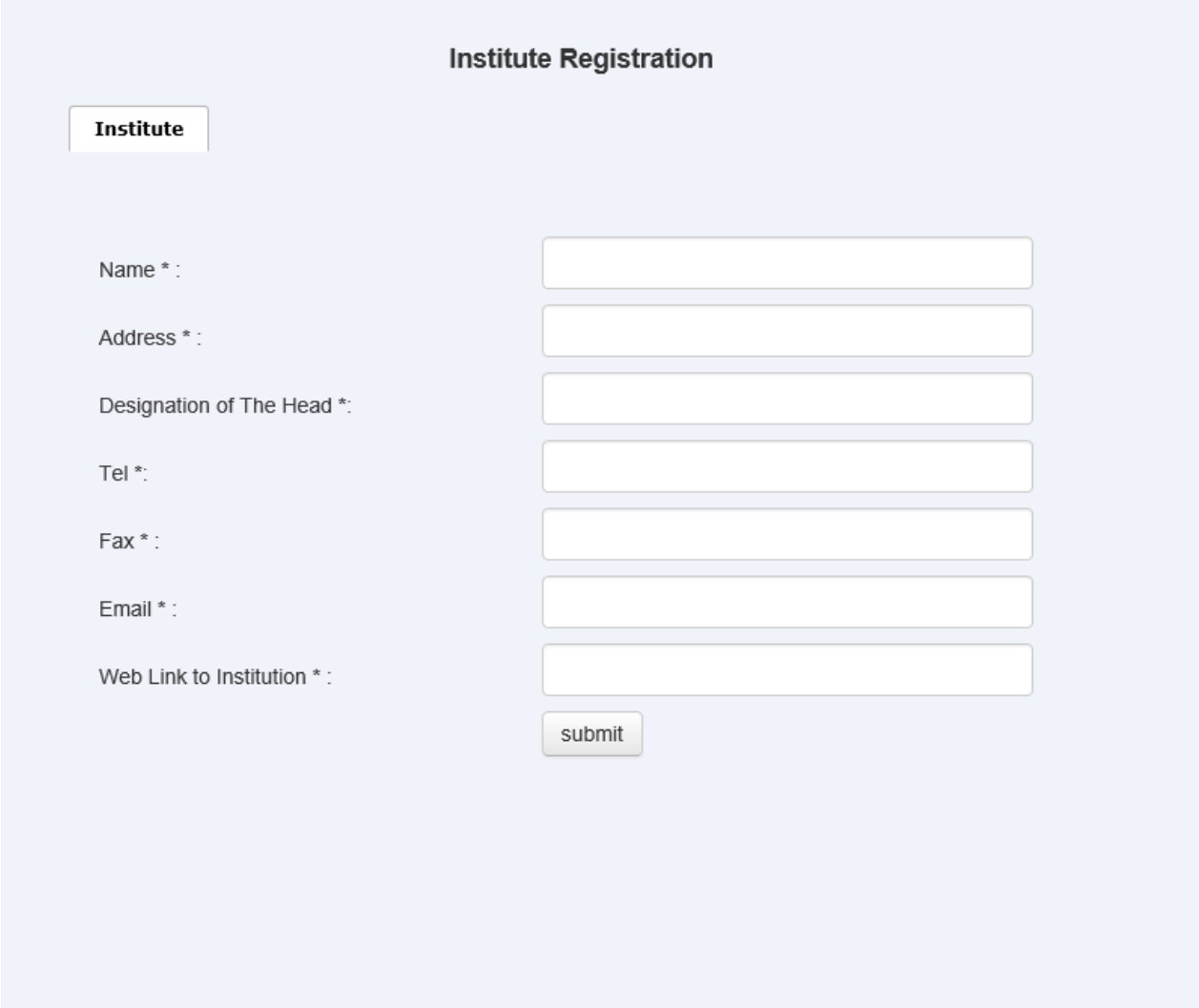


FIGURE A. 5 Institute registration interface

1. Enter all required fields in the institute registration form.
2. Finally click “Submit” button to save institute registration details.
3. After click submit button user will redirect to **user registration form**

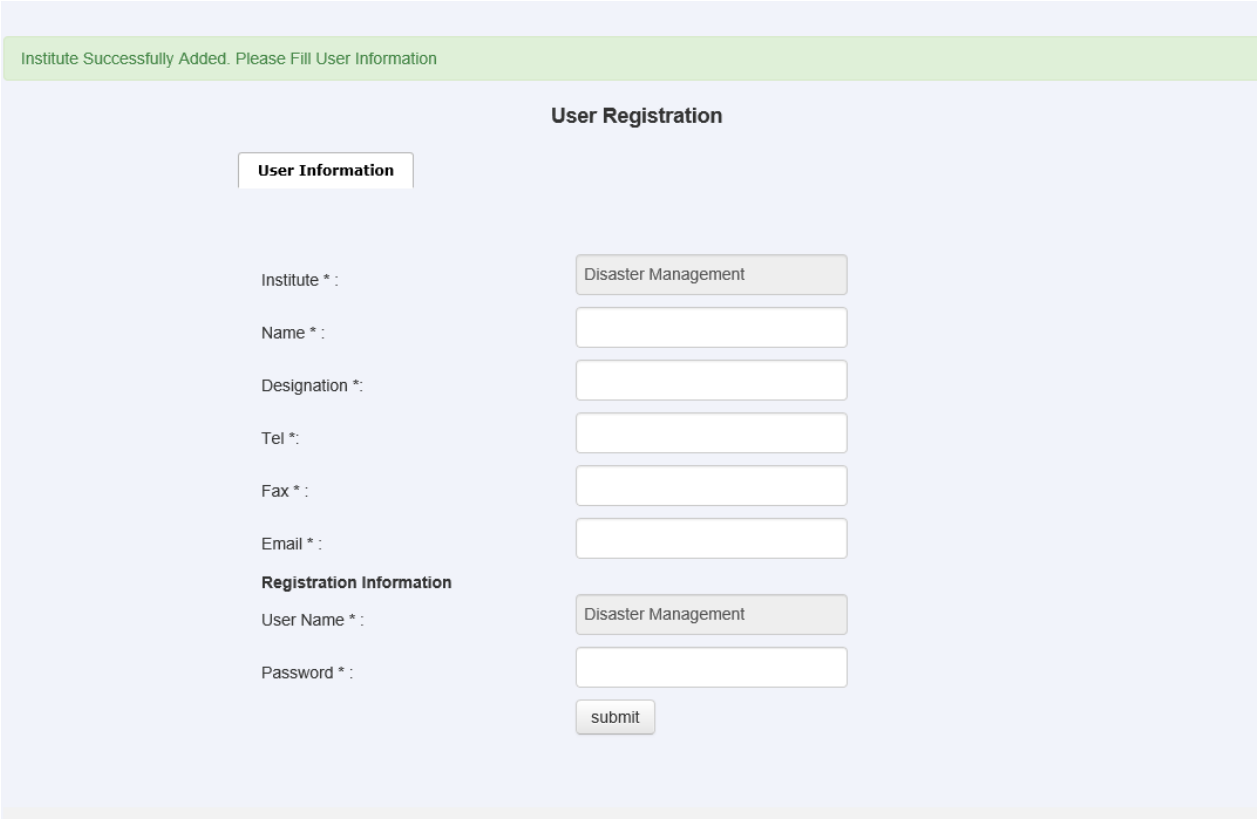


FIGURE A. 6 User registration interface

1. Enter all required fields in the user registration form.
2. Enter password for login to the system.
3. Finally click “Submit” button to save user registration details.

Administration

Click on user login button. Then administrator will redirect to user login screen. Select administrator and enter password.

Then figure – A.2 will be displayed on your screen.

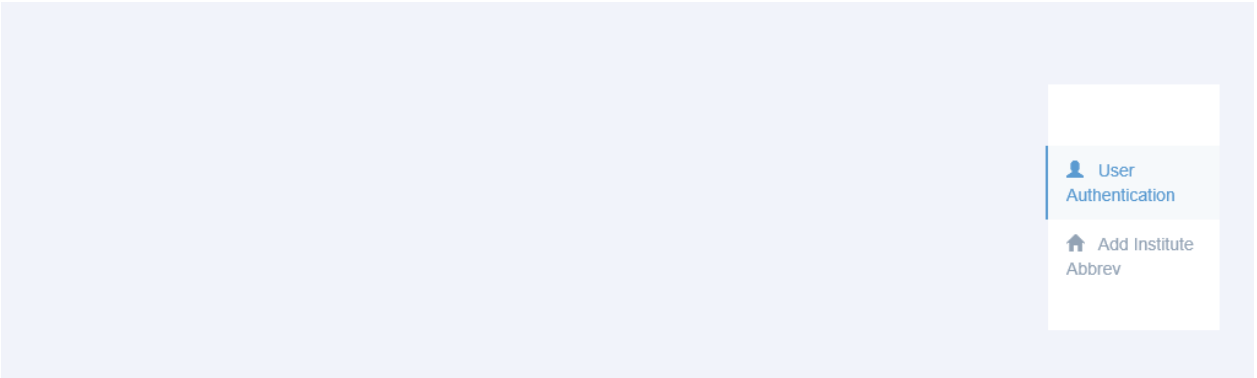


FIGURE A. 7 Administration interface

1. Click on user authentication screen. Add tick to authenticate users from registered user list.
2. Finally click “submit” button to save authenticated users.

Add Institute Abbreviation

1. Click on “Add Institute Abbreviation” link.

Then figure – A.3 will be displayed on your screen.

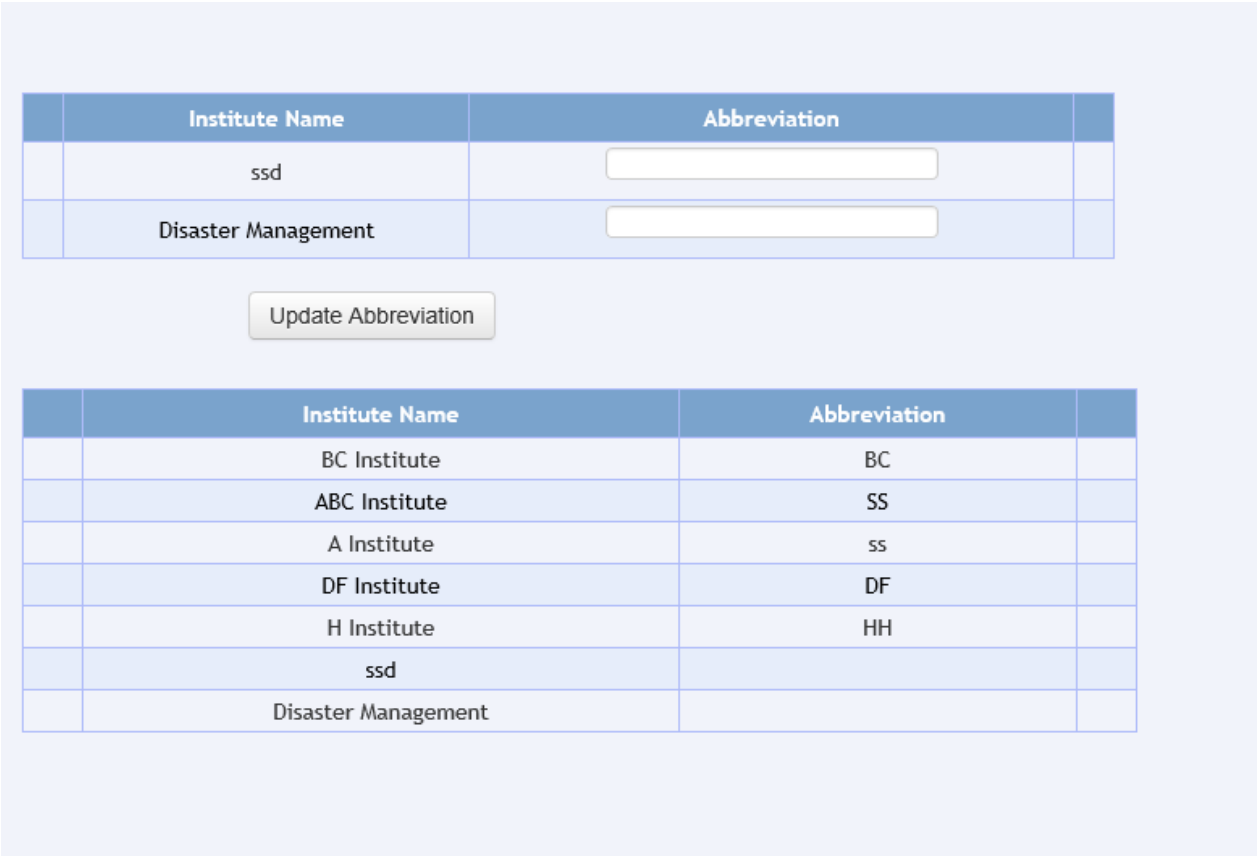


FIGURE A. 8 Add institute abbreviation interface

2. Enter institute abbreviation of each department. And then click “update abbreviation” button to save details.

Add datasets

This screen used to enter dataset metadata details in to the system

1. Authorized department user should login first using username and password.

Then figure – A.4 will be displayed on your screen

The Metadata screen consists of four main sections.

1. Metadata Point of contact
2. Metadata
3. Identification Information

4. Data Quality
5. Maintenance Info

Metadata Point of contact

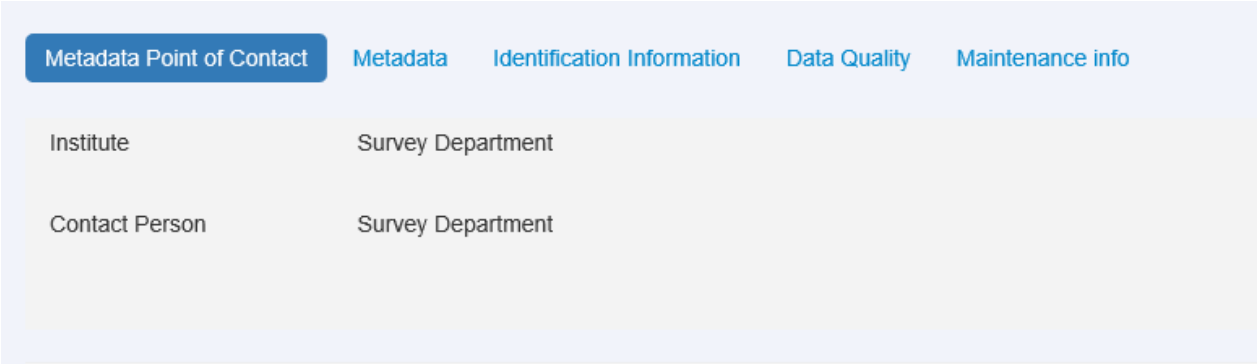


FIGURE A. 9 Metadata point of contact interface

This section of the screen displays contact information of the metadata datasets.

Metadata

This section of the screen contains the metadata information of datasets. For example language, Hierarchy level, Date Stamp, Metadata standard name, etc. See figure A.5

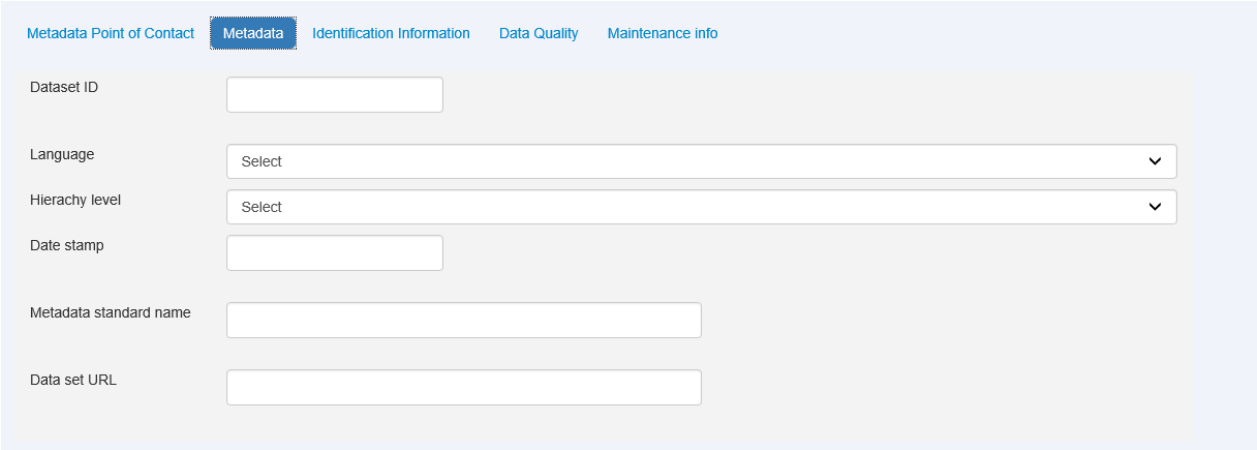


FIGURE A. 10 Add metadata interface

Identification Information

This section of the screen contains the metadata Identification information of datasets. For example Title, Abstract, Purpose, Status, etc. See figure A.6

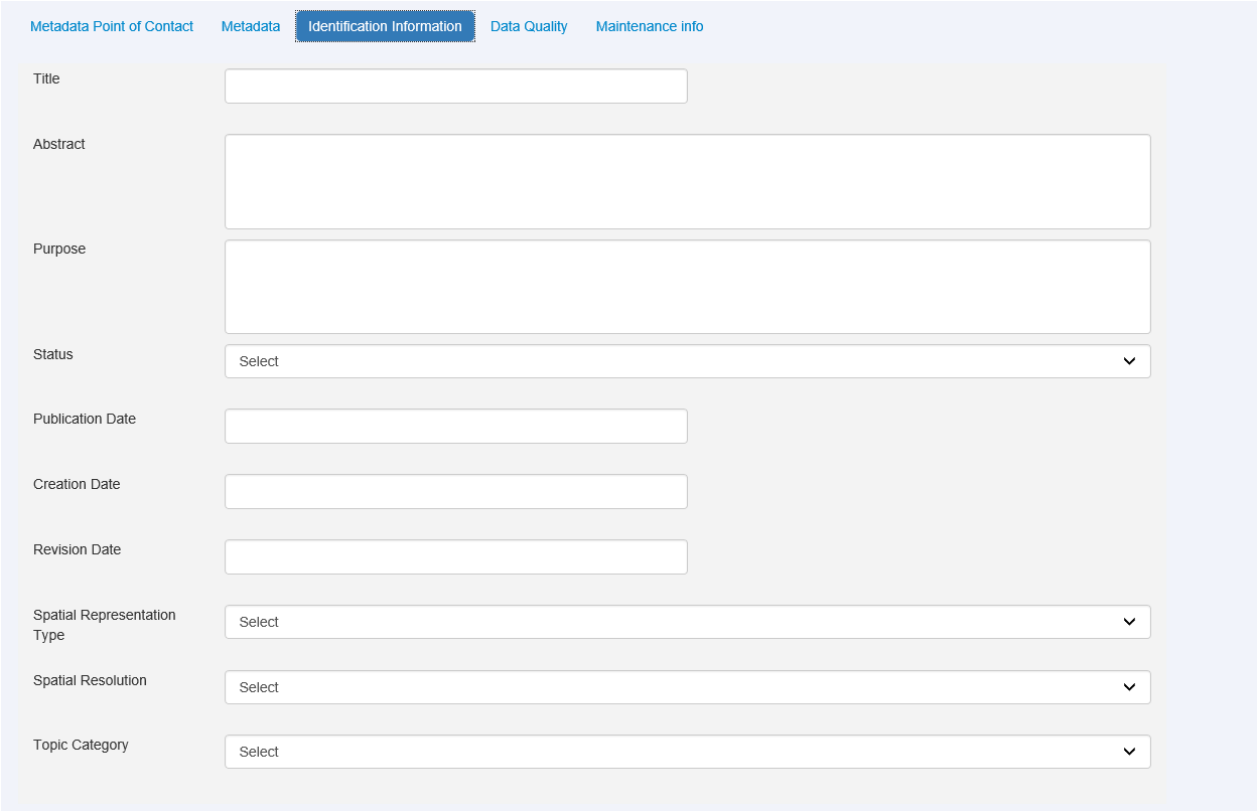


FIGURE A. 11 Add identification information interface

Data Quality

This section of the screen contains the Data Quality information of datasets. For example Level, Lineage etc. See figure A.7

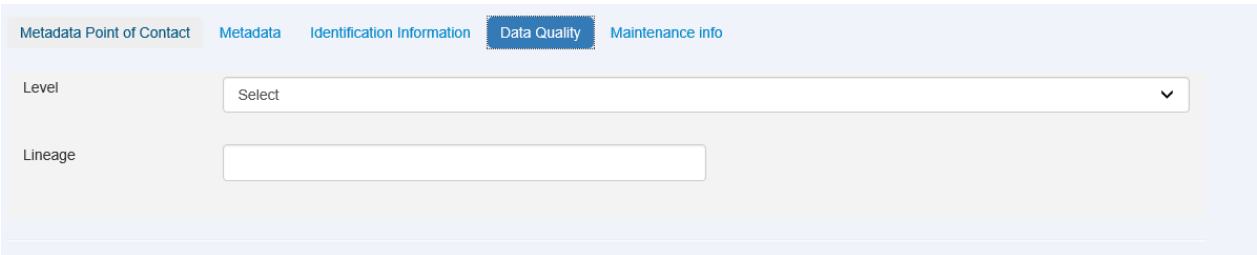


FIGURE A. 12 Add data quality interface

Maintenance Information

This section of the screen contains the Maintenance information of datasets. For example Maintenance and update frequency, Date of next update etc. See figure A.8

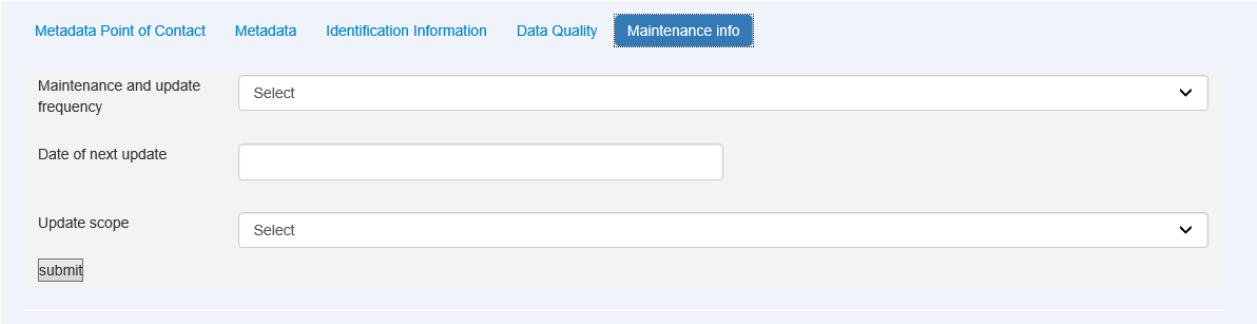


FIGURE A. 13 Add maintenance info interface

Upload Bulk metadata

Following screen is used when user wants to upload bulk metadata.

Department user should upload csv using following screen.

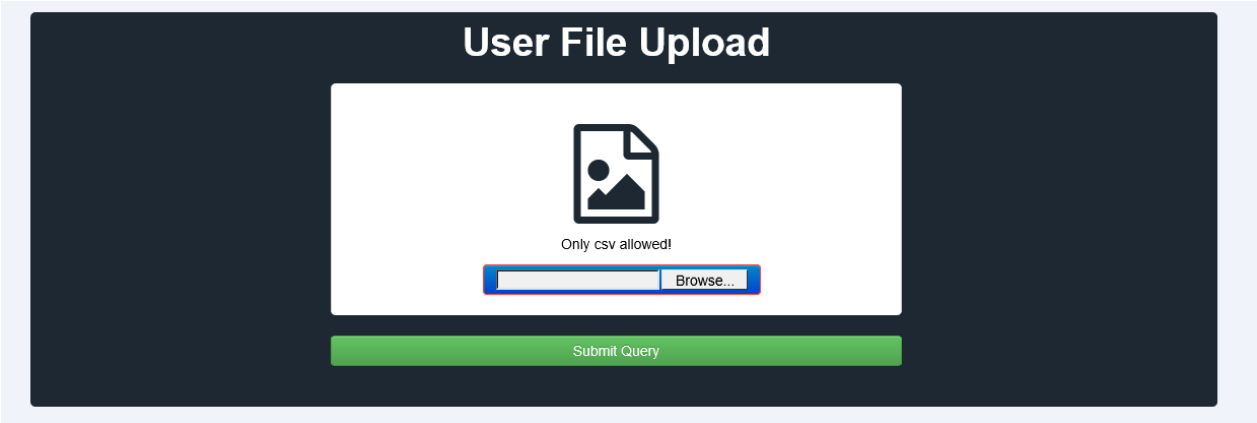


FIGURE A. 14 File upload interface

Data Mapping with ISO classification

Once department user upload csv, need to map department dataset with ISO classification

This screen used to map department data with ISO classification.

1. Select each category and map mismatched data with ISO classification
2. Finally click “submit” button to save data mapping.

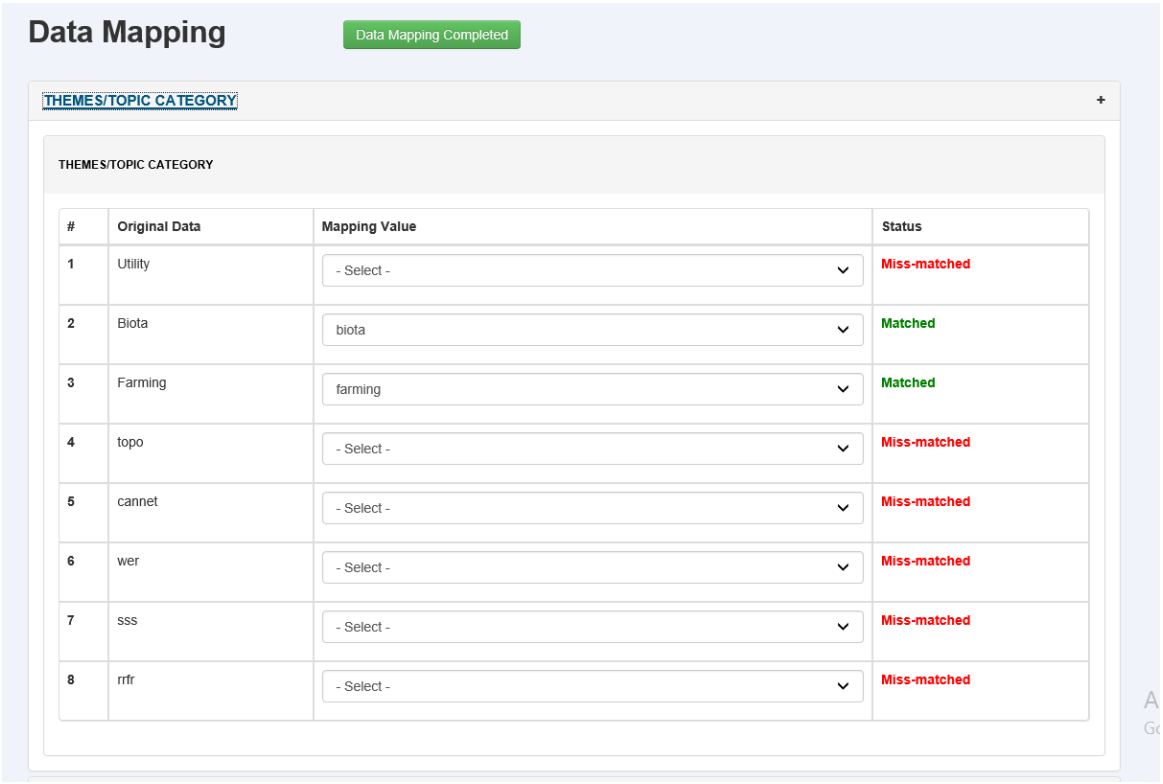


FIGURE A. 15 Data mapping interface

Data Mapping verification

Once department authorized user completed mapping, administrator can verify each department mapping

1. Select the department.
2. Select each category and verify mapped data with ISO classification
3. Finally click “submit” button to save data mapping.

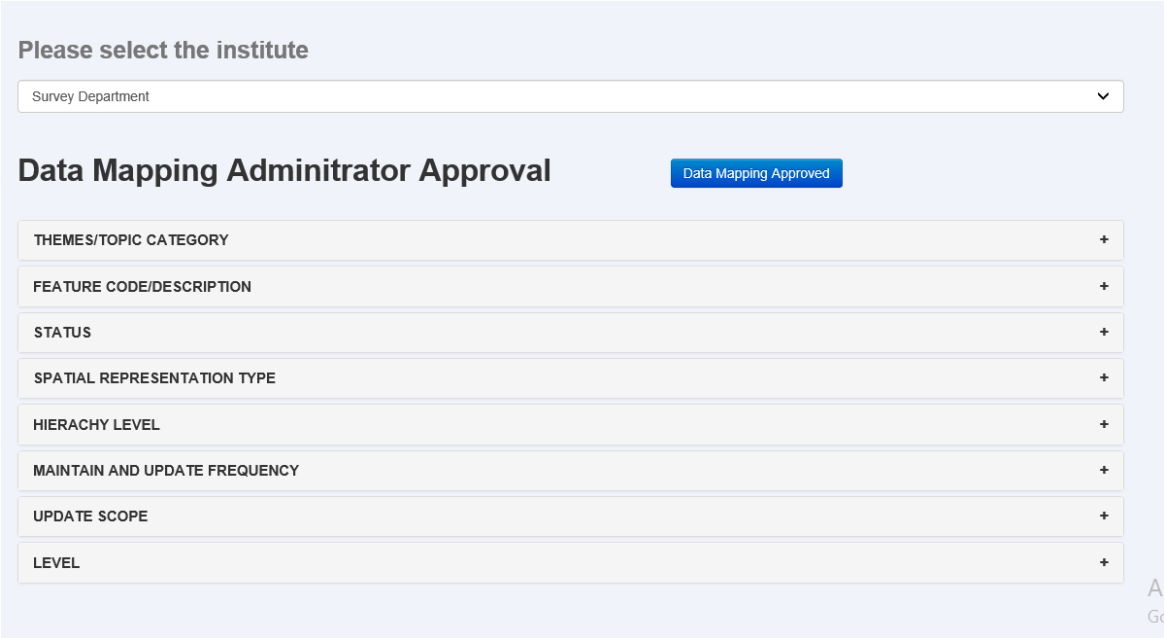


FIGURE A. 16 Mapping Verification interface

APPENDIX B – QUESTIONNAIR

Spatial Data Infrastructure

Questionaire on spatial data utilization

A.1 Information on Organization

A.1.1	Name of the organization :	LUPPD
A.1.2	Address :	No 31, Pelikiba Rd, Colombo 05
A.1.3	Contact details of the head :	0112368931
A.1.4	Designation of the head :	Deputy Director (Information Systems)
A.1.5	Tel :	2368931
A.1.6	Fax :	2368718
A.1.7	Email :	merlypriyan@yahoo.com

A.2 Details of the contact person regarding metadata Same as above

A.2.1	Name :	
A.2.2	Address :	
A.2.3	Designation :	
A.2.4	Tel :	
A.2.5	Fax :	
A.2.6	Email :	

Mark a √ if yes

A.3	Does your organization generate spatial data?	yes
A.4	Does your organization use spatial data?	yes
A.5	Does your organization share spatial data with other organizations?	yes

Mark a √ if yes

A.6. Is your organization mainly a provider or user of base data?

1.	Mainly a provider	✓
2.	Mainly a user	✓
3.	Both	
4.	Not a provider or user	
5.	No idea	

A.6.1. As a provider, who are the main users of base data? Please specify

Irrigation Dept, Agriculture Dept, DMC, CEA, Meteorology, UDA, NBRO, Universities

A.6.2. As a user, who are the main providers of base data? Please specify

Survey Dept, Forest Dept, Wild life.

A7. How have you classify your base/thematic data? Is it based on your own standards or themes. Please answer Q2

A.8 Do you have a mechanism to publish the data you maintain for the information of other stakeholders?
If yes, What methods do you apply?

Intent to publish data in next year.

A.9 How do you presently query and find out the availability of data you need to get from other stakeholders?

1.	Through searching metadata only	
2.	By an inquiry	✓
3.	Personal	

A.10 How is your base data / thematic data shared with your internal / external stakeholders?

Mark a √ if yes

Manually (As requested)	✓
Data files shared by email or DVD	✓
Can search through online catalog	
Down-loadable through internet or intranet	✓
Web service access	
Other	
(Please specify)	by emails.

A.11 How do you access base data from external sources?

Manually (As requested)	✓
Data files shared by email or DVD	✓
Can search through online catalog	✗
Down-loadable through internet or intranet	✓
Web service access	
Other	
(Please specify)	by email

A.12 What can be improved in providing and sharing base data?

If there will be spatial data sharing potal it is very much useful

B. Standards

B.1 Does your organization adopt international standards for the following

B.1.1 Data Modelling

Yes	✗
No	✓
No idea	

If yes, please specify :	

B.1.2. Metadata representation

Yes	
No	✓
No idea	

If yes, please specify:	By giving details by manually.

B.1.3 Data publication and sharing (e.g. web service protocol)

Yes	
No	✓
No idea	

If yes, please specify:	

B.1.4 Other (e.g. Application development in business process)

Yes	
No	✓
No idea	

If yes, please specify :	

B.2 Does your organization have any local standards and methods in place?

Yes	✓
No	
No idea	

If yes, please specify :	Prepare departmental guidelines to collect classify land use types

B.3 If your organization adheres to local standards in spatial data, what differences do you observe in these standards in relation to international standards?

Please specify :	issues & problems in implementation to local level.

B.4 What suggestions can you make to improve local standards to international standards, Please specify.

awarness programs necessary among the departments.

C. Policies

C.1 Does your organization have any information management processes in place for geospatial data?

Yes	✓
No	
No idea	

If yes, please specify :	1. Provide Base data related to each Districts 2. update the Base data (according to department directions) 3. data sent to H.O. 4. Checked & corrected. 5. Maintaining digital data updated land use and produce thematic data

C.2 How does your organization measure the effectiveness of its investments in geospatial information?

based on the demand of digital data.

C.3 Does your organization have a long term plan or strategy for managing geospatial information?

Yes	✓
No	
No idea	

If yes, please specify :	every 5 years time land use survey should be continued & if there is major changes in local level it should be updated.

C.4 In your organization, are regulations and policies established for the administration of geospatial information?

Yes	✓
No	
No idea	

If yes, please specify :	data sharing done according to the agreement prepared by LUPPD.

C.5 Is your organization engaged in any partnerships or collaborations with external parties regarding geospatial utilization?

✓	Yes
	No
	Sometimes
	No idea

C.6 Does your organization develop regulations/standard specifications in terms of data quality based on user requirements?

Yes	✓
No	
No idea	

(guidelines)

If yes, please specify :	giving the steps to be followed given to officers.

C.7 Do you have any policies about data security (data disclaimers/copyright laws)

Yes	✓
No	
No idea	

If yes, please specify :	Agreement.

C.8 Any data sharing policies do you apply in exchanging data?

	Licensing (eg. Open data) (Please specify)	
	Pricing (e.g. cost of transmission, cost of recovery) (Please specify)	
	Other (Please specify)	
✓	Data distribution/redistribution	
	Data formats (Xml/GML/SVG)	

C.9 Does your organization have work flows in data handling and production?

Yes	✓
No	
No idea	

If yes, do such work flows adopted in different spatial data handling sections interrelate each other?

Please Specify

There are no Sections in LMTPD H.O. But H.O and District Offices have relationship with Spatial data

D. Technology

D.1 Has your organization adopted a standard in the Geospatial platform(s) arena?

Yes	✓
No	
No idea	

If yes, please specify :	maintaining local standards

D.2 In your organization, who is responsible for the geospatial information IT infrastructure and services?

IT Department	IT & GIS unit
Specialized Department	
External Organization	

D.3 Is there a geospatial architecture for your organization?

Yes	
No	✓
No idea	

If yes, please specify :	

D.4 Does your organization have a web platform in storing/updating/dissemination and sharing geospatial data? No

Please Specify

D.5 How is interoperability between different systems (geospatial & non-geospatial) enabled? E.g. ad-hoc, using translators such as FME, or the use of web-service APIs?

Please Specify

Non spatial data taken from other organizations join with geo spatial data. (GN level)

D.5 Have you already adapted an organizational or a national policy regarding geospatial technology choices in terms of hardware (Networks/Desktop/Servers/Cloud)/software(Open source/Proprietary) and system architecture (Distributed/ Centralized/ Hybrid)? (AGES)

Please Specify

D.7 What improvements do you envisage in the technological development of handling geospatial data?

Please Specify

technology & knowledge improvement necessary.

CRS

Available spatial data themes and sub themes (Based on ISO classification)

Mark a √ if available

Other types (Specify the themes below)

1. Farming			
Agriculture	✓	Irrigation	✓
Aquaculture		Plantations	✓
Herding		Pests	
Diseases affecting crops		Livestock	

2. Biota			
Wildlife	✓	Vegetation	✓
Biological sciences		Ecology	
Wilderness		Sea life	
Wetlands		Habitat	
Biological resources			

3. Boundaries			
Administrative boundaries	✓	Governmental units	
Political boundaries		Marine boundaries	
Voting districts		School districts	
International boundaries			

4. Climatology meteorology Atmosphere			
Cloud cover		Weather	
Climate		Atmospheric conditions	
Climate change		Precipitation	

5. Economy			
Production		Labor	
Revenue		Business	
Commerce		Industry	
Tourism		Ecotourism	
Forestry		Fisheries	
Commercial or subsistence hunting		Minerals	
Oil		Gas	

6. Elevation			
Altitude		Bathymetry	
Digital elevation models	✓	Slope	
Derived products		Dems	
Tins			

7. Environment			
Environmental pollution		Waste storage and treatment	
Environmental impact assessment		Monitoring environmental risk	
Nature reserves	✓	Landscape,	
Water quality		Air quality	
Environmental modeling			

8. Geoscientificinformation			
Geophysical features and processes		Geology	
Minerals		Sciences dealing with the composition	
Structure and origin of the earth's rocks		Risks of earthquakes	
Landslides		Gravity information	
Soils		Permafrost	
Hydrogeology		Groundwater	
Erosion			

9. Health			
Disease and illness		Factors affecting health	
Hygiene		Substance abuse	
Mental and physical health		Health services	
Health care providers		Public health	

10.Imagerybasemapsearthcover			
Land/earth cover	✓	Topographic maps	
Imagery	✓	Unclassified images	
Annotations		Digital orthoimagery	

11. Intelligencemilitary			
Barracks		Training grounds	
Military transportation		Information collection	

12.Inlandwaters			
Rivers and glaciers	✓	Salt lakes	
Water utilization plans		Dams	
Currents		Floods and flood hazards	
Water quality		Hydro-graphic charts	
Watersheds		Wetlands	
Hydrography			

13.Location			
Addresses		Geodetic networks	

Geodetic control points		Postal zones and services	
Place names	✓	Geographic names	✓

14.Oceans			
Tides		Tidal waves	
Coastal information		Reefs	
Maritime		Outer continental shelf submerged lands	
Shoreline			

15. Planning cadastre			
Land use maps		Zoning maps	
Cadastral surveys		Land ownership	
Parcels		Easements	
Tax maps		Federal land ownership status	
Public land conveyance records			

16. Society			
Settlements		Housing	
Anthropology		Archaeology	
Education		Traditional beliefs	
Manners and customs		Demographic data	
Tourism		Recreational areas and activities	
Parks		Recreational trails	
Historical sites		Cultural resources	
Social impact assessments		Crime and justice	
Law enforcement		Census information	
Immigration		Ethnicity	

17. Structure			
Buildings	✓	Museums	
Churches	✓	Factories	
Housing		Monuments	

Shops		Towers	
Building footprints		Architectural and structural plans	

18.Transportation			
Roads	✓	Airports/airstrips	✓
Shipping routes		Tunnels nautical charts	
Vehicle or vessel location		Aeronautical charts	
Railways	✓		

19. Utilities communication			
Hydroelectricity		Geothermal	
Solar and nuclear sources of energy		Water purification and distribution	
Sewage collection and disposal		Electricity and gas distribution	
Data communication		Telecommunication	
Radio		Communication networks	

Base data Roads. Hydro features, Places., contours.

Other layers admin
Reservers.
Toponomy.
burldings
landuse

2.2 Metadata identification information

Theme/Sub theme of spatial data *(Select from the list above)*		1. Citation			2. Description		3. Time period of content
		1.1. Title	1.2. Production date/year	1.3 spatial data presentation form	2.1 Abstract	2.2 Purpose	3.1 Currentness Reference
1. Biota	1.1	Plantations				1,2,3,5,6	2016
2.	1.2	Grassland		vector digital data			
3.	1.3	Forests.					
4. Boundries	2.1	colombo district boundry					
5.	2.2	GN Boundry	✓	vector digital		1,2,3,4,5,6	
6.	2.3	colombo DS boundry					
7.	2.4	colombo Local Authority					
8. Environment	3.1	Basins in Sri Lanka	= Survey				
9.	3.2	Hazard soc Is level wise	N/A				
10.	3.3	Hazard Tsunami	2013	"	✓	✓	2013
11.	3.4	Hazard Slope	2013	vector digi	✓	7, 8.	2013
12. Farming	4.1	Farmlands	2016	"	✓	"	2016
13. health	5.1	hospitals generic.	CSM				
14. Imagery Basemap	6.1	Landuse of colombo.	2016	"	✓	✓	2016
15. Inland waters	7.1	Flood zip	2016	"	✓	✓	2016
		Title may the name by which the data set is known.		Atlas,audio,diagram, document,globe,map, model,multimedia,presentation,profile,raster digital data,remote-sensing image, section,spreadsheet,tabular digital data,vector digital data,video,view	A brief narrative summary of the data set.	1. Mandatory Obligation 2. Government Requests 3. National Development 4. Title Registration 5. Land Use Planning 6. Disaster Management 7. Climate Resilience. 8. Land Allocation 9. Others (Specify)	(the basis on which the time period of content information is determined.) "ground condition" "publication date"

1. raster digi
2. vector digi

1,2,3,4,5,6 → 10

2.2 Metadata identification information

Theme/Sub theme of spatial data (Select from the list above)	4. Status		5. Spatial Domain		6. Coverage	7. Source Data
	4.1 Progress	4.2. Maintenance and update frequency	5.1 Spatial data organization	5.2 Spatial Reference		
1. 1.1	complete	weekly	3	5	NP	
2. 1.2	"				NP	OSM
3. 1.3	"				All island	
4. 2.1	complete	non planned	1	2,	3	8.
5. 2.2						
6. 2.3						
7. 2.4						
8. 3.1	survey					
9. 3.2	NA					
10. 3.3	Tsunami complete	as needed	3	4 5	Islandwide	ask survey!
11. 3.4.	complete	nonplanned	1	5	1,	8
12. 4.1	complete	weekly	3	5	NA	OSM
13. 5.1						
14. 6.1	complete	uneven	1	5	3.	1, 8
15. 7.1		Noplan	1	5	3	
	Complete In work Planned	"Continually" ,"Daily" "Weekly" ,"Monthly" "Annually" "Unknown" ,undertaken "As needed" aplanned "Irregular" nonplanned	Approach to organizing multiple records containing information Discipline, Process and Programs focusing on the organization of data: 1. structured 2. Unstructured 3. Combination of structured and unstructured	1. Geo-Coded via Orbit Data 2. Geo-coded via Control Points 3. Geo-coded via Control Points & DEM 4. Local Coordinates 5. Transform to WGS 84	1. National 2. Provincial 3. District 4. Divisional 5. Grama Niladhari 6. Electorates 7. Specific Regions 8. Functional Regions 9. Project Area	1. Aerial Photographs 2. VHR Satellite Images 3. Ground Control Points 4. LIDAR 5. Total Station/ EDM 6. GPS 7. Drone 8. Field Survey

2.2 Metadata identification information

Theme/Sub theme of spatial data (Select from the list above)	8. Scale of the dataset	9. Format	10. Product Type
1. 1.1	1:1	1, 8	
2. 1.2	1:1		2.
3. 1.3	1:1		
4. 2.1			
5. 2.2			5, 2
6. 2.3	1:50000		
7. 2.4			
8. 3.1			
9. 3.2			
10. 3.3	.ud.	8, 1	5
11. 3.4		8, 1	1
12. 4.1	1:1	1, 8	2
13. 5.1			
14. 6.1	1:5	1, 8	1,
15. 7.1		8, 7, 1	1
	1. 1:1,000,000 2. 1:500,000 3. 1:250,000 4. 1:100,000 5. 1:50,000 6. 1:25,000 7. 1:10,000 8. 1:5,000 9. 1:1,000 10. Other (specify)	1. Shapefiles 2. Geodatabase in ArcGIS 3. ArcINFO 4. DGN 5. CAD 6. TIN 7. Raster 8. Vector 9. Orthophoto 10. LiDAR 11. Terrain/DEM 12. Others (Specify)	1. Hard Copy Maps 2. Digital spatial db 3. JPEG 4. Statistical data 5. Analyzed data

]
2.3 Data quality information

Theme/Sub theme of spatial data *(Select from the list above)*		1. Attribute Accuracy			2. Completeness Report				
		1.1. Errors of commission/omission	1.2. Planimetric	1.3. DEM-Height	2.1 Polygon Continuity	2.2 Line Continuity	2.3 Edge Enhancement	2.4 Labeling	2.5. Interval Continuity - Contour
1.	1.1	rapidly		×					
2.	1.2	checking			✓	✓	×	✓	×
3.	1.3								
4.	2.1								
5.	2.2	×	×	×	✓	✓	✓	✓	×
6.	2.3								
7.	2.4								
8.	3.1								
9.	3.2								
10.	3.3	×	undefined	undefined	✓	✓	×	✓	×
11.	3.4				✓	✓			×
12.	4.1	rapidly chang	×	×	✓	✓	×	✓	×
13.	5.1								
14.	6.1	ondemand check-	ud	×	✓	✓	✓	✓	×
15.	7.1	×	ud	×	✓	✓	×	×	×

2.3 Data quality information

Theme/Sub theme of spatial data *(Select from the list above)*	3. Logical consistency			4. Compatibility with similar dataset		5. Any procedures for Change Control		6. Certification of metadata
	3.1 Semantics	3.2 Data Schema	2.3 Data Syntactic	4.1 Yes	4.2 No	5.1 Yes	5.2 No	
1. 1.1				✓				
2. 1.2				✓		✓		✓
3. 1.3				✓				
4. 2.1	Survey			✓				
5. 2.2				✓		survey		✓
6. 2.3				✓		✓		
7. 2.4				✓				
8. 3.1								
9. 3.2								
10. 3.3		✓		✓			✓	x
11. 3.4				✓			✓	x
12. 4.1				✓		✓		✓
13. 5.1								
14. 6.1				✓		✓		x
15. 7.1	survey			✓		✓		x

2.4 Spatial data organization information

Theme/Sub theme of spatial data *(Select from the list above)*	1. Indirect spatial reference		2.Direct spatial reference method	3. Point and vector object info	4.Raster object info
	1.1 geographic features	1.2 addressing schemes			
1. 1.1	✓	✓			
2. 1.2	✓	✓	vector		
3. 1.3	✓	✓			
4. 2.1	✓				
5. 2.2	✓		vector.		
6. 2.3	✓		.		
7. 2.4	✓				
8. 3.1					
9. 3.2					
10. 3.3	✓		vector.		
11. 3.4	✓		vector		
12. 4.1	✓		vector.		
13. 5.1	✓				
14. 6.1 7.1	✓		vector.		
	name of types of geographic features, addressing schemes, or other means through which locations are referenced in the data set		Point Vector Raster vector		

2.5 Spatial reference information

Theme/Sub theme of spatial data *(Select from the list above)*	1.Horizontal coordinate system		2.Vertical coordinate system	
1. 1.1			2.	
2. 1.2	WGS 84			
3. 1.3				
4. 2.1	SLD99			
5. 2.2				
6. 2.3			2.1	
7. 2.4				
8. 3.1				
9. 3.2				
10. 3.3	WGS.		2	
11. 3.4	〃		2	
12. 4.1	WGS		2	
13. 5.1				
14. 6.1	WGS		2	
15. 7.1	WGS		2	
	1.Datum 2.Coordinate system name 3.EPSG of coordinate system		Height based on 1.MSL 2.WGS84(Global ellipsoid) 3.Local ellipsoid	

2.6 Entity and attribute information
(details about the information content of the data set, including the entities types(Road), their attributes(Name,type,), and the domains(String,Int) from which attribute values may be assigned)

Theme/Sub theme of spatial data *(Select from the list above)*	**1.Detailed description**		**2. Overview Description** (detailed description of, the information content of the data set.)	
	1.1 Entity Type	**1.2 Attribute**	**2.1 Entity and attribute overview**	**2.2 Entity and attribute detail citation**
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				
			detailed summary of the information contained in a data set.	reference to the complete description of the entity types, attributes, and attribute values for the data set.

7 Metadata accessibility information

Theme/Sub theme of spatial data *(Select from the list above)*	1. metadata classification			2.Data sharing format	3. Accessibility	4. Data sharing method	5. Data Fee
	1.1 Proprietary	1.2 Confidentiality	1.3 Security				
1. 1.1	?		✓				
2. 1.2	×	✓	✓	4	1	Web Access	Free
3. 1.3			✓				
4. 2.1					×		
5. 2.2				2.	2.	〃	Not yet
6. 2.3	✓						defined.
7. 2.4							
8. 3.1							
9. 3.2							
10. 33	×	×	×	2	2	official request Web access	Not yet defined.
11. 3.4	✓	×	✓	2	1	official request	〃
12. 4.1	×	×	✓	4	1	〃 〃	Free
13. 5.1							
14. 6.1	✓	×	✓	2	2.	web acce	Not yet
15. 7.1	✓	×	✓	1	2	official req/ web access	Not yet
				1. Raw data on request 2. Derived form on request 3. All the Geospatial data 4. General data 5. Processed data on user needs	1. Freely available to I.download by web Only by Key Staff of the Organization 2. Available to all the Staff of the Organization Defined Key Focal Points of the Institutions falling within the Ministry Any Government Organization	Personal visit Official request Official request, approved by HO & Payment Request by email Request through established geoportal and LAN/WAN Web Access Only by payment	Base for costing: 1. Map sheet or tile 2. Area basis 3. Others (Specify below) Other (Base for costing):

2.8 Metadata Reference Information

Theme/Sub theme of spatial data *(Select from the list above)*	1.Date of metadata (Last updated date)	2. Metadata Standard name	3. Metadata Standard version	4. Metadata security classification
1. 1.1		Yes ISO		M
2. 1.2	Weekly	FGDC		Unclassified.
3. 1.3		ebRIM		
4. 2.1		Dublincore		
5. 2.2				
6. 2.3	maitenance info.			Unclassified
7. 2.4				
8. 3.1				
9. 3.2				
10. 3.3		~	~	
11. 3.4		~	x	Unclassified
12. 4.1	Weekly	ISO		Unclassified
13. 5.1				
14. 6.1		~	~	Unclassified
15. 7.1	~~No~~ 2015	~	~	" "
		the name of the metadata standard used to document the data set.	identification of the version of the metadata standard used to document the data set.	"Top secret" "Secret" "Confidential" "Restricted" "Unclassified" "Sensitive"

]

4.1 Data Storage Information

Storage medium	Types of data stored		Data format	Risk and vulnerability		
				Compliance	Security	Privacy
Image server	1 Digital Orthophotography 2 VHR Satellite Images 3 Other Type of Satellite Images 4 Other Raster Data (Aerial Photos etc) 5 Scanned Maps					
Data server	1 Oracle GIS Databases 2 ArcSDE file server	✓	Shape file. N/A			
Application Server						
Web server						
Work server						
Directory servers						
Fire-walls						
Domain name servers						
Archived server	1. Arc Info Libraries 2 Shapefiles 3 GIS Vector Data 4 Geodata Database					
Anti-virus						
Intrusion detection system						
Intrusion protection system						
Workstations Personal computers						

Laptops			✓			
CD-Rom			✓			
External Hard drive			✗			
Other types						
(Please specify)						

Organizational profile spatial data

Unit of the organization	Main activities of the unit	Types of spatial data (Mark a √)						Where do you receive spatial data (Mark a √)			Do you generate, use or share spatial data in each activity (Mark a √)		
		Vector	Raster	Text	mapsHard copy	Images / videos	(Please specify)Others	Internal	External	If source is external, please specify the external source or institute	Generate	Use	Share
Mitigation Research & Development	Risk Assessment	✓	✓			✓				Survey Dept	✓	✓	✓
	Research	✓	✓			✓					✓	✓	✓
	Emergency mapping	✓	✓			✓		✓	✓	Int. Charter Sentinel Asia	✓	✓	✓
										Survey Dept			

APPENDIX C – DATA DICTIONARY

C.1 Survey Department Data Dictionary

Coverage name : **BUILDING**

Scale of compilation : 1:10,000 & 1: 50,000

Feature Class : Polygons (1:10,000) & Points (1: 50,000)

Description : All Buildings compiled as building polygons or points.

Features : All building features, that can be shown as building polygons.

Attribute table name : BUILDING.PAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION (In 1:10,000 scale)
100	BLDGA	Building -Unspecified – without name
110	BTMPA	Buddhist Temple
112	HTMPA	Hindu Temple (Kovil)
114	CHRHA	Church
116	MOSQA	Mosque
120	USCHA	School – Unclassified
127	UNSTA	University
128	TCHCA	Technical College
129	TREIA	Tertiary Education Institutes
130	UHSPA	Hospital – Unclassified
137	PHSPA	Hospital -Private
134	DSPNA	Dispensary
140	PLCSA	Police Station
142	PLCPA	Police Post
148	UCRTA	Courts - Unclassified
150	MPOFA	Main Post Office
152	SPOFA	Sub Post Office
153	APOFA	Agency Post Office
154	UPOFA	Post Office - Unclassified
160	HOTLA	Hotel
162	RTHSA	Rest House
164	CTBNA	Circuit Bungalow
180	CMTBA	Cemetery Building
184	LTHSA	Light House
170	PTHSA	Private House
172	GVTBA	Other Govt Building
174	HSTSA	Historical Monument
176	BANKA	Bank Building
178	CMMBA	Commercial Buildings
179	FCTRA	Factory Building

190	BLDCA	Building Under Construction
180	RLSTA	Railway Station
181	RLHTA	Railway Halt
182	BUSSA	Bus Stand
184	FLSTA	Filling Station
192	APRTA	Air Port
194	PORTA	Port

SDCODE	GFCODE	FEATURE DESCRIPTION (In 1:50,000 scale)
100	BLDGP	Building -Unspecified – without name
110	BTMPP	Buddhist Temple
112	HTMPP	Hindu Temple (Kovil)
114	CHRHP	Church
116	MOSQP	Mosque
120	USCHP	School – Unclassified
127	UNSTP	University
128	TCHCP	Technical College
129	TREIP	Tertiary Education Institutes
130	UHSPP	Hospital – Unclassified
137	PHSPP	Hospital -Private
134	DSPNP	Dispensary
140	PLCSP	Police Station
142	PLCPP	Police Post
148	UCRTP	Courts - Unclassified
150	MPOFP	Main Post Office
152	SPOFP	Sub Post Office
153	APOFP	Agency Post Office
154	UPOFP	Post Office - Unclassified
160	HOTLP	Hotel
162	RTHSP	Rest House
164	CTBNP	Circuit Bungalow
180	CMTBP	Cemetery Building
184	LTHSP	Light House
170	PTHSP	Private House
172	GVTBP	Other Govt Building
174	HSTSP	Historical Monument
176	BANKP	Bank Building
178	CMMBP	Commercial Buildings
179	FCTRP	Factory Building
190	BLDCP	Building Under Construction
180	RLSTP	Railway Station
181	RLHTP	Railway Halt
182	BUSSP	Bus Stand
184	FLSTP	Filling Station
192	APRTP	Air Port
194	PORTP	Port

Coverage name : **TRANS**

Scale of compilation : 1:10,000 & 1: 50,000

Feature Class : Arcs

Description : All Roads and Railways

Features : Linear features showing Roads and Railways

Attribute Table : TRANS.AAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
200	EXPRL	Expressway
210	MNRDL	Main Roads
211	MRBRL	Main road on Bridge
212	MRBNL	Main road on Bund
213	MRTNL	Main road along Tunnel
214	MRCWL	Main road on Causeway
220	SDRDL	Secondary/Minor Roads
221	SRBRL	Secondary/Minor Road on Bridge
222	SRBNL	Secondary/Minor road on Bund
223	SRTNL	Secondary/Minor road along Tunnel
224	SRCWL	Secondary/Minor road on Causeway
240	TRCKL	Jeep/Cart Track
241	TRBRL	Track on Bridge
242	TRBNL	Track on Bund
243	TRTNL	Track along Tunnel
244	TRCWL	Track on causeway
245	LANEL	Lane
250	FTPHL	Footpath
251	FPBRL	Footpath on Bridge
252	FPBNL	Footpath on Bund
253	FPTNL	Footpath along Tunnel
260	RAILL	Railways
261	RLBRL	Railway line on Bridge
262	RLBNL	Railway line on Bund
263	RLTNL	Railway line along Tunnel
265	RNWYL	Runway
267	TXWYL	Taxiway
270	BRDGL	Bridge
272	RDUCL	Road Under Construction

273	FRRYL		Ferry Service
275	RLCPL		Railway Crossing – Protected (line)
274	MISCL		Line Unidentified (applicable for 10,000 raw data)
TYPE	4,4,C	eg. A12 or B1	Type and Number for Roads
		BGS	Broad Gauge Single Railways
		BGD	Broad Gauge Double Railways
		NBG	Narrow & Broad Gauge
NAME	30,30,C	*	Name of the Roads if available.
YEAR	4,4,B		Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching

Note:

- Name of the Road, Lane etc. eg. KIRULA ROAD.
- Road Directions are stored as annotation feature class.

Coverage name : **LUSE**

Scale of compilation : 1:1,000 & 1: 50,000

Description : All vegetation areas.

Feature Class : Arcs and Polygons

Features : Arcs that define vegetation/land cover polygons listed below and polygons of such vegetation areas.

Arc Attribute Table : No arc attributes

Polygon Attribute Table : LUSE.PAT

Attribute Descriptions:

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
300	MNGRA	Mangrove
305	MRSHA	Marsh
306	SWMPA	Swamp
310	PDDYA	Paddy
315	PDYAA	Paddy-abandoned
320	TEAA	Tea
322	RBBRA	Rubber
324	CCNTA	Coconut
331	CNMNA	Cinnamon
332	CTNLA	Cittranella
333	CSHWA	Cashew
334	PLMRA	Palmyrah
335	OLPMA	Oil Palm
336	SGCNA	Sugarcane
337	OTHRA	Other cultivations
338	MIXDA	Mixed tree and other perennial crops
339	SPRSA	Sparsely used cropland
340	FRSDA	Dense Forest
342	FRSOA	Open Forest
344	FRSPA	Forest Plantation
345	FRSUA	Forest - Unclassified
346	SCRBA	Scrub land
350	CHNAA	Chena
352	GRSLA	Grassland
360	NLNDA	Associated non-agricultural land
362	BRRNA	Barren land

364	QRRYA	Quarry
365	DSTSA	Distorted surface
366	ROCKA	Rock
368	PARKA	Park
369	PLGDA	Playground
370	HOMSA	Homesteads/Garden
380	AQTCA	Aquatic farms
382	AGRCA	Agricultural farms
384	LSVTA	Livestock farms
399	UNCLA	Unclassified
378	CMTYA	Cemetery
372	SANDA	Sand areas
376	BLTPA	Built up area (only in 50,000)
390	HYDRA	All Water areas - Unclassified

YEAR	4,4,B		Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching.

Coverage name : **HYDRO**

Scale of compilation : 1:10,000 & 1: 50,000

Feature Class : Arcs & Polygons

Description : All water bodies natural or man made

Features : Linear and Polygon features showing Rivers, Streams, Channels.

Attribute Table Name : HYDRO.AAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE		FEATURE DESCRIPTION
410	STRML		Boundary/feature of all Streams
412	STRMV		Stream virtual line
420	CHNLL		Irrigation Channel
422	CHNLV		Irrigation Channel virtual line
424	CHNAL		Channel (Abandoned)
425	CNNLL		Canal
428	TNNLL		Tunnel
430	RSVRL		Reservoir boundaries
432	LAKEL		Lake boundaries
434	TANKL		Tank boundaries
436	TANKV		Tank boundaries - virtual
436	TNKAL		Tank- abandoned boundaries
438	PONDL		Pond boundaries
440	LAGNL		Lagoon boundaries
442	LAGNV		Lagoon boundaries - virtual
444	LEWYL		Lewaya/Salt pan boundaries
446	LEWYV		Lewaya/Salt pan boundaries – virtual
448	WTRHL		Water holes boundaries
450	BUNDL		All bund lines
451	BNDAL		Bund line (Abandoned)
452	DAML		All Dam lines
453	SPLLL		Spill line
454	ANCTL		Anicut Line
460	OUTBL		Outline of the country
462	OUTBV		Outline of the country - virtual
490	HYDRV		Arcs to close polygons at the sheet edge.
492	ILNDL		Island Boundaries
NAME	50,50,C	*	Name of the water feature (if available).

YEAR	4,4,B		Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching

Note:

* Name of the River, Stream etc. eg. KELANI GANGA or YAN OYA.

Attribute Table Name : HYDRO.PAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
411	STRMA	Areas of all Minor Streams
431	RSVRA	Reservoirs
433	LAKEA	Lakes
435	TANKA	Areas of all tanks
437	TNKAA	Areas of all abandoned tanks
439	PONDA	Areas of all Ponds
441	LAGNA	Areas of all Lagoons
445	LEWYA	Areas of Lewaya/Salt pan
449	WTRHA	Areas of all Water holes
470	CNNLA	Areas of Canals
499	SEAA	All Sea areas
475	BNDAA	Bund abandoned areas
474	BUNDA	Bund areas
473	TNNLA	Tunnel areas
472	CHNAA	Channel - abandoned
421	CHNLA	Channel area
470	CNNLA	Canal area
494	ILNDA	Island areas

NAME	50,50,C	*	Name of the water feature (if available).
YEAR	4,4,B		Year of data collection.

Coverage name : **TERRAIN**

Scale of compilation : 1:10,000 & 1: 50,000

Feature Class : ARCS & POINTS

Description : All Contours and Height points

Features : All Contour lines and points in which the heights are known.

Arc Attribute Table : TERAIN.AAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
500	INDXL	Index Contours
502	INDUL	Index Contours - Uncertain
510	INTRL	Intermediate Contours
512	INTUL	Intermediate Contours - Uncertain
514	SUPPL	Supplementary Contours
520	UNCRL	Uncertain Contours
530	BATHL	Bathematic Contours

Item	Item Format	Value Domain	Value Description
ELEVATION	5,5,I	as applicable	Elevation
YEAR	4,4,B	as applicable	Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching

Point Attribute table : TERRAIN.PAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	SPHTP	All Spot Height Points

Coverage name : **PLACES**

Scale of compilation : 1:1,000 & 1: 50,000

Feature Class : POINTS

Description : All places and features symbolised as points

Features : All places, culverts, that are symbolised as points

Arc Attribute Table : PLACES.PAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
600	PLCEP	Place Name
602	VILLP	Village Name
604	GNDVP	GN Division Name
605	TOWNP	Town Name
606	ESTTP	Estate Name
607	JUNCP	Junction Name
610	TRNSP	Transformer point
612	SPLLP	Spill point
614	SLCEP	Sluice Point
616	ANCTP	Anicut Point
618	CLVTP	Culvert
620	RLCPP	Railway Crossing – Protected
622	RLCUP	Railway Crossing – Un protected
624	KLMPP	Kilo meter posts
	TRIGP	Trig Points
626	HLPDP	Helicopter pad
628	WTRFP	Water Fall
630	MISCP	Miscellaneous point
632	TBWLP	Tube Well
640	TOWRP	Tower
645	FORDP	Ford

NAME	50,50,C	Name of the place if any.
YEAR	4,4,B	Year of data collection.

Coverage name : **ADMIN**

Scale of compilation : 1:1,000 & 1: 50,000

Feature Class : Arcs and Polygons

Description : Administrative boundaries and administrative areas.

Features :Administrative boundaries and polygons of DS divisions and the Local Government areas.

Arc Attribute Table: ADMIN.AAT

Attribute Descriptions.

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE (in the order of Hierarchy)	FEATURE DESCRIPTION (in the order of Hierarchy)
700	EEZBL	Exclusive Economic Zone
705	CTZBL	Contiguous Zone limit
707	TTWBL	Territorial waters limit
710	OUTBL	Outline of the country
712	OUTBV	Outline of the country - Virtual
720	PRVBL	Province boundary
730	DSTBL	District boundary
740	DSDBL	DS Division boundary
750	LGVBL	Local Govt. boundary
760	GNDBL	GN boundary
770	ADMNV	Arcs to close all ADMIN boundaries

YEAR	4,4,B		Year of source data compiled.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching

Polygon Attribute Table: ADMIN.PAT

Coverage name : **RESERVES**

Scale of compilation : 1:1,000 & 1: 50,000

Description : All reservation areas.

Feature Class : Arcs and Polygons

Features : Arcs that define reservation cover polygons listed below and polygons of such reservation areas.

Arc Attribute Table : No arc attributes

Polygon Attribute Table : RESERVES.PAT

Attribute Descriptions:

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	See table below	See table below
SDCODE	3,3,I	See table below	See table below

SDCODE	GFCODE	FEATURE DESCRIPTION
800	FRRSA	Forest Reserves.
810	WLRSA	Wildlife Reserves

NAME	50,50,C	*	Name of the reservation
YEAR	4,4,B		Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		7	Compiled form 1: 50,000 photographs
		8	Compiled form 1: 20,000 photographs
		9	Compiled form 1: 8,000 photographs
		10	Compiled by Ground Survey
		7	Compiled by Manual Sketching.

Coverage name : **UTILITY**

Scale of compilation : 1:10,000 only

Feature Class : Arcs

Description : All Utilities

Features : Linear features showing all utilities

Attribute Table : UTILITY.AAT

Attribute descriptions :

Item	Item Format	Value Domain	Value Description
GFCODE	5,5,C	PWERL	Power transmission lines
		WTERL	Water pipe lines
		WTNNL	Water Tunnel
TYPE	8,8,C	15KV	Voltage
SDCODE	3,3,I	900	Power transmission lines
		910	Water pipe lines
		920	Water Tunnel
NAME	30,30,C		Name of the utility if any.
YEAR	4,4,B		Year of data collection.
METHOD	2,2,B	1	Digitized from 1:50,000 maps
		2	Digitized from 1:10,000 maps
		3	Compiled form 1: 50,000 photographs
		4	Compiled form 1: 20,000 photographs
		5	Compiled form 1: 8,000 photographs
		6	Compiled by Ground Survey
		7	Compiled by Manual Sketching

Coverage name : **CONTROL**

Scale of compilation : 1:10,000 & 1: 50,000

Feature Class : Arcs and Points

Description : Horizontal and Vertical control traverses and points

Features : Primary, secondary, and tertiary traverses, primary, secondary, & tertiary triangulation points, GPS control points, Fundamental Benchmarks, primary, secondary, & tertiary level lines.

ARC Attribute Table: CONTROL.AAT

Attribute Descriptions:

Item	Item Format	Value Domain	Value Description
GFCODE	4,4,C	PTVL	Primary Traverse Line
		STVL	Secondary Traverse Line
		TTVL	Tertiary Traverse Line
		PLVL	Primary Level Line
		SLVL	Secondary Level Line
		TLVL	Tertiary Level Line
TRID	4,4,C		Traverse/level line number
YEAR	4,4,B		Year of data collection.

POINT Attribute Table: CONTROL.PAT

Attribute Descriptions:

Item	Item Format	Value Domain	Value Description
GFCODE	4,4,C	PTGP	Primary triangulation point
		STGP	Secondary Triangulation Point
		TTGP	Tertiary Triangulation Point
		GPSP	GPS control point
		PTVP	Primary Traverse Point
		STVP	Secondary Traverse Point
		TTVP	Tertiary Traverse Point
		FBMP	Fundamental Bench Mark
STID	4,4,C		Station ID Number
NORTHING	6,6,F,3		North coordinate
EASTING	6,6,F,3		East coordinate
ELEVATION	4,4,F,3		Elevation
YEAR	4,4,B		Year established or observed

C.2 LUPPD – LANDUSE CLASSIFICATION

Main Category	Sub Category	Symbols
Built-up areas	Homestead/ Home gardens	HG
	Urban Areas	UA
	Express way	Exp
	Aquatic farms	AQF
	Livestock Farms	LSF
Agricultural Lands / Cultivation area	Paddy	P
	Tea	T
	Rubber	R
	Coconut	C
	Industrial Parks	IP
	Industrial Sites	IS
	Parks/ Playground	PK/PG
	Botanical Gardens	BG
	Security camps/ Security Zones	SCA
	Air Ports	AP
	Cemetery	CM
	Agricultural farms	AGF
Agricultural Lands/ Cultivation Area	Seasonal Corps	SC
	Foliage/ Flowering plants	FLP
	Sugar cane	SUG
	Oil Palm	OILP
	Cashew	CAH
	Cinnamon	CIN
	Banana	BAN
	Pineapple	PIN
	Mango	MNG
	Pepper	PEP
	Mixed tree and other perennials	MTOP
	Sparsely used corps	SUCL
	Abandoned paddy	AP
	Abandoned rubber	AR
	Abandoned Tea	AT
	Dense Forest	DF
	Open Forest	OF
	Scrub Land	SL
	Forest Plantation	FP
	Grass Lands	GL
Wet Lands	Marsh	M
	Swamp	S
	Mangroves	MN
	Villu	
	Lagoon	LG

Water Bodies	Major Reservoirs	MJR
	Minor Reservoirs	MNR
	Abandoned Tanks	ABT
	Natural Ponds	NP
	Rivers/ Streams	RIV/STR
	Lakes	LAK
	Canals	CAN
	Irrigation Canals	IRCAN
	Salterns	SALT
Sandy Areas	Sand Dunes	SDUN
	Sandy Areas	SARE
Rocky Areas		RARE
		MA
		AQR
Bare Lands	Unutilized Lands	UUL
		CLP
	Clay Pits	
	Gravel Pits	GLP
	Barren Lands Distorted surfaces	BL/DS

APPENDIX D – FEATURE MAPPING

Class	Theme	Category
Farming	Landuse	Mangrove Marsh Swamp Paddy Paddy-abandoned Tea Rubber Coconut Cinnamon Cittranella Cashew Palmyrah Oil Palm Sugarcane Other cultivations Mixed tree and other perennial crops Sparsely used cropland Dense Forest Open Forest Forest Plantation Forest – Unclassified Scrub land Chena Grassland Associated non-agricultural land Barren land Quarry Distorted surface Rock Park Playground Homesteads/Garden Aquatic farms Agricultural farms Livestock farms Unclassified Cemetery Sand areas Built up area (only in 50,000) All Water areas - Unclassified
Biota		
Boundaries	Administrative	Exclusive Economic Zone Contiguous Zone limit Territorial waters limit Outline of the country Outline of the country - Virtual

		Province boundary District boundary DS Division boundary Local Govt. boundary GN boundary Arcs to close all ADMIN boundaries
Climatalogy meteorology atmosphere		
Economy		
Elevation	Terrain	Index Contours Index Contours - Uncertain Intermediate Contours Intermediate Contours - Uncertain Supplementary Contours Uncertain Contours Bathematic Contours
Environment	Reserves	Forest Reserves. Wildlife Reserves
Geo scientific information		
Health		
Iamagery Basemap earthcover		
Intelligancemilitary		
Inland waters	Hydrography	Boundary/feature of all Streams Stream virtual line Irrigation Channel Irrigation Channel virtual line Channel (Abandoned) Canal Tunnel Reservoir boundaries Lake boundaries Tank boundaries Tank boundaries - virtual Tank- abandoned boundaries Pond boundaries Lagoon boundaries Lagoon boundaries - virtual Lewaya/Salt pan boundaries Lewaya/Salt pan boundaries – virtual Water holes boundaries All bund lines Bund line (Abandoned) All Dam lines Spill line Anicut Line

		Outline of the country Outline of the country - virtual Arcs to close polygons at the sheet edge. Island Boundaries
Location	Toponyms	Place Name Village Name GN Division Name Town Name Estate Name Junction Name Transformer point Spill point Sluice Point Anicut Point Culvert Railway Crossing – Protected Railway Crossing – Un protected Kilo meter posts Trig Points Helicopter pad Water Fall Miscellaneous point Tube Well Tower Ford
Oceans		
Planing cadaster		
Society		
Structure	Buildings	Building -Unspecified – without name Buddhist Temple Hindu Temple (Kovil) Church Mosque School – Unclassified University Technical College Tertiary Education Institutes Hospital – Unclassified Hospital -Private Dispensary Police Station Police Post Courts - Unclassified Main Post Office Sub Post Office Agency Post Office

		Post Office - Unclassified Hotel Rest House Circuit Bungalow Cemetery Building Light House Private House Other Govt Building Historical Monument Bank Building Commercial Buildings Factory Building Building Under Construction Railway Station Railway Halt Bus Stand Filling Station Air Port Port
Transportation	Transportation	Expressway Main Roads Main road on Bridge Main road on Bund Main road along Tunnel Main road on Causeway Secondary/Minor Roads Secondary/Minor Road on Bridge Secondary/Minor road on Bund Secondary/Minor road along Tunnel Secondary/Minor road on Causeway Jeep/Cart Track Track on Bridge Track on Bund Track along Tunnel Track on causeway Lane Footpath Footpath on Bridge Footpath on Bund Footpath along Tunnel Railways Railway line on Bridge Railway line on Bund Railway line along Tunnel Runway Taxiway Bridge

Utilities communication	Utility	Power transmission lines Water pipe lines Water Tunnel Voltage Power transmission lines Water pipe lines Water Tunnel

TABLE C. 1 Survey department theme mapping with ISO topic categories

APPENDIX E – TEST CASES

E.1 Add Institute Abbreviation

Add institute abbreviation test case is shown in Table E.1

No	Test Description	Expected Output	Actual Output	State
01	Enter valid data to required fields	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty institute abbreviation	Display an error message “Please enter abbreviation”	Display an error message “Please enter abbreviation”	Pass

TABLE E. 1 – Add Institute Abbreviation Test case

E.2 User Authentication

User authentication test case is shown in Table E.2

No	Test Description	Expected Output	Actual Output	State
01	Select authorized users.	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty users	Display an error message “Please mark users for authorization”	Display an error message “Please mark users for authorization”	Pass

TABLE E. 2 User Authentication Test case

E.3 Add Metadata

Add metadata test case is shown in Table E.3

No	Test Description	Expected Output	Actual Output	State
01	Enter valid data to required fields	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty language	Display an error message “Please select language”	Display an error message “Please select language”	Pass
03	Leave empty hierarchy level	Display an error message “Please select hierarchy level”	Display an error message “Please select hierarchy level”	Pass

04	Leave empty date stamp	Display an error message “Please select date stamp”	Display an error message “Please enter select date stamp”	Pass
05	Leave empty dataset URL	Display an error message “Please enter dataset URL”	Display an error message “Please enter dataset URL”	Pass
06	Leave empty title	Display an error message “Please enter dataset title”	Display an error message “Please enter dataset title”	Pass
07	Leave empty abstract	Display an error message “Please enter abstract”	Display an error message “Please enter abstract”	Pass
08	Leave empty purpose	Display an error message “Please enter purpose”	Display an error message “Please enter purpose”	Pass
09	Leave empty status	Display an error message “Please select status”	Display an error message “Please select status”	Pass
10	Leave empty production date	Display an error message “Please select production date”	Display an error message “Please select production date”	Pass
11	Leave empty creation date	Display an error message “Please select creation date”	Display an error message “Please select creation date”	Pass
12	Leave empty revision date	Display an error message “Please select revision date”	Display an error message “Please select revision date”	Pass
13	Leave empty spatial representation type	Display an error message “Please select spatial representation type”	Display an error message “Please select spatial representation type”	Pass
14	Leave empty spatial resolution	Display an error message “Please select spatial resolution”	Display an error message “Please select spatial resolution”	Pass
15	Leave empty topic category	Display an error message “Please select topic category”	Display an error message “Please select topic category”	Pass
16	Leave empty level	Display an error message “Please select level”	Display an error message “Please select level”	Pass

17	Leave empty lineage	Display an error message “Please enter lineage”	Display an error message “Please enter lineage”	Pass
18	Leave empty maintenance and update frequency	Display an error message “Please select maintenance and update frequency”	Display an error message “Please select maintenance and update frequency”	Pass
19	Leave empty date of next update	Display an error message “Please enter date of next update”	Display an error message “Please enter date of next update”	Pass
20	Leave empty scope	Display an error message “Please select scope”	Display an error message “Please select scope”	Pass

TABLE D. 3- Add Metadata Test case

E.4 User File Upload

User file upload test case is shown in Table E.4

No	Test Description	Expected Output	Actual Output	State
01	Browse CSV file and Upload	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Submit without a CSV file	Display an error message “Please select CSV file”	Display an error message “Please select CSV file”	Pass

TABLE E. 4 User file upload test case

E.5 Data Mapping

Data mapping test case is shown in Table E.5

No	Test Description	Expected Output	Actual Output	State
01	Define all mappings	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty mapping field	Display an error message “Please define mapping for all required fields”	Display an error message “Please define mapping for all required fields”	Pass

TABLE E. 5 Data Mapping Test Case

E.6 Mapping Verification

Mapping verification test case is shown in Table E.6

No	Test Description	Expected Output	Actual Output	State
01	Define all mappings	Display successful message and save data to database	Display successful message and save data to database	Pass
02	Leave empty mapping field	Display an error message “Please define mapping for all required fields”	Display an error message “Please define mapping for all required fields”	Pass

TABLE E. 6 Mapping Verification Test Case

APPENDIX F – USER EVALUATION RESULTS

USER EVALUATION FORM

For

Standard Metadata Web Portal

No	Questions	User Satisfaction		
		High	**Moderate**	**Low**
01	Ease of accessing	✓		
02	Easy navigation through the web		✓	
03	User friendliness and consistency with the user interface	✓		
04	Ability to grant privileges for authenticated users	✓		
05	Administrator has the privilege to access every menu option of the system	✓		
06	Ability to understand module functions easily	✓		
07	Easy to understand error messages	✓		
08	Ability to maintain data		✓	
09	Easy to understand form fields and operation of the system	✓		
10	Proper validation of forms		✓	
11	Availability of proper buttons, text boxes, dropdown boxes in forms	✓		
12	Provide sufficient information on views	✓		
13	Response time	✓		
14	Fulfil all required functionalities	✓		
15	Accessibility of product support	✓		
16	Overall reliability	✓		
17	Overall Performance	✓		

Department Name : Survey Department

USER EVALUATION FORM

For

Standard Metadata Web Portal

No	Questions	User Satisfaction		
		High	**Moderate**	**Low**
01	Ease of accessing	✓		
02	Easy navigation through the web	✓		
03	User friendliness and consistency with the user interface	✓		
04	Ability to grant privileges for authenticated users	✓		
05	Administrator has the privilege to access every menu option of the system	✓		
06	Ability to understand module functions easily		✓	
07	Easy to understand error messages	✓		
08	Ability to maintain data	✓	✓	
09	Easy to understand form fields and operation of the system	✓		
10	Proper validation of forms	✓		
11	Availability of proper buttons, text boxes, dropdown boxes in forms	✓		
12	Provide sufficient information on views	✓		
13	Response time	✓		
14	Fulfil all required functionalities	✓		
15	Accessibility of product support	✓		
16	Overall reliability	✓		
17	Overall Performance		✓	

Department Name : LUPPD

USER EVALUATION FORM

For

Standard Metadata Web Portal

No	Questions	User Satisfaction		
		High	**Moderate**	**Low**
01	Ease of accessing	✓		
02	Easy navigation through the web		✓	
03	User friendliness and consistency with the user interface		✓	
04	Ability to grant privileges for authenticated users			
05	Administrator has the privilege to access every menu option of the system	✓		
06	Ability to understand module functions easily	✓		
07	Easy to understand error messages	✓		
08	Ability to maintain data	✓		
09	Easy to understand form fields and operation of the system	✓		
10	Proper validation of forms	✓		
11	Availability of proper buttons, text boxes, dropdown boxes in forms	✓	✓	
12	Provide sufficient information on views	✓		
13	Response time	✓		
14	Fulfil all required functionalities	✓		
15	Accessibility of product support	✓		
16	Overall reliability	✓		
17	Overall Performance	✓		

Department Name : Disaster Management Centre

USER EVALUATION FORM

For

Standard Metadata Web Portal

No	Questions	User Satisfaction		
		High	**Moderate**	**Low**
01	Ease of accessing	✓		
02	Easy navigation through the web	✓		
03	User friendliness and consistency with the user interface	✓		
04	Ability to grant privileges for authenticated users	✓		
05	Administrator has the privilege to access every menu option of the system		✓	
06	Ability to understand module functions easily		✓	
07	Easy to understand error messages		✓	
08	Ability to maintain data	✓		
09	Easy to understand form fields and operation of the system	✓		
10	Proper validation of forms	✓		
11	Availability of proper buttons, text boxes, dropdown boxes in forms	✓		
12	Provide sufficient information on views		✓	
13	Response time	✓		
14	Fulfil all required functionalities	✓		
15	Accessibility of product support	✓		
16	Overall reliability		✓	
17	Overall Performance	✓		

Department Name : RDA

APPENDIX G – MAJOR CODE SEGMENTS

```
<?php
$csv = array();

$array_od = array();

$array_topic = array();
$array_gfcode = array();
$array_status = array();
$array_srt = array();
$array_hl = array();
$array_mauf = array();
$array_us = array();
$array_level = array();


// check there are no errors
if ($_FILES['csv']['error'] == 0) {
    $name = $_FILES['csv']['name'];
//    $ext = strtolower(end(explode('.', $_FILES['csv']['name'])));
    $type = $_FILES['csv']['type'];
    $tmpName = $_FILES['csv']['tmp_name'];

    // check the file is a csv
//    if ($ext === 'csv') {
    if (($handle = fopen($tmpName, 'r')) !== FALSE) {
        // necessary if a large csv file
        set_time_limit(0);

        $row = 0;

        while (($data = fgetcsv($handle, 1000, ',')) !== FALSE) {
            // number of fields in the csv
            $col_count = count($data);
            if ($row !== 0) {
                //Orginal Data Set
                $array_od_sub = array($data[0], $data[1], $data[2], $data[3],
$data[4], $data[5], $data[6], $data[7], $data[8], $data[9], $data[10],
$data[11], $data[12], $data[13], $data[14], $data[15], $data[16], $data[17],
$data[18], $data[19], $data[20], $data[21], $data[22], $data[23]);
                array_push($array_od, $array_od_sub);

                //Data Mapping set
                //topicCategory
                if ($data[0] !== '' && !in_array($data[0], $array_topic)) {
                    $found = false;
                    $sql_topic = pg_exec("SELECT * FROM original_data WHERE
md_mdid IN (SELECT mdid FROM md_metadata WHERE instituteid=$instituteid AND
status=1)");
```

```
                    while ($data_od = pg_fetch_array($sql_topic)) {
                        $lowerOD = strtolower($data_od[2]);
                        $lowerCSV = strtolower($data[0]);
                        if ($lowerOD == $lowerCSV) {
                            $found = true;
                        }
                    }
                    if (!$found) {
                        array_push($array_topic, $data[0]);
                    }
                }
                //gfCode
                if ($data[1] !== '' && !in_array($data[1], $array_gfcode)) {
                    $found = false;
                    $sql_gfcode = pg_exec("SELECT * FROM original_data WHERE
md_mdid IN (SELECT mdid FROM md_metadata WHERE instituteid=$instituteid AND
status=1)");
                    while ($data_od = pg_fetch_array($sql_gfcode)) {
                        $lowerOD = strtolower($data_od[3]);
                        $lowerCSV = strtolower($data[1]);
                        if ($lowerOD == $lowerCSV) {
                            $found = true;
                        }
                    }

                    if (!$found) {
                        array_push($array_gfcode, $data[1]);
                    }
                }

//Data Mapping View

<?php
for ($x = 0; $x < count($array_topic); $x++) {
?>
<tr>
<th scope="row"><p><?php echo $x + 1; ?></p></th>
<td>
<p class="orginalData"><?php echo $array_topic[$x]; ?></p>
</td>
<td>
<select class="form-control" onchange="updateDataMapping(this)">
<option>-  Select -</option>
<?php
$sql_topic = pg_exec("SELECT * FROM topic_category");

$statusMsg = '<p class="dataMissMatched">Miss-matched</p>';
while ($row = pg_fetch_array($sql_topic)) {
if (strtolower($array_topic[$x]) === strtolower($row[1])) {
$statusMsg = '<p class="dataMatched">Matched</p>';
```

```
echo "<option selected='true'>$row[1]</option>";
} else {
echo "<option>$row[1]</option>";
}
}
?>
</select>
</td>
<td class="mappingStatus"><?php echo $statusMsg; ?></td>
</tr>


Javascript validation

<script language="javascript">
            function readArrayData() {
                var found = true;

                var list_topic = [];
                $('#tableTopic tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_topic.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_topic = list_topic.join(",");

                var list_gfcode = [];
                $('#tableGfcode tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_gfcode.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_gfcode = list_gfcode.join(",");

                var list_status = [];
                $('#tableStatus tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
```

```
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_status.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_status = list_status.join(",");

                var list_srt = [];
                $('#tableSrt tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_srt.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_srt = list_srt.join(",");

                var list_hl = [];
                $('#tableHl tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_hl.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_hl = list_hl.join(",");

                var list_mauf = [];
                $('#tableMauf tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_mauf.push(orginalData + "#" + mappingValue);
                    }
```

```
                });
                var data_mauf = list_mauf.join(",");

                var list_us = [];
                $('#tableUs tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_us.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_us = list_us.join(",");

                var list_level = [];
                $('#tableLevel tr').each(function () {
                    var orginalData = $(this).find(".orginalData").html();
                    var mappingValue = $(this).find(".form-control
:selected").text();
                    if (orginalData !== undefined) {
                        if (mappingValue === '-  Select -') {
                            found = false;
                        }
                        list_level.push(orginalData + "#" + mappingValue);
                    }
                });
                var data_level = list_level.join(",");

                if (found) {
                    $.ajax({
                        type: 'post',
                        url: 'ArrayReader.php',
                        data: {
                            source_topic: data_topic,
                            source_gfcode: data_gfcode,
                            source_status: data_status,
                            source_srt: data_srt,
                            source_hl: data_hl,
                            source_mauf: data_mauf,
                            source_us: data_us,
                            source_level: data_level
                        },
                        success: function (data) {
                            //alert(data);
                            window.alert("Congradulation..! Dataset Submited.
Pending for Approval.....");
                            console.log(data);
```

```
                        window.location.replace('userfileUpload.php');
                    }
                });
            } else {
                window.alert("Please Mapped the all data");
            }

        }

    </script>
```