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Standardization Metadata Schema for Securing Interoperability: A Case Study at FORDA Digital Libraries-Indonesia

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Declaration

I certify that all material in this dissertation which is not my own work has been identified and that no material is included for which a degree has previously been conferred upon me.


.....Amma Naningrum (Submitted electronically)

ABSTRACT

Metadata schema is very important and should be considered in a digital library. Metadata schema makes possible metadata interoperability in digital libraries. Standard metadata schema is needed for consistency and ensuring interoperability. We should also consider the requirements of partner library institutions for creating and developing the standard metadata schema. Without consider the requirements of those institutions, metadata interoperability is not going well.

The aims of this study are to find out the issues of metadata interoperability for FORDA digital libraries and to give recommendation to secure the interoperability among them. This research uses a qualitative study approach and use case study as the research strategy. The case study of this research is FORDA digital libraries-Indonesia. Data collections techniques in this study are interview and documentation.

The finding of this study shows that there are several issues which create interoperability problems in the current FORDA metadata schema, such as: complexity of the current FORDA metadata schema, different metadata format files and unavailability metadata import facility different metadata schema, extensibility the current FORDA metadata schema, lack of expertise, language problem, limited number of metadata element, and technological problem. Those issues are the important issues that must be consider when we create and develop the new standard metadata schema for secure interoperability among digital libraries.

The findings also show that there are three recommendations for this study, such as: firstly, we recommend determining a standard metadata schema (INDOMARC) for securing interoperability among FORDA digital libraries. Secondly, we suggest using aggregation approach for securing interoperability among digital libraries which have multiple metadata schema and different requirements without determined a standard metadata schema. Thirdly, we propose the authority of FORDA digital libraries should take some initiative for securing interoperability among them. The recommendations are reasonable to develop and be able to implement so it makes interoperability among FORDA digital libraries is going well.

Keywords: Metadata schema, Interoperability, Standard, Digital Library, FORDA

Dedication

To my lovely Mother (Piranti) and Father (Abdul Chotib), my beloved honey (Huda Muwaffaq) and my beloved hubby (Heru Astanto) who has always kind, sincere, care, love and support to me and always make me happy. Without you I am nothing and because all of you I am stand up today.

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List of Abbreviations

*.csv	Comma-Separated Text files
*.mst	Microsoft Windows Installer Transform files
*.par	Parity Archive files
*.sql	Structured Query Language files
*.xls	Microsoft Excel spreadsheet files
A.Md	Ahli Madya
AACR	Anglo-American Cataloguing Rules
AITC	the Art Information Task Force
AUSMARC	Australia Machine-Readable Cataloguing (National MARC of Australia)
BBPBTH	Balai Besar Penelitian Bioteknologi dan Pemuliaan Tanaman Hutan
BPHPS	Balai Penelitian Hutan Penghasil Serat
BPK	Balai Penelitian Kehutanan
BYBSYS-MARC	Bibliographic format standard that used in Norwegian library
CC: DA	Committee on Cataloguing: Description and Access
CD	Compact Disk
DANMARC	Denmark Machine-Readable Cataloguing (National MARC of Denmark)

DCMES	Dublin Core Metadata Element Set
DDC	Dewey decimal classification
DTD	Document Type Definition
DVD	Digital Video Disk or Digital Versatile Disk
E-Resources	Electronic Resources
FORDA	Forestry Research and Development Agency
HTTP	Hypertext Transfer Protocol
I-1	Informant One
IFLA	International Federation of Library Associations
INDOMARC	Indonesian Machine-Readable Cataloguing
ISBD	International Standard Bibliographic Description
ISBN	International Standard Bibliographic Number
ISO	International Organization for Standardization
KI-1	Key Informant One
KI-2	Key Informant Two
KI-3	Key Informant Three
KI-4	Key Informant Four
KI-5	Key Informant Five
LMS	Library Management System
MARC	Machine-Readable Cataloguing
METs	Metadata Encoding and Transmission Standard

MODS	Metadata Object Description Standard
MPEG	Moving Pictures Experts Group
MPEG-21	Moving Pictures Experts Group series 21
MPEG-7	Moving Pictures Experts Group series 7
MySQL	My Structured Query Language
NISO	National Information Standards Organization
NORMARC	MARC standard that used in Norwegian libraries
OAI	Open Archives Initiative
OAI-PMH	Open Archives Initiative protocol metadata harvesting
PHP	Hypertext Pre-processor
QGEA	Quesland Government Enterprise Architecture
RDF	Resource Description Framework
SGML	Standard Generalized Mark-up Language
TEI	Text Encoding Initiative
UDC	Universal Decimal Classification
UNIMARC	Universal Machine Readable Catalogue created by IFLA in 1977
W3C	World Wide Consortium
WINISIS	Windows version of the CDS/ISIS system
XML	Extensible Mark-up Language

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Chapter 1

Introduction

1.0 CHAPTER ONE: INTRODUCTION

This chapter is the introductory section of this thesis and it outlines the background of the study, followed by statement of the problems, research questions, aims and objectives of research, benefit of research and methodology of research, limitation of study, outline of study, and summary of the chapter.

1.1 Background of Study

Metadata schema is very important and should be considered in a digital library. "*Metadata is structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource*" (NISO, 2004, p.1). Metadata in information and library field have a lot of functions and purposes. European commission (2010) described that the key purpose of metadata is to facilitate and to improve information retrieval. And according to NISO (2004) metadata have such functions as resource discovery, organizing e-resources, interoperability facilities, digital identification and archiving and preservation.

Metadata is also expected to represent almost the original data from a collection and we have to use well defined metadata schema, including metadata standard and model. We use metadata schema to make possible interoperability in digital library. Interoperability activity in digital library would well run if there is standard metadata schema among those digital libraries. This was reinforced by Shiri (2003) which states that:

> "*The requirement for interoperability generally derives from the fact that various digital libraries with different architectures, metadata formats, and underlying technologies wish to effectively interact, something they can do through applying a range of common protocols and standards*."(Shiri, 2003, p.199)

At the same time, standard metadata schema is needed for consistency and interoperability purposes. Standard or uniform metadata schema would ensure highest consistency in interoperability. QGEA (2010) mentioned that:

> "*In many cases, metadata schemas have been 'standardized' to promote consistency within a particular discipline or for a specific metadata usage scenario…. The use of standard metadata schema ensures the use of a consistent set of metadata elements*" (QGEA, 2010, p.11).

Through this interoperability activity, digital library has opportunities to provide new and better services. To fulfil this, it needs integration technology information where metadata of digital libraries become integrated. It makes user easier to access information that they need. Interoperability failed because some reasons and problems, one of those reasons is there is no standard metadata schema among those digital libraries, for instance because those digital libraries have multiple metadata schemata.

Each digital library has requirements for metadata schema that makes that digital library has different metadata schema. It would be better if it can follow existing metadata standards which are roughly relevant and appropriate to their all requirements and goals.

> "*If a particular standard metadata schema does not meet our needs, then it is usually better to define an additional metadata schema in an existing framework such as RDF and to use custom metadata schema in combination with standard metadata schema, rather than totally ignore the standard schema*" (W3C, 2010).

In an organization, needs of metadata schema is varies depending on their own demands. Sometimes, it is very difficult to do standardization while we perform interoperability in digital libraries.

1.2 Statement of Problems

The standard metadata schema that used among multiple digital libraries should be based on the requirements of digital library institutions. We should consider those requirements for creating and developing the standard metadata schema because it makes that standard suitable with the requirements of institutions and makes interoperability going smoothly. The problem arises when the standard metadata schema is not created and developed based on the requirements of the institutions. Thus it creates problems of interoperability among digital libraries. That problem happened in Indonesia, Forestry Research and Development Agency (FORDA) digital libraries where their interoperability is hampered due to lack of standardization of metadata schema. Currently, the home-grown metadata schema used by digital libraries of FORDA is based on the default WINISIS database system, but in fact it is not going well. In this case, we can say there is no standardization of metadata schema because partner libraries did not agree and apply that metadata schema. For instance, standard metadata schema does not comply in accordance with their needs of representation metadata to their documents. Still there are some important metadata elements that cannot be covered of the metadata standard that has been determined. It's significant to investigate the issues of current metadata schema in FORDA and suggest relevant metadata schema that all partner libraries accept.

1.3 Research Questions

1. What are the issues of interoperability in current home-grown metadata schema used in FORDA digital libraries?
2. What are the recommendations to secure the interoperability of metadata among digital libraries in FORDA?

1.4 Aims and Objective of Research

The aim of this research is to find out the issues of metadata interoperability for FORDA digital libraries and to give recommendation to secure the interoperability among them.

The Objectives are:

1. To find out the issues of metadata interoperability for FORDA digital libraries
2. To give recommendation to secure the interoperability among FORDA digital libraries.

1.5 Benefit of Research

1. Securing interoperability activities in digital libraries of the FORDA of the Ministry of Forestry Republic of Indonesia.
2. This research is benefited to the researcher as a means to implement and practice the knowledge acquired during the course with the real situation on the ground.

1.6 Methodology of Research

This research uses a qualitative study approach and use case study as the research strategy. Data collection techniques in this research are interview and documentation. Interview techniques used in this study project is the in-depth interview or unstructured interview.

The study looks at six digital libraries in the FORDA, the Ministry of Forestry Republic of Indonesia and their experience uses the current standard metadata schema. These institutions are five institutions as partner libraries: 1) Digital library of Balai Besar Penelitian Bioteknologi dan Pemuliaan Tanaman Hutan (BBPBPTH) Yogjakarta, 2) Digital library of Balai Penelitian Hutan Penghasil Serat (BPHPS) Kuok, 3) Digital library of Balai Penelitian Kehutanan (BPK) Solo, 4) Digital library of Balai Penelitian Kehutanan (BPK) Ciamis, 5) Digital library of Balai Penelitian Kehutanan (BPK) Manado; and one institution, which is RI Ardi Koesuma digital library as central digital library.

In this study, FORDA is a case institution where local metadata schema is not suitable with the requirements of FORDA and creates interoperability problems.

This problem is applicable to other similar institutions. FORDA digital libraries could be representative to similar institutions with interoperability problems.

The process of data analysis of this study is based on the model of Miles and Hiberman (1994). It consists of data reduction, data display and conclusion drawing or verification process. A more detailed discussion of the methodology is presented at chapter 3.

1.7. Limitation of Study

In this study there are some limitations, which are:

- This study has domain specific, look at one case which could be representative of similar cases with interoperability problems.
- This research is limited only related to the metadata among FORDA digital libraries, e.g. RI Ardi Koesuma digital library with their partner libraries.
- The time of the research is about six months from January 2011 to June 2011.

1.8. Outline of Study

The thesis consists of five chapters, which are:

Chapter one gives the background and context, for this research followed by statement of problems; research questions; aims and objectives of research; benefit of research; methodology of research; then limitation of study; and finally outline of thesis is presented.

Chapter two presents the background institutions, review of relevant literature and it consists of the general overview of digital library, metadata that consist metadata function and purpose also type of metadata; metadata schema, requirement of metadata schema for institutions; interoperability; and how achieving and securing interoperability. Furthermore, the existing metadata

schema standard are discussed, which are: DCMES, MARC, METS, MODs and MPEG.

Chapter three outlines the detailed methodology of the research. This chapter comprises research paradigm, research design, data collection, determination of key informant and informant, data processing and analysis, validity data, ethical considerations. The summary is presented in the end of this chapter.

Chapter four is data analysis and discussion section which consists of background studyof key informants, the current home-grown metadata schema in FORDA digital libraries, the issues of metadata interoperability in FORDA digital libraries, the requirements of the new FORDA metadata for securing interoperability among FORDA digital libraries. Finally, the summary is presented.

Chapter five presents discussion of the research questions and conclusion, and implications of research and implication of further research.

2.0. CHAPTER TWO: BACKGROUND AND LITERATURE REVIEW

2.1. Introduction

This chapter presents the background of institution and the review of relevant literature from various works and it consists of the general overview of digital library, metadata and its functions, purpose and also type of metadata; metadata schema; standardization of metadata schema; requirements of standard metadata schema for institutions; interoperability; and how achieving and securing metadata interoperability. Furthermore, some of the existing metadata schemas are discussed, such as: DCMES, MARC, METS, MODS and MPEG. Finally, the summary is presented.

2.2 Background Institution: Digital Library of the Ministry of Forestry Republic of Indonesia

There are six digital libraries that exist in the Ministry of Forestry Republic of Indonesia. All of them are placed in the Forestry Research and Development Agency (FORDA). The libraries are situated on three islands: Java, Sumatra and Sulawesi. FORDA digital libraries on Java presented in this project was RI Ardi Koesuma Digital Library, digital library of BPK Ciamis, BPK Solo and BBPBPTH Yogjakarta. One of FORDA digital libraries on Sumatra was BPHPS Kuok and another digital library on Sulawesi was digital library of BPK Manado.

The descriptions below are the overview of FORDA digital libraries.

1. Digital Library of BBPBPTH Yogjakarta

The office of BBPBPTH Yogjakarta digital library located in Jalan Palagan Tentara Pelajar Km. 15 Purwobinangun Pakem Sleman, Yogjakarta). The digital library of BBPBPTH Yogjakarta was founded at 2007 together with founded final institution web hosting. The digital library was funded by government fund under BBPBPTH Yogjakarta. The site is placed in http://biotifor.or.id/index.php?action =generic_content. main&id_gc=153 and link to http://202.65.118.203/. Total number of collections is 4786. It contains of book, journal, report and magazine.

Library of BBPBPTH Yogjakarta itself built in 2006 in line with established of the institution of BBPBPTH Yogjakarta. The vision of the library of BBPBPTH Yogjakarta is to support the vision of their institution, which is: to support BBPBPTH Yogjakarta that responsible for carrying out research in biotechnology and plant breeding based on the forest policies set by the Head of FORDA. The basic task of BBPBPTH Yogjakarta library, both physic library and digital library is providing information services in science and technology (Science and Technology) research results and research services in the field of biotechnology and plant breeding forests.

BBPBPTH Yogjakarta digital library has developed their own metadata schema as their metadata standard. This metadata schema created based on their requirements according to their demand, objective and purposes. This metadata schema is created under their library web system.

2) Digital Library of BPHPS Kuok

This library located in Jalan Raya Bangkinang-Kuok Km 9 Kuok Bangkinang, Riau and their digital library placed in http://www.balithut-kuok.org/index.php?option=com_booklibrary&Itemid=58.

BPHPS digital library was built in 2009 and launched in 2010 with initiative of Ir. Syahrul Donie, M. Sc who is the head of the BPHPS Kuok. BPHPS Kuok digital library is an institution repository, it has vision to supporting

institution activity, which is become a center of information and technology in management wood plantation that is pulp.

Their digital library rent server from one of commercial company in Jakarta. BPHPS Kuok digital library server is connected with BPHPS Kuok main website, which is http://www.balithut-kuok.org/. There is one staff that managing their digital library. Their digital library is managed by Evaluation and Services Sections of BPHPS Kuok.

Beside the digital library, BPHPS Kuok also has the physical or traditional library. This traditional library built in line with the established of their institution in 1986. The vision of the BPHPS Kuok library is to supporting the vision of their institution, which is: it being a center of information and technology in the field of pulp wood plantation forest management. A total number collection until 2010 in BPHPS Kuok approximately is 3500. It contains of book, articles, journal, magazine, maps, reports, series, booklet or leaflet, and audio visual collections.

BPHPS Kuok digital library uses their own metadata schema as their metadata standard that created and develops under Atheneum Light 8.5 library management system according to their requirements.

3) Digital in Library of BPK Solo

Library of BPK Solo located in Jalan Ahmad Yani Pobox 295, Pabelan, Surakarta, Central Java and their digital library located in http://www.bpk-solo.or.id/perpustakaan. Library of BPK Solo established since 1979 with initiative of Dr. Ir. Dwiatmo Siswomartono, M.Sc.

BPK Solo digital library was built at 2003 in line with their institution website. Their digital library rent and used server from commercial company. Their server is connected with their main institution site at http://www.bpk-solo.or.id/. Total numbers of collections are 9.970. It includes textbook, reference book, research reports, magazine, bulletin, journal, undergraduate thesis, thesis, dissertation and other information. One person is managing their

digital library but total number of library staff is five. Digital library of BPK SOLO have task which is serving the internal and external user who need information from BPK SOLO.

BPK Solo digital library uses their own metadata schema that created and developed according their requirements under MySQL database management system and PHP.

4) Digital in Library of BPK Ciamis

Library of BPK Ciamis placed in Jl. Raya Ciamis-Banjar Km.4 Pobox 5 Ciamis West Java. Library of BPK Ciamis was built at 2007. This library is an extension of Monsoon Forest Research Agency Library which incidentally is also an extension of BPDAS. There is one staff that managing their library. Total number of collections until 2010 is 3164. It consists of textbook, reference book, leaflet, booklet, CD and cassette. Their library has vision to support the institution vision. Their digital library was built at 2009 because of technological problem it disappear. Currently, their digital library is under development process and it is not visible. Later it will place under their main institution website, which is in http://bpkciamis.org/index2.php.

Currently, this institution is using INDOMARC metadata format as their metadata schema.

5) Digital in Library of BPK Manado

This library located in Jl. Raya Adipura, Kel. Kima Atas, Kec. Mapanget – Manado. Their digital library is ongoing progress that will place under their main institution website, which is in http://bpkmanado.or.id/. Their library is managed by Service and Infrastructure facility Section of BPK Manado. There is one staff that responsible to managing this library. This digital library has responsible to supporting research and development activity in BPK Manado. Their physical library is still new and it established in 2010. They still have small number of collections, it is about 961 and it will increase in the future. It includes book, journal and magazine.

They used their own metadata schema based on Atheneum Light 8.5 library management system. This library is similar with BPHPS Kuok where their metadata schema created and developed based on Atheneum light 8.5, but their metadata elements is different.

6) RI Ardi Koesuma Digital Library

This digital library is a central digital library of FORDA and placed in Jl. Gunung Batu No. 5, Bogor West Java, Indonesia. RI Ardi Koesuma digital library was initiatived by Dr. Ir. Hadi Pasaribu, M. Sc as the head of FORDA at 2004. RI Ardi Koesuma digital library was built in 2005 and launched in 2007. Vision of RI Ardi Koesuma digital library is to be a center of information in forestry research and to develop national and international network with other libraries.

The traditional library of RI Ardi Koesuma itself was built in 2004. This library is a result of library relocation and revitalization between three libraries in FORDA, e.g. Library of Pusat Litbang Hutan dan Konservasi Alam, Library of Pusat Litbang Teknologi Hasil Hutan, and Library of Pusat Litbang Sosial Budaya dan Ekonomi Kehutanan. It was done to find the challenges of advanced in technology and the demand of research and development of forestry field.

Their digital library placed in their site, It is http://library.forda-mof.org/libforda/. It has own server that is connected with the server of FORDA website, which is www.forda-mof.org. The server uses Windows NT operating system and was built based on PHP programming and MySQL database management system.

RI Ardi Koesuma digital library is managed by the sub section of Dissemination, Publication and Library, Evaluation Section at Dissemination and Library under The Secretary of FORDA. Total number of staff in this library is 11 and one of them is dedicated to managing their digital library. Number of collection until 2010 is 36.382. The collections include reference

collection, reserve collection, textbook, old collection, map collection, audio visual, report, magazine, bulletin and journal.

RI Ardi Koesuma using INDOMARC metadata schema as their metadata standard under MySIPISIS library management system. This system is the latest version of the library automation system database based on CCS/ISIS database library system and it developed by IPB library Automation Team.MySIPISIS is te synergy between the bibliographic database CDS/ISIS and transactional MySQL database.

FORDA digital libraries have different metadata schema that can be seen at table below. Those metadata schemas was created and developed based on the requirements of those digital libraries.

Table 2.1: Metadata Schema at FORDA Digital Libraries

NO	BBPBPTH Yogjakarta	BPHPS Kuok	BPK SOLO	BPK CIAMIS	BPK MANADO	RI ARDI KOESUMA
1	Own metadata schema	Own metadata schema created and develop based on Atheneum Light 8.5 library management system	Own metadata schema created and develop based on PHP and MySQL database system	INDOMARC	Own metadata schema created and develop based on Atheneum Light 8.5 library management system	INDOMARC that based on MySIPISIS library management system

2.3 Literature Review

2.3.1 Digital Library

Digital library is a library that collects, organize and disseminate the information resources in digital format and provide digital services that accessible through network. Digital libraries offer convenience for their users to access their information sources anytime, anywhere connected over a network. Arms (2000, p. 1) stated that digital library managed the collection of information, with associated services, where the information is stored in digital formats and

accessible over a network. According to Papy (2008, p.11) a digital library is a real library since its collection is organized, selected and well presented and their access can be controlled. A digital library also responds to the need to develop collections of documents such as digital resources, articles, books, etc.

Cooperation among libraries has developed along with technological developments and the need to use existing resources together. To provide new and better services to the user digital library cooperate with other digital libraries and offered more completed and easier access to the information resources.

Exchange and merging bibliographic data or metadata is a common matter in both traditional and digital libraries.

2.3.2 Defining of Metadata

The term metadata was familiar as bibliographic data of collections. Metadata is very important and has an important role in digital library. Several experts provide the definition of metadata. The most concise and general definition of the metadata is *"Structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource*" (NISO, 2004, p.1). According to W3C (2010) "*Metadata is machine understandable information for the web*." Caplan (2003, p.13) mentioned that metadata is used to mean structured information about an information resource of any media, type or format.

CC: DA (2000) defined metadata as "*Structured, encoded data that describe characteristics of information bearing-entities to aid in the identification, discovery, assessment and management of the described entities*."

Based on the definitions above, it shows that the metadata is data that:

1. Structured
2. Describes characteristic of information, like: content, quality, condition and other characteristics
3. Describe an information resource

4. Having a specific purpose, such as helped the identification, discovery, research, retrieve, etc.

Function and Purpose of Metadata

In the field of library and information metadata, There are a lot of functions and purposes, e.g. preservation, advance information retrieval, interoperability, etc. European commission (2010) described the key purpose of metadata is to facilitate and to improve information retrieval. NISO (2004, p.1-2) expressed the functions of metadata, which are: resource discovery, organizing e-resources, facilitating interoperability, digital identification, archiving and preservation.

Baca (2008, p. 13) also described the primary functions of metadata are: creation, multi-versioning, reuse, and re-contextualization of information objects, organization and description, validation, searching and retrieval, utilization and preservation and disposition.

Types of Metadata

Generally metadata can be categorized into three types, They are:

1. Descriptive metadata

This metadata identify the sources of information that facilitate the process of discovery (resource discovery) and selection. This metadata include such elements as author, title, year of publication, subject heading or keyword and other information which would normally be recorded in the traditional catalog process. In the library environment about the development of bibliographic listings based on ISBD (International Standard Bibliographic Description), AACR, classification like DDC (Dewey Decimal Classification), UDC (Universal Decimal Classification), Library of Congress Classification, subject heading lists which produce a concise document representatives (representation document or document surrogate) standard that serves as a bibliography listing. World records created finding aids.

2. Administrative metadata

This kind of metadata provides information for the management of information resources, such as: when and how it was created, file type, other technical data, and its owner, and who are entitled to access it. Administrative metadata includes data relating to intellectual property rights and the ropes (rights management metadata), storage (archiving) and preservation of information resources (preservation metadata).

3. Structural metadata

This metadata explains how a structured digital object can be combined into one logical entity. A digital source for instance, books, it consists of several chapters, and each chapter consists of the pages, each of that is a separate digital file. Structural metadata needed to know the relationship between physical files and pages, pages and chapters, and chapters in books as a final product, then these allow the software displays a list of the contents of the book and immediately bring the selected chapter (with click) by users, or navigate to the section (page) other than "books". Another example: a multimedia object consisting of components need to synchronize audio and text, and for this there must be needed structural metadata.

Metadata is also expected to represent almost the original data from a collection and we have to use well defined metadata schema, including metadata standard and model.

2.3.3 Metadata Schema

Metadata is captured in the form of a prescribed list of element known as a metadata schema. Metadata schema is very important and must be the one that consider when we create a digital library. Each metadata created to specific purpose. Metadata is created based on a metadata scheme, which is a group of metadata elements and rules for use, designed for a specific purpose, e.g. to a particular environment or to the description of a particular kind of source information. Chan and Zeng (2006) stated that "*A metadata schema consists of a*

set of elements designed for a specific purpose, such as describing a particular type of information resource."

As defined in the report of the American Library Association Committee on Cataloguing: Description and Access (CC:DA) Task Force on Metadata:

> *"A metadata schema provides a formal structure designed to identify the knowledge structure of a given discipline and to link that structure to the information of the discipline through the creation of an information system that will assist the identification, discovery, and use of information within that discipline." (CC: DA, 2000)*

Getty.edu (s.a.) described that "*Metadata schema are defined ways of structuring metadata elements, in other words, they used to structure information or data. The idea behind the development of metadata schemas is to promote consistency and uniformity of data so that it can be easily aggregated, moved, shared, and ultimately used as a resource discovery tool or for other purposes*."

A metadata schema has three aspects: (1) Semantics, (2) Content, and (3) Syntax.

Semantics is the definition of the meaning of the elements of the scheme concerned. Each element was given the name and definition. Usually, accompanied by the information status of constituents, which are: whether mandatory, optional, or mandatory in certain circumstances (mandatory if applicable).

Content is a rule for the value of the elements, or elements of the scheme rules to fill. Semantic scheme for example to determine that there is an element that is named "Author", then the rules for the contents of setting criteria for determining who is "Author" and how the name of the person selected must be listed. What is the name in accordance with the form found on the title page of books? Or according to a specific format, for example: family name, little name? Or form a canopy uniform name taken from a list control header name (for name authority lists)? Whether to subject, the subject heading list should have used? Regulation of the content is very important because it helps ensure uniformity and

consistency of filling elements, and these facilitate the achievement of a match or a match in the retrieval process.

Syntax is a rule for encoding, which is how the elements of the schema were transferred to the machine-readable form, which can be read and processed by computer. For this is usually used in SGML (Standard Generalized Mark-up Language) or XML (Extensible Mark-up Language), which developed by the W3C (World Wide Web Consortium), is a subset of SGML. XML is easier than SGML because it has clear rules and consistent, not so many features and options that it could create confusion. Some other features that support the popularity of XML as a means of encoding is the freedom to set its own landmark (tags) which match as well as human-readable, and ease the exchange of structured data. Thus, we can say that XML has become the de-facto standard for metadata representation, especially for Internet resources.

Following are the examples of the existing metadata schema format in digital library, which are:

1. DCMES (Dublin Core Metadata Element Set): the general scheme for the description of a wide range of digital resources. DCMES as known as Dublin Core. "*DCMES is a general-purpose scheme for resource description originally intended to facilitate discovery of information objects on the Web*." (Caplan, 2003, p. 76)

   Dublin Core standard is simple and understandable not only for librarian but also for user. There are fifteen elements in Dublin Core, which are: title, creator, subject, description, publisher, contributor, date, type, format, identifier, source, language, relation, coverage, rights.

   Mostly, Dublin Core is more widely used for the digital library program where the simplicity of its elements becomes a primary consideration; the elements in Dublin Core can be implemented for sharing of digital library metadata collection.

2. MARC (Machine Readable Cataloguing): scheme used in the library environment since the 1960s to create an electronic bibliography listing standards. MARC was developed by the Library of Congress. The format of MARC was very beneficial for the dissemination of data cataloging of library materials. Several country was adopted the concept of MARC. There are alternatives of MARC, which are: MARC 21 (that maintained by the Network Development and MARC standards office of Library of Congress); AUSMARC (national MARC of Australia); BIBSYS-MARC and NORMARC (used in Norwegian libraries); DANMARC (National MARC of Denmark); UNIMARC (created by IFLA in 1977); INDOMARC (Indonesian MARC Standard), etc.

   INDOMARC is an implementation of the International Standard (ISO) ISO2709 for Indonesia; consist of 700 class elements with very complete bibliography. INDOMARC is a format to sharing, exchange information bibliographic among magnetic tape or other machine-readable. There are three main parts in INDOMARC, such as: record label, directory and variable fields (National Library Republic of Indonesia, 1994, p.13-16).

3. METS (Metadata Encoding and Transmission Standard): schema metadata for complex digital objects stored in the library collection. METs is an XML schema. According to Caplan (2003, p. 162) METs have sections for descriptive metadata, administrative, and structural metadata, and a file inventory.

   Beside that METS also has header and behavioral. Behavioral used to associate executable behaviors with content in the METS object.

4. MODS (Metadata Object Description Standard): scheme for a detailed description of electronic sources. A MODS is an XML schema that based on bibliographic description. MODS created and developed by the United States Library of Congress Network Development and Standards Office in 2002. A MODS was designed as a compromise between the complexity of

the MARC format used by libraries and the extreme simplicity of Dublin Core metadata.

5. MPEG (Moving Pictures Experts Group) established in 1988. Appropriate MPEG are MPEG-7 and MPEG-21: standard for audio and video recordings in digital form. MPEG encapsulates descriptive, administrative, and structural metadata. MPEG-7 is an implementation of ISO/IEC 15938 and MPEG-21 is implementation of ISO/IEC 21000. MPEG-21 used for multimedia frameworks.

We could not say one of those metadata schemas is the best metadata schema for all institutions because each metadata schema has their own strength and weakness. And the most important thing is those metadata schema was created and developed for specific reason. For instance, Dublin Core is a standard that create and develop to provide simple of the metadata elements based on simplicity aspect to make the creator easier to do it. Different with MARC that provide rich metadata elements and MPEG is a standard metadata that create and develop for audio and video format.

2.3.4 Standard Metadata Schema

Nowadays, there are a lot of metadata schemas. QGEA (2010, p. 11) stated that there are hundreds of standard metadata schemas and each of them serves a specific context or purpose.

Standard metadata schema is needed for consistency and interoperability purposes. Standard metadata schema or uniform standard metadata schema would ensure highest consistency in interoperability:

> "*In many cases, metadata schemas have been 'standardized' to promote consistency within a particular discipline or for a specific metadata usage scenario…. The use of standard metadata schema ensures the use of a consistent set of metadata elements*." (QGEA, 2010, p.11)

> "*Ideally, a uniform standard approach would ensure maximum interoperability among resource collections*." (Chan and Zeng, 2006)

But standard metadata schema is not always feasible and acceptable, mostly in diversity situations with different institution requirements and user communities where collections include different type of resources with variety of specialized schemas. The standardization metadata schema only suitable and applicable at the starting stages of building a digital library. According to Chan (2005):

> *"Recent decades have witnessed a proliferation of metadata schemas for description of digital resources. Each metadata schema has been designed based on the requirements of the particular user community, intended users, type of resources, depth of description, etc. Problems arise when building a large digital library or repository with participants using different description methods or metadata records prepared according to diverse schemas."*
>
> "*It is not always feasible or practical, particularly in heterogeneous environments serving different user communities where components or participating collections contain different types of resources already described by a variety of specialized schemas. The uniform standardization method is only viable at the beginning or early stages of building a digital library or repository, before different schemas are adopted by the participants."* (Chan and Zeng, 2006)

2.3.5 Requirements of Standard Metadata Schema for Digital Libraries

Metadata schema is strongly encouraged to consider the requirements of the digital libraries. It is expected that the metadata schema could have provide satisfied and fit with existing requirements.

Digital library institution has different requirements of metadata schema because it depends on their demand, objectives and priorities. "*Metadata standards have generally been developed in response to the needs of specific resource types, domains or subjects*" (Kelly, 2006). Sometimes it is very difficult to do maintain standardization while we perform interoperability in digital libraries. Even the

FORDA metadata schema does not meet the requirements of data representation of collection; it creates problems of interoperability among digital libraries.

It would be better if the metadata schema can follow existing standard metadata schema, which is roughly relevant and appropriate to our all requirements and goals. This statement reinforced by W3C (2010) that described:

> *"If a particular standard metadata schema does not meet our needs, then it is usually better to define an additional metadata schema in an existing framework and to use custom metadata schema in combination with standard metadata schema rather than totally ignore the standard schema."*

Kelly (2006) wrote that:

> "*There is no single standard that is best for all circumstances. Each metadata schema is designed to meet a need and has its own strengths and weaknesses. Start by considering the circumstances of the individual digital project and identify the need(s) or purpose(s) that the metadata will need to satisfy. Once it is done, one can evaluate rival metadata schemas and find the best match*."

Some general requirements of metadata schema for digital libraries, which mentioned bellow:

- **Simplicity (Simple and easy to use)**

Anderson (2007), WorldNet 3.0 (2003-2008), and The American Heritage (2000) define simplicity is a quality of being simple. Other complete definition stated by Wikipedia (2011) that simplicity is a property of being simple which is easy to understand or explain.

To summary the definition simplicity is a property or quality or condition, situation or something of being simple which is easy to understand or explain. The

simplicity in metadata schema refer to the metadata schema is being simple which understandable for their users.

Usually digital library institutions required the standard metadata schema that is simple and easy to use, which is not complicated and not difficult to apply.

But simplicity in the standard metadata schema is also problematic because it makes missing of data elements. Dushay and Hillmann (2003, p. 2) stated that:

> *"Because we were interested in providing simple search limits based on resource type and format, data missing from the Dublin Core "format" and "type" elements were particularly. In many cases, the entire collection consisted of materials in one format or of one type, and the missing information was deemed and the missing information was deemed unnecessary for the collection's local purposes. In other cases, the metadata was very brief, or was taken from an earlier store of metadata that did not include the information."*

- **Extensibility**

Standard metadata schema should have possibility to extension. By considering into extensibility, a metadata schema to be more than just documentation or a guide formulation manufacture system, but also an effort to recognize the flexibility for institutions to meet their specific needs. Extensibility allows institutions to customize their metadata elements, for instance with extensibility we can define new metadata elements that we need. Kennedy (2008, p.3) stated that:

> "*The schema may be more extensive because the relationships between search terms are as yet unknown, and a developer will want to provide for as many possibilities as are reasonable, in order to provide a satisfactory search result"*

Duval, et.al (2002) described metadata systems should be allowed for extensions and the particular needs of a given application could be accommodated.

- **Multilanguage**

In respond to the rapid of development of digital libraries and various user communities, the standard metadata schema should be visible in multi language because when the metadata schema only visible in local language, it only useful and understandable for the local people. Using local language metadata in digital libraries other people would not able to understand the content and digital libraries failed to global acceptance. Duval, et.al (2002, *p.4-5)*) wrote that:

> *"It is essential to adopt metadata architectures that respect linguistic and cultural diversity. The Web as a global information system is important in that it affords unprecedented access to resources of global scope. However, unless such resources can be made available to users in their native languages, in appropriate character sets, and with metadata appropriate to management of the resources, the Web will fail to achieve its potential as a global information system."*

2.3.6 Interoperability

One of the goals of build metadata schemas as described above is to facilitate cooperation and ensure interoperability in a network. We use metadata standard to make possible interoperability and interchange in digital library. Interoperability and interchange activity in digital library will well run and effective if there is standard metadata schema among those digital libraries.

> "*The requirement for interoperability derives from the fact that various digital libraries with different architectures, metadata formats and underlying technologies wish to effectively interact, something they can do through applying a range of common protocols and standards*" (Shiri, 2003).

There is a misunderstanding about the concept of interoperability, interoperability does not assume that all the digital library or institution must have a same metadata schema or file format, but interoperability is an ability to understand or adopt those different metadata schema.

Some definitions of interoperability described by experts and organization standard, such as NISO (2004) expressed that "*Interoperability is the ability of multiple systems with different hardware and software platforms, data structures, and interfaces to exchange data with minimal loss of content and functionality*." CC: DA (2000) defined "*Interoperability is the ability of two or more systems or components to exchange information and use the exchanged information without special effort on either system*." Taylor (2004, p. 369) mentioned that interoperability as the compatibility of two or more systems such that they can exchange information and data and use without any special manipulation.

2.3.7 Achieving and Securing Metadata Interoperability

According to Chan and Zeng (2006) there are three level models to achieving interoperability in digital library, which are: achieving interoperability at schema level, achieving interoperability at record level and achieving interoperability at repository level. In achieving interoperability at schema level, they give six ways to achieving interoperability, which are: 1) Derivation, 2) Application profiles, 3) Crosswalks, 4) Metadata framework and 5) Metadata registry. Achieving interoperability at record level is including two common methods, which are: 1) Conversion of metadata records, 2) Data reuse and integration. And in achieving interoperability at repository level including six activity methods, which are: 1) Metadata repository based on the Open Archives Initiative (OAI) protocol, 2) A metadata repository supporting multiple format without record conversion, 3) Aggregation, 4) Element-based and value-based cross-walking services, 5) Value-based mapping for cross-database searching, 6) value-based Co-Occurrence Mapping.

The following descriptions present about those models to achieving interoperability, which are:

- **Derivation**

In this approach to achieving interoperability metadata, a new metadata schema is derived from an existing one and it is dependent on the source schema. This

approach produces the schema with a basic structure and common elements while allowing different components for vary in-depth and details. For instances, MODS and MARC Lite that is derived from MARC21, TEI Lite is derived from the TEI. This approach offer the extensibility of metadata elements that allow us to extend and expand our metadata elements based on the particular needs.

- **Application Profile**

Rarely there is a metadata schema that could be satisfied for all requirements. In this model one schema is used as the basis for a general. Creating an application profile is implemented for specific needs. Profiles describe the extent to which existing schemas would be implemented and provided guidance for application in the environment concern.

Chan (2005) described that "*application profiling model ensures a similar basic structure and common elements, but with varying depths and details*."

- **Crosswalks**

Interoperability between different metadata schemes is facilitated by the use of *crosswalks* or authoritative mappings from the metadata elements of one scheme to those of another. Crosswalks are lateral (one-way) mappings from one scheme to another. A primary use of crosswalks is to serve as base specifications for physically converting records from one metadata scheme to another for record exchange, contribution to union catalogue or metadata harvesting. Crosswalks can also be used by search engines to query fields with the same or similar content in different databases.

- **Metadata Framework**

In this approach to achieving interoperability elements from different metadata schema is collected in a place. This place defined as metadata framework. Two approaches are possible for creating a metadata framework: 1) establishing a framework before the development of individual schemas and applications, and 2) building a framework based on existing schemas. Regardless of which approach is

used, the function of a metadata framework is to provide a suitable environment for the diverse audiences of involved communities.

In this model, a metadata framework is used as a shell or container as that includes metadata elements from multiple metadata schemas of institutions can be accommodated (see Fig.5.1). This method can be built based on either the existing schema of digital libraries institutions or new schema before they create metadata schema. The function of this method is to offer a suitable situation for multiple metadata schemas.

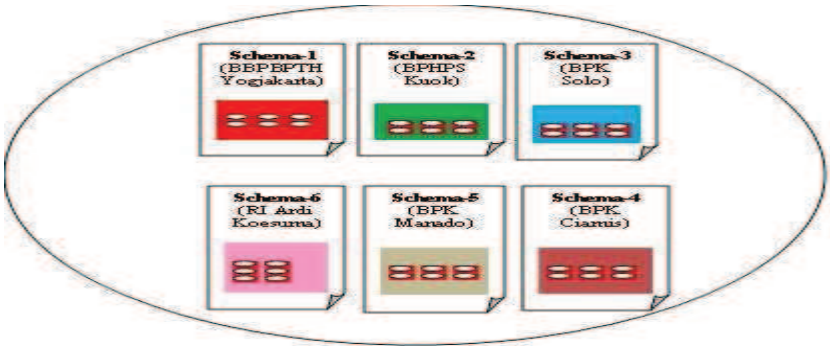

Figure 2.1: A framework and metadata schemata associated with the framework.

- **Metadata Registry**

This method will be address the issues of interoperability because this model stored multiple metadata schemata of institutions and provide description and information about those schemata. This method also provides the information and its services for human and machine. A metadata registry build based on the existing metadata schema in institutions. "*The purpose of a metadata registry is fairly straightforward: to collect data regarding metadata schemas. Because the reuse of existing metadata terms is essential to achieving interoperability among metadata element sets, the identification of existing terms becomes a prerequisite step in any new metadata schema development process*." (Chan and Zeng, 2006)

The following figure described the metadata registry.

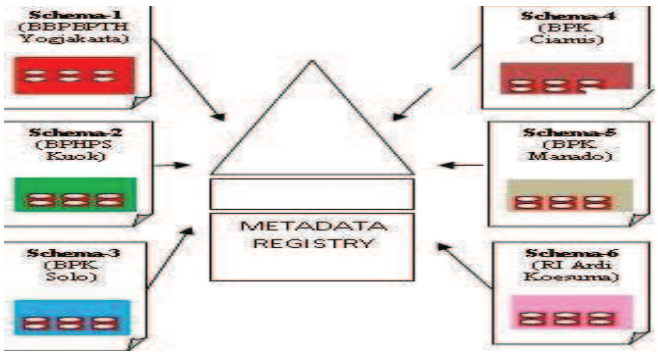

Figure 2.2: Metadata Registry

Using this model we also have other benefit because it has other several functional requirements for a metadata schema registry, e.g. searching, browsing, schema mapping, version management, multilingual user interface and API for software tools.

- **Conversion of metadata records**

It is means changing a current of metadata schema to another. Zeng and Chang (2006) described that the major challenge in converting records prepared according to a particular metadata schema into records based on another schema is how to minimize loss or distortion of data. They also mentioned that various tools have created to facilitate such conversion.

For example, we can convert metadata schema from Dublin Core to MARC. Conversion metadata schema can be done with both manually and automatically. But maybe there are lots of problems that will be faced if we will convert metadata schema manually especially if the particular metadata is more complex.

Mize and Robertson (2009) mentioned that "*more often than not, manually created records contain omissions and errors caused by poor-record management tools and in adequate quality control measures. In additional, it is clear that any manually executed generation, quality control, management of metadata can be a resource drain on any organization*." (p.1)

They also mentioned that metadata automation, which is the programmatic process of creating and updating metadata, is the key to providing accurate metadata.

Conversion metadata process is presented in the following figure:

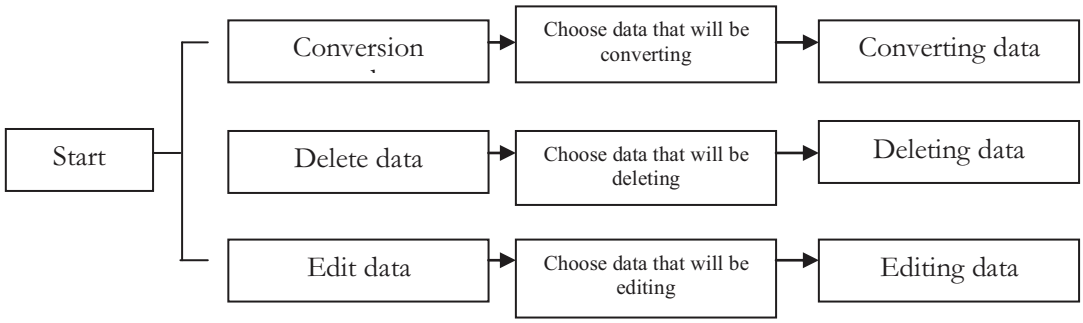

Figure 2.3: Conversion Metadata Process (Putro, et.al, 2007, p.3)

- **Data Use and Integration**

This model will be one of the good solutions to address issues in this study. This model is created and develops a new metadata records according to the existing metadata records. It is focus on integrating multiple metadata schemas of institutions with different requirements in one common format. For this study the best solution is to use XML's namespace declaration of the metadata schema under RDF record.

This Resource Description Framework (RDF) is provided a mechanism for combining multiple metadata schemas of institutions. The benefit of using this method, partner libraries can work and use their metadata schema as usual without disturbing other their library activity. It is very suitable because we can use the existing metadata schema from partner libraries institution without lost data.

This model provides "*a framework within which independent communities can develop vocabularies that suit their specific needs and share vocabularies with other communities*" (Zeng and Chan, 2006).

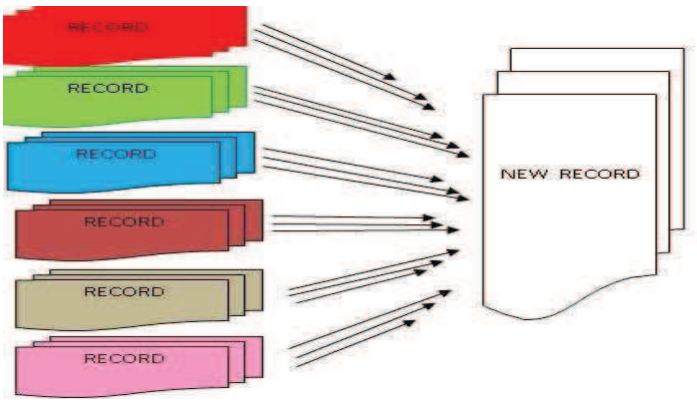

Figure 2.4: Data Use and Integration Model

Metadata records from partner libraries and central library institution that integrated using RDF creating to make a new record that can be generated for securing interoperability purpose.

- **Switching-across Schema**

Chan (2005) and Chan and Zeng (2006) mentioned that "*one of the schemas is used as the switching mechanism among multiple schemas. Instead of mapping between every pair in the group, each of the individual metadata schemas is mapped to the switching schema only*." This model reduces drastically the number of mapping processes required. The switching-across schema usually contains elements on a fairly broad level.

Switching schema could be addressing the issues in interoperability because this model has possibility to mapping of the elements among multiple schemas in institutions. Both new or the existing schema from each institutions could be used as a switching schema. In this solution, one of the chosen schemas used as the switching schema among multiple schemas in the institutions and there is no direct mapping process among these schemas, but each of the existing schemas in the institutions is mapped to the switching schema (see Fig.2.5).

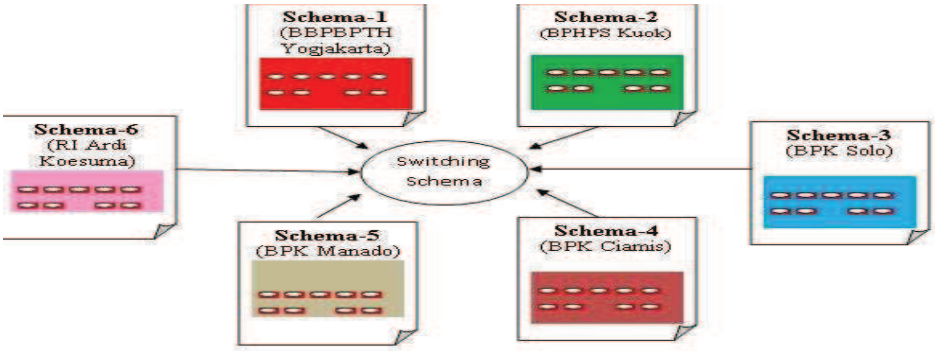

Figure 2.5: Switching-across process

- **Metadata repository based on OAI protocol**

Hillmann, et.al (2004) described that the metadata repository has also facilitated the construction of an automated "ingestion" system, based on the OAI-PMH. Though this protocol, metadata flow into the metadata repository with a minimum of ongoing human intervention (p.1).

Carpenter (2003) defined The OAI-Protocol for Metadata Harvesting (OAI-PMH) is a mechanism for harvesting records containing metadata from repositories. The OAI-PMH gives a simple technical option for data providers to make their metadata available to services, based on the open standards HTTP (Hypertext Transport Protocol) and XML (Extensible Markup Language).

Lagoze (2002) described that the goal of the OAI-PMH is to supply and promote an application-independent interoperability framework that can be used by a variety of communities engaged in publishing content on the Web.

Zeng and Chang (2006) also mentioned that the OAI approach enables searching for Web-accessible resources across different collections, databases, and repositories, based on the capability of metadata sharing, publishing, and archiving.

- **Aggregation**

This method is could be achieving interoperability because aggregation process in a metadata repository is to combine missing data, incorrect data, confusing data

and insufficient data. The perception of this process is each metadata record contains a series of statements about a particular resource; therefore, to build a more complete profile of that particular resource metadata from different sources can be aggregated.

Shreeves (2007) described that metadata aggregation model pulls metadata from many sources into a single location. Search engines, union catalogues, OAI-PMH, RSS and ATOM do this. It provides an opportunity to enrich and normalize the metadata.

This model "*employs an automated "ingestion" system based on OAI-PMH, whereby metadata flows into the Metadata Repository with a minimum of ongoing human intervention.*" (Zeng and Chang, 2006)

The following figure illustrated the process of enriching metadata records:

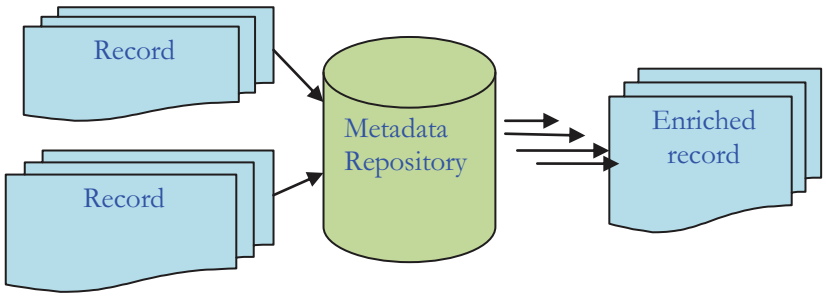

Figure 2.6: Enriched Metadata Records
Source: Zeng and Chan (2006)

- **Element Based and Value Based Cross-walking Services**

This method is achieving interoperability among digital libraries which have multiple metadata schemata because it effective to exchange and to share metadata schema. "*Crosswalks have paved a way to the relatively effective exchange and sharing of schema and data.*" (Zeng and Chang, 2006)

The best example is the OCLC project. This project has developed "*a model for metadata crosswalk that that associates three pieces of information: the crosswalk, the source metadata standard, and the target metadata standard, each*

of which may have a machine-readable encoding and human-readable description. The crosswalks are encoded as METS records that are made available to a repository for processing by search engines, OAI harvesters, and custom-designed Web services." (Godby, et.al, 2004)

- **Value-based mapping for cross-database searching (MACS)**

This method is used an existing metadata database. This model is allowed the users to search and retrieve across multiple databases of partner libraries in multi languages such as: English, French and German.

> "*Instead of integrating records or mapping the data of every field, MACS chose to only map the values in the subject field. The method employed for mapping is to compare subject headings in three monolingual lists and check the consistency of bibliographic records retrieved with these headings. The links were analyzed on three levels: terminological level (subject heading), semantic level (authority record), and syntactic level (application)"* (Freyre & Naudi, 2003).

3.0 CHAPTER THREE: METHODOLOGY OF RESEARCH

3.1 Introduction

Measures of study are appropriate and sequential to get good results. It makes easier in the proof of the truth, analyze and repair of errors and also useful for further development. This chapter describes the methodology and steps taken to address issues in the study, so this research can be resolved. This chapter includes paradigm of the research, research design, research approach, data collection technique, determination of key informants and informant, pilot study, data processing and analysis, validity data, limitation of the study and ethical considerations. At the end of this chapter also describe the summary of this chapter.

3.2 Methodology of Research

3.2.1 Research Paradigm

Paradigm in this study is based on post-positivist paradigm. This paradigm considers the study with an effort to built knowledge directly at the source. The main characteristic of this paradigm is look evidence, facts or data as something independent with contextual background or certain meaning with its environment. Thus, knowledge gained from the results study is original. This study is based on the inductive where expression and explanations given by key informants and informants of the study is a form of expression that comes out from their experience and perceptions of the context study.

3.2.2 Research Design: Qualitative Research

This research uses qualitative approach as a research design. The function of this research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible. This qualitative approach has taken because the qualitative research is suit with the research aim and objectives of this study. Sugiyono (2010) wrote that qualitative research methods is based on post-positivism philosophy, used to examine natural objects condition which the researcher as a key instrument, data collection techniques implemented in triangulation, data analysis is inductive or qualitative and results of the research emphasize the meaning rather than generalization.

Gorman and Clayton (2005) wrote that:

> "*Qualitative research is a process of enquiry that draws data from the context in which events occur in an attempt to describe these occurrences, as a means of determining the process in which events are embedded and the perspectives of those participating in the events, using induction to derive possible explanations based on observed phenomena.*"

3.2.3 Research Strategy: Case Study

In this research, a case study is used and chosen as a research strategy for achieving the aims and objectives of this research. Due limited of time and effort, a case study is suitable to address the aims that is to find out the appropriate standard metadata schema of institutions for securing interoperability among digital libraries and to address the objectives of this research.

FORDA is a case institution and a specific domain of this study where standard metadata schema is not suitable with the requirements of FORDA and creates interoperability problems.

Generalization or transferability of this study project could be applied elsewhere when those other places have the same domain and same issues of interoperability

in the current standard metadata schema because it would be applicable to other same domain with similar cases.

Afriani (2009) stated case study is a study that explored an issue with the restrictions detailed, has a depth of data retrieval, and includes a variety of sources information. This research is limited by time and place, and the cases studied in the form programs, events, activities, or individuals.

> "*A case study as an in-depth investigation of a discrete entity (which may be a single setting, subject, collection or event) on the assumption that is possible to derive knowledge of the wider phenomenon from investigation of a specific instance or case."* (Gorman and Clayton, 2005, p.47)

1. Types of Case Study

This study project use explanatory case studies as the case study type. Particularly in complex studies of organizations or communities, one might desire to employ multivariate cases to examine a plurality of influences.

Baxter and Jack (2008, p.547) stated that:

> "*This type of case study would be used if you were seeking to answer a question that sought to explain the presumed causal links in real-life interventions that are too complex for the survey or experimental strategies. In evaluation language, the explanations would link program implementation with program effects*."

2. Advantage and Disadvantage of the Case Study Approach

There are advantage and disadvantage of use this case study in this research project. The advantage of using case study approach mentioned below:

1) The main benefit is that the focuses on one or a few instances allow us to deal with subtleties and intricacies of complex social situations. The analysis is holistic rather than based on isolated factors.
2) Allow the use a variety of research methods.

3) Related with multiple methods, case study approach fosters the use of multiple sources of data.
4) Particularly suitable where we has little control over events.

The disadvantage of using case study approach mentioned below:

1) The point is most vulnerable to criticism is in relation to the credibility of generalizations made from its findings. We need to be particularly careful to allay suspicions and to demonstrate the extent to which the case is similar to, or contrast with, others of its type.
2) Unwarranted though it may be, case study are often perceived as producing soft data. The approach gets accused of lacking the degree of rigout expected of social science research.
3) The boundaries of the case can prove difficult to define in an absolute and clear-cut fashion.
4) Negotiating access to case study setting can be a demanding part of the research process.
5) It is hard for case study to achieve the aim of investigating situations as naturally occur without any effect arising from their presence.

3.2.4 Data Collection

3.2.4.1 Pilot Study

Pilot study in this research used as a preliminary study that allows us to test interview questions, to establish pattern of communication between we with informant and focus on things that are considered important.

The pilot study for this research was arranged with two key informants. They are Staff in digital Library of BBPBPTH Yogjakarta and Staff in central library which is digital Library of RI Ardi Koesuma. The transcript of the pilot interview obtained variations and all the research questions were adequately answered. After pilot study done, we improve and fix existing interview questions and make the result as the instruments for the real interview research.

3.2.4.2 Data Collection techniques

Data collection techniques in this research use the interview and document techniques.

1. Interview

Most common data collecting method in qualitative research used interview. "*Interviews are used frequently in information and library research*." (Pickard, 2007, p.171)

> "*Interview is a well established and well used technique for data collection. Interviews are appropriate when the purpose of the researcher is to gain individual views, beliefs and feelings about a subject, when questions are too complex to be asked in straightforward way and more depth is required from the answers."* (Pickard, 2007, p.181)

We do interviews is start with easy questions, starting with the fact the information, avoiding questions multiple, re-answers for clarification, provide a positive impression, and control negative emotions.

This study project uses several interview types for data collection with the following detail:

- **In-Dept Interview**

  Interview techniques used in this research is the in-depth interview or unstructured interview. In-depth interview is a process obtains information for research purposes by way of question and answer with a face to face between the interviewer with informants, with or without using the guidelines interview. This is often referred to as in-depth or intensive interviews. Neither the exact wording of the questions nor answers has been predetermined, although it is usual to have a set of questions or interview guide prepared as a starting point.

- **Mobile Interview**

This research also used mobile interviews for data collection. Pickard (2007, p.179) described there are two approaches available to online interviewing: the synchronous or asynchronous approach. Synchronous or real time interviewing involves the use of internet relay chat (IRC) software which facilitates a live chat area allowing for real-time conversations between two or more people. The conversation takes place on the screen with both parties taking part at the same time, it is virtual conversation. Asynchronous or non real time interviewing involves the use of email and sometime discussion threads within a designated area. Questions are sent or posted into the designated space and respondents can add their reply at any time.

- Online Interview

Lastly, telephone interview is also used for data collection in this research. Berg (2001, p.83) described that qualitative telephone interviews are likely to be best when the researcher has fairly specific questions in mind and also quite productive when they are conducted among people with whom the researcher has already conducted face-to-face interviews, or with whom they may have developed a rapport during fieldwork.

2. Documentation

This study also used documentation of metadata schema in institutions such as the data on the server and flash, the data stored on the website, and others.

3.2.5 Determination of Key Informants and Informant

In this study we determine staff in partner libraries as key informants because we believes that they do not only provide information, but they also get involved in the activities under investigation. The key informants expected to answer the questions based on their experience about the current FORDA metadata schema. They are:

1) Staff in Library of BBPBPTH Yogjakarta as key informant one (KI-1), he is: Muhammad Nurdin Asfandi, A.Md

2) Staff in Library of BPHPS Kuok as key informant two (KI-2), she is: Meilastiti M Wijaya

3) Staff in Library of BPK Solo as key informant three (KI-3) he is Sutedjo

4) Staff in Library of BPK Ciamis as key informant four (KI-4), she is Maria Palmolina

5) Staff in Library of BPK Manado as key informant five (KI-5), she is Eva Betty Sinaga

We also took interview with one informant from central library (digital Library of RI Ardi Koesuma). Staff in central library is Hari Setijono as informant 1 (I-1). By reason they are considered related and knows the ins and outs of the standard metadata schema in digital library.

3.2.6 Data Processing and Analysis

This project study will use interactive data analysis that based on the model of Miles and Hiberman (1994). Miles and the colleague mentioned that activity in qualitative data analysis is interactive and ongoing process until the research complete. They mentioned that interactive process activities included data reduction, data display and conclusion drawing or verification. Data analysis process described in below figure:

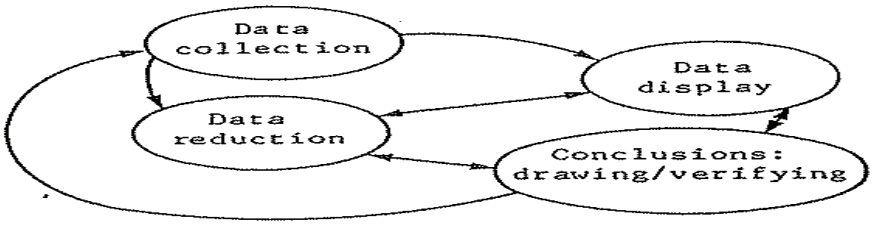

Figure 3.1: Component of data analysis: interactive model

(Miles and Hiberman, 1994, p. 12)

The data research collected is reduced and organized (organized data in issues/ categories, described in the units, synthesis, organized in a pattern and choose which is important and will be studied more deeply) and displayed and then conclusions could be drawn from the data (i.e. regularities, patterns, differences/similarities, explanations, propositions).

The following sections describe the process of data analysis in this project study which refers to model Miles and Hiberman (1994):

1. Data Reduction

Firstly, the result of online interview (using Video Call in Yahoo messenger feature) and mobile interview (using telephone cellular) was handwritten then transferring to Microsoft Word. Additionally, the result of online interview using online chatting was transferring in Microsoft Word directly (see Fig.2.1.).

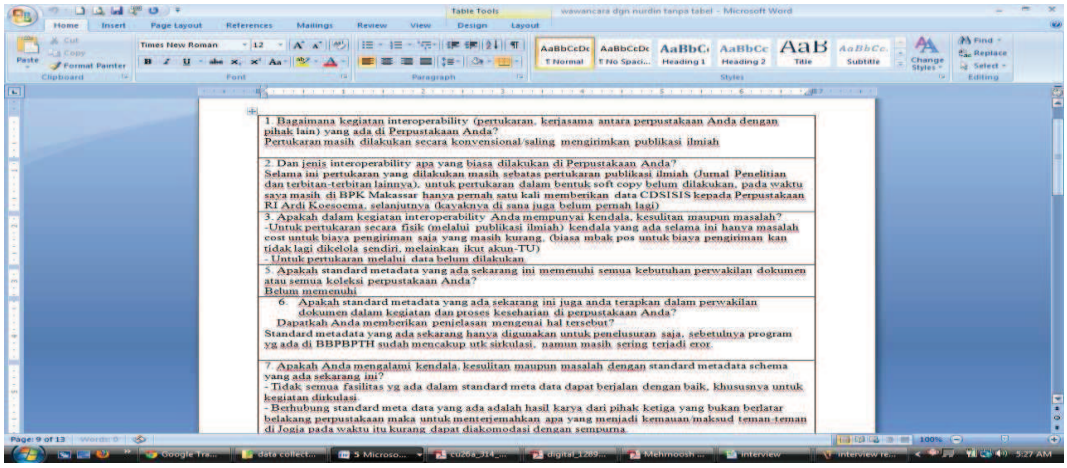

Figure 3.2: A screenshot of Microsoft Word sheet-An example of notes of the result interviews

Secondly, these data collections appeared in the written notes had been selected which is important, and delete which is not used, it were organized using Microsoft Excel. For every interview a sheet was applied consist of two columns for questions (pertanyaan) and answers (jawaban) (see Fig. 3.3).

Figure 3.3: A screenshot of Microsoft Excel sheet-An example of notes, highlight and commenting of the result interviews

Thirdly, each of interviews was organized and structured in Microsoft Excel, notes; highlight and coding to the answer's column with commenting facility. Those processes make simplified and transformed in a way with some categories based on the issues. The issues based on the interview result of this progress study.

Fourthly, the gathered data from the document about metadata schema of each institution was organized in Microsoft Excel. Afterwards, the data is combined, organized and structured in Microsoft Word by the institutions names (see Fig. 3.4).

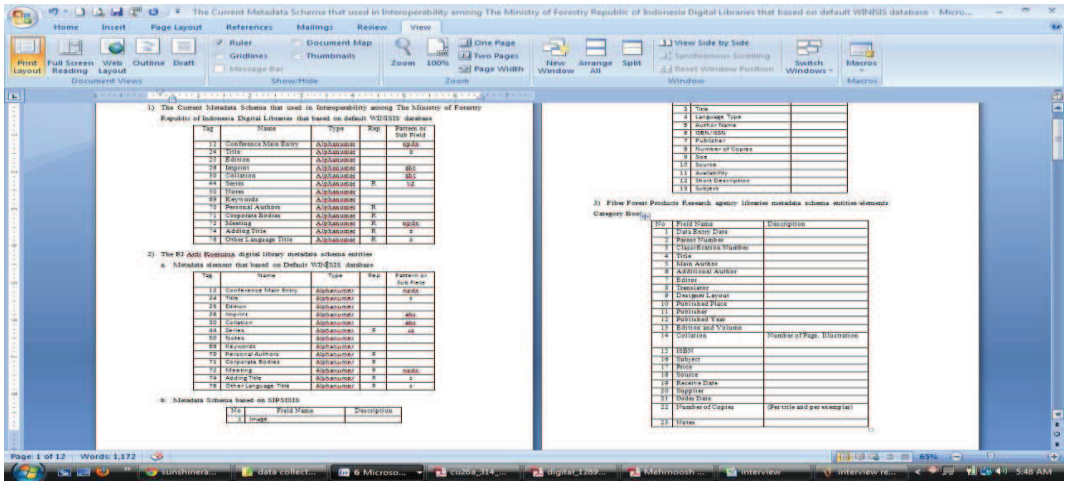

Figure 3.4: A screenshot of Microsoft Word sheet-An example of data analysis of document about metadata schema

Finally, the process will be reduced data to verify the general and major statements. Those processes are helped to sharpen, focus and organize the data in a way that allowed for next steps.

2. Data Display

Data display will be narrative text which helps to understand about process of analysis or caution on that understanding. For data display, the reduced data are arranged systematically and understandably. After that, the data will be conducted into a pattern. This process was organized in Microsoft Word.

3. Conclusion drawing or verification

A third step is conclusion drawing or verification. For verification purpose, we read and revisited the entire data collection of interviews and documents as many times as possible to cross-check or verify these emergent ideas.

After all statements combined and transferred into Microsoft Word according to the issues categories, descriptions about quotes were presented if needed and conclusion were presented, which are: clarified in next chapter: Data Analysis and Discussion.

After data analysis conducted and presented the next stage of this study project is a discussion. Discussion section discusses the issues of this study project that based on the research questions. Chapter 4 presents the details of this data analysis and discussion.

Illustration of data analysis processes in this research can be displayed in below:

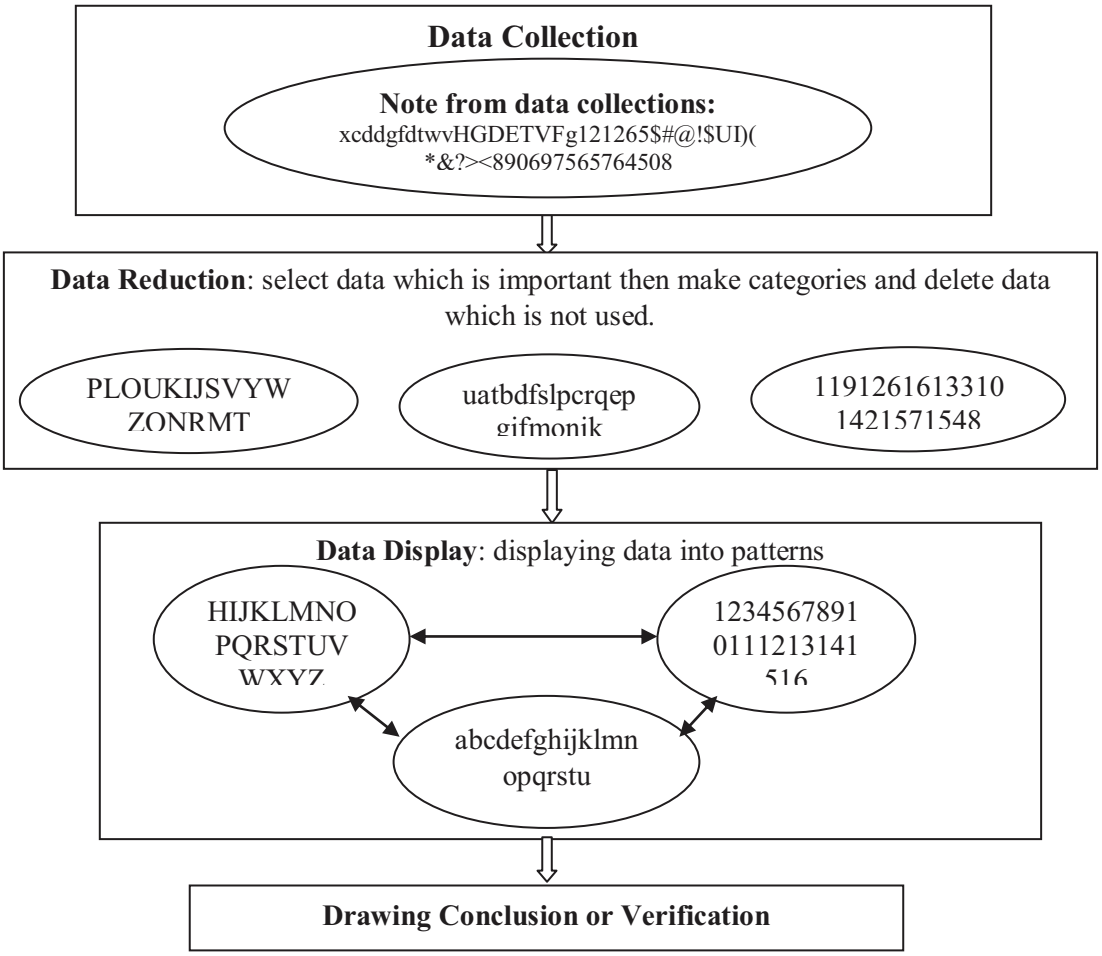

Figure 3.5: Illustration of data reduction, data display and conclusion or verification

3.2.7 Validity Data

Most of qualitative research, a reliable research tool was interviews contain many weaknesses when done openly and especially without controls; and qualitative data sources that are less credible will affect the accuracy of research results.

All data collections and techniques in this study is conducted following the data techniques procedures and process and also according the data analysis process systematically and structurally to ensure the data and to obtain data with high validation.

3.2.8 Limitation of Approach

The results of this research are limited to a specific domain, which is: digital libraries of Forestry Research and Development Agency, the Ministry of Forestry Republic of Indonesia studied. And this research also limited by time, only six months from January 2011 to June 2011.

3.2.9 Ethical Considerations

Lincoln & Guba (1987) described that ethical issues are highly important in qualitative study. The researcher should therefore always emphasize to the respondents that their participation was voluntary, and that they have the right to refuse or withdraw from the research process at anytime, without any consequences. In other words, the respondent life and career should not be harmed by any lawful, physical and emotional terms.

This research considered ethical issues. The main considerations included:

1) Respect to key informants and informant

   Before the study, potential key informant and informant will get a bid if they are willing to become volunteers as key informants and informants of this research. Mechanism of informed consent will be applied before the interviews conducted.

2) Beneficence

   Goodness, usefulness and confidentially of key informants and informants are a priority of this study. This research would not sacrifice or harm any key informants, informants or other parties.

For us, the ethical consideration will be applied to run smoothly and quality the research, also some issues related with following:

   1) To promote fairness

2) We were able to assess, understand, and explain the advantages and and weaknesses of research
3) We maintain intellectual property rights and anti-plagiarism.

3.3 Summary

This chapter has laid the methodology for this research. It described the research of paradigm, which is: post-positivism paradigm, research design that is qualitative design, research approach is case study, data collection technique is using interviews and documents, determination of key informants and Informant, data processing and analysis, validity data, ethical considerations, finally limitation of approach has described. The following chapter is data analysis and processing data.

4.0. CHAPTER FOUR: FINDINGS AND DATA ANALYSIS

4.1 Introduction

This chapter describes findings and data analysis of the data collected from interviews. It discusses the issues in responses to the main research questions. Firstly, this chapter begins with a brief overview of background study of key informants and the overview of the current local standard metadata schema in FORDA digital libraries. Secondly, it discusses about the issues of metadata interoperability in current FORDA metadata schema. Thirdly, it discusses about requirements of the new standard metadata schema of FORDA digital libraries. Lastly, the summary of this chapter is presented.

The process of data analysis of this study is based on the model of Miles and Hiberman (1994). It consists of data reduction, data display and conclusion drawing or verification process. Key informants were asked to reflect their experience on important aspects related with the issues of metadata interoperability in current local metadata schema used in their digital libraries and the requirements of the new metadata schema. The answers from key informants were classified into some issues.

4.2 Background Study of Key Informants

In this study we interviewed five key informants from the partner libraries. They are staff that responsible for managing the different FORDA libraries. 1 key informant (20%) had an LIS background and other the 4 (80%) were from non-LIS. The background study of key informants has shown in the following figure.

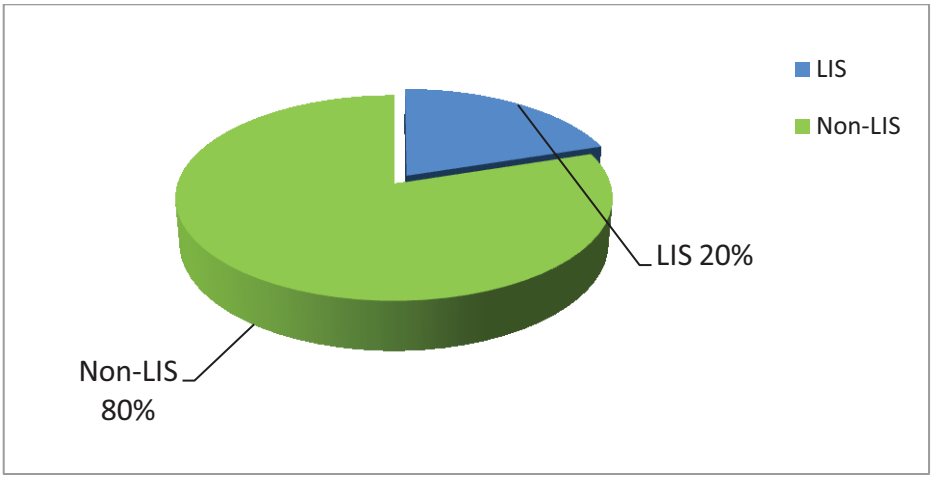

Figure 4.1: Profile background study of key informants and informant

In figure 4.1 described that key informants have variants background study. Key informants from digital library of BPK Ciamis and BPK Manado have forestry science background. The informants from BPK Solo have high school graduate and library training skills. The informants from BBPBPTH Yogjakarta have library science background. Lastly the informants from BPHPS Kuok have management science background.

4.3 The Current Home-grown Metadata in FORDA Digital Libraries

Currently, the home-grown metadata schema used by digital libraries of FORDA is created and developed based on *the default Windows Integrated Set of Information System (WINISIS) database system*. This metadata schema is used as a uniform local metadata schema to promote the interoperability among FORDA digital libraries. FORDA digital libraries included five partner libraries (BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado) and one central library (RI Ardi Koesuma). Unfortunately it was not going well.

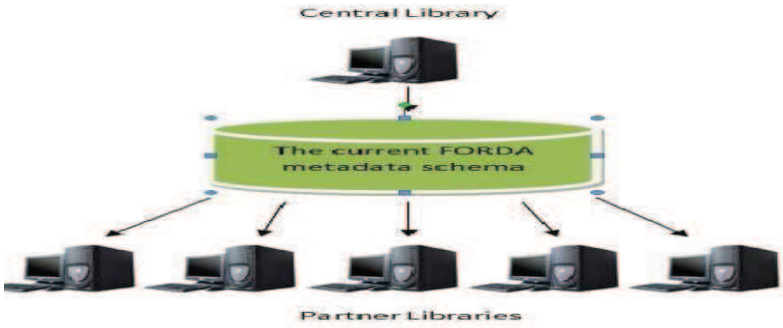

Figure 4.2: Workflow the current FORDA metadata schema creation

The current FORDA metadata schema determined by central digital library without considers the requirement of partner libraries institutions, which is illustrated in figure 4.2.

For instance, the current FORDA metadata schema does not comply in accordance with partner libraries needs (BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado) of representation metadata elements in documents. Still there are some important metadata elements that cannot be covered of the metadata standard that has been determined.

4.4. The issues of metadata interoperability in FORDA digital libraries

Our findings include several issues which creates interoperability problems in the current FORDA metadata schema. These categorizes were determined from the interview results.

4.4.1. Complexity of the FORDA Metadata Schema

Complexity means the partner libraries were confused to use the FORDA metadata schema. There are two points in this issue.

Firstly, *the current FORDA metadata schema has confusing symbol (KI-1, KI-2)*. For instance, data entry process in FORDA metadata schema used the confusing symbol and when that symbol is forgotten or it does not included, the error will be occurred and consequently metadata elements could not be displayed.

For instance, key informant-1 mentioned that FORDA metadata schema is complicated because it uses a special symbol (^) for data entry in any subfield. It consumed much time in usage and it was disturbed other activity in their library. Key informant-2 also indicated similar problem.

But other key informants from BPK Solo, BPK Ciamis and BPK Manado did not mentioned about this issue.

The following figure presents the data entry interface in the FORDA metadata schema:

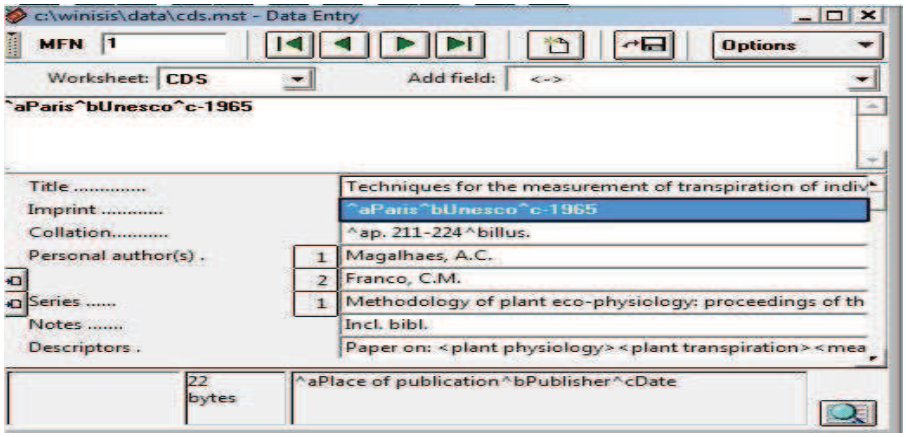

Figure 4.3: Data Entry Interface with the current home-grown metadata schema

Secondly, *the current FORDA metadata schema required to use some programming language in application (KI-1 and KI-2).*

For instance, key informant-2 mentioned that they feel confused with the current FORDA metadata schema because it required some programming language to display the metadata elements according to their desire format for information retrieval purpose and when it does not created properly, the error will be occurred and consequently metadata elements could not be displayed. The following figure presents the programming language which needed to display the metadata elements:

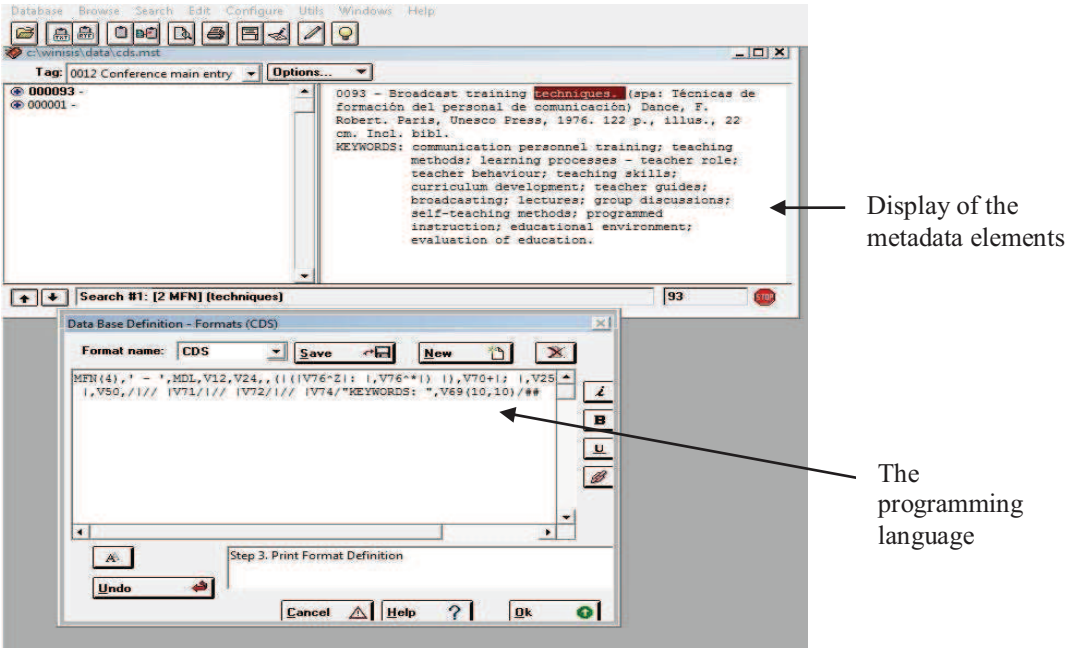

Figure 4.4: Display of the metadata elements and the programming language interface

Because of this issue, BBPTPH Yogjakarta and BPHPS Kuok did not use FORDA metadata schema. Therefore, it's hard to achieve the interoperability in FORDA digital libraries.

4.4.2 Different Metadata Format Files and Unavailability Import Metadata Facility

There are two main points in these issues. Firstly, *partner library have different metadata format files with the FORDA metadata format file.* The following table illustrates about this issue.

Table 4.1: Metadata format files in Partner Libraries Institution

NO	FORDA Digital Libraries	BBPBPTH Yogjakarta	BPHPS Kuok	BPK SOLO	BPK CIAMIS	BPK MANADO
1	*.mst and *.par	*.xml	*.csv	*.sql	*.mst and *.par	*.csv

In table 4.1 there are four partner libraries that have different metadata format files with the current FORDA metadata schema, which are: BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo and BPK Manado. Metadata format file of BBPBPTH Yogjakarta is stored in xml format. Metadata format file of BPHPS Kuok and BPK Manado are stored in Comma-Separated Text Files (*.csv). Metadata format file of BPK Solo is stored in Structured Query Language files (*.sql) and it has possibility to convert in Extensible Markup Language (xml) and Microsoft Excel spreadsheet file (*.xls) file using Hypertext Preprocessor (php). Metadata format file of BPK Ciamis was same with the current FORDA metadata schema format, which is stored in Microsoft Windows Installer Transform (*.mst) and parity archive file (*.par).

Due to using different file format these four libraries could not exchange their metadata elements from their metadata schema to the current FORDA digital libraries and vice versa.

Secondly, *the current FORDA metadata schema does not have import metadata facility*. Import metadata means an ability to combine the existing metadata with other metadata from other system. Four partner libraries experienced this issue. Unavailability import facility in the current FORDA metadata schema made the library unable to reuse existing metadata elements and need to re-entry their existing metadata elements manually in FORDA metadata schema.

For instance, key informant-1 mentioned that his library did not use current FORDA metadata schema because they had difficulty to import their own metadata schema to the FORDA metadata schema. And they do not have enough staff and time to re-enter the existing metadata.

Digital libraries of BPHPS Kuok and BPK Manado also have this problem because they could not import automatically their existing metadata to the FORDA metadata schema. But these issues did not occur in library of BPK Ciamis because they have similar format file with the FORDA metadata format files. From this reason, four partner libraries were not used current FORDA metadata schema. This created interoperability problem among them.

4.4.3 Different Metadata Schema

One main issue that partner libraries did not use the current FORDA metadata schema is each library has their own metadata schema that was developed specifically. The following table presents the different metadata schema in partner libraries institution.

Table 4.2: Metadata Schemata in Partner Libraries Institution

NO	The Current Standard Metadata Schema	BBPBPTH Yogjakarta	BPHPS Kuok	BPK SOLO	BPK CIAMIS	BPK MANADO
1	Metadata schema which created and developed based on WINISIS	Own metadata schema which created and developed specially	Own metadata schema which created and develop based on Atheneum Light 8.5 library management system	Own metadata schema which created and develop based on MySQL database system	INDOMARC	Own metadata schema which created and develop based on Atheneum Light 8.5 library management system

In the table 4.2 digital library of BBPBPTH Yogyakarta has their own metadata schema. The digital library of BPK Ciamis used the INDOMARC metadata standard. The digital libraries of BPK Manado and BPHPS Kuok are using a metadata schema that was created and developed based on of Atheneum Light 8.5 database library management system. Even though BPHPS Kuok and BPK Manado use same metadata standard that was created based on the Atheneum Light 8.5 library management system, their metadata elements are quite different because they created and developed specially based on their requirements. BPK Solo has their own metadata schema based on the PHP and MySQL database system. Thus it is a major problem to conducting interoperability activity in the FORDA digital libraries. This issue is the barrier of interoperability among FORDA digital libraries.

4.4.4 Lack of expertise

Lack of expertise is refer to a lack of understanding of the task or specific knowledge and the technological issue about metadata elements, metadata schema, interoperability, and also about LIS field. There are two main points in lack of expertise issues, which are:

Firstly, *the partner libraries staff was lacking in Library Information Science (LIS) background study (KI-2, KI-3, KI-4, and KI-5).* 4 key informants that are managing FORDA digital libraries (80%) do not have LIS background study. They are staff from BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado. And only 1staff from BBPBPTH Yogjakarta has LIS background study (see Fig. 4.1). In fact, without LIS background study, they could not understand the basic knowledge about cataloguing and then they could not use the current FORDA metadata schema properly. Without the basic knowledge on cataloguing those staff could not able to do such work and difficult for them to maintain the consistency of metadata elements. Therefore, this issue makes interoperability problems in FORDA digital libraries.

Secondly, *lack of the mastery of basic and specific knowledge about metadata schema and interoperability (KI-1, KI-2, KI-3, KI-4, and KI-5).* This mastery of basic knowledge refers to knowledge and skills about terms, definitions in metadata schema and interoperability. The mastery of specific knowledge refers to understanding of technological knowledge about it. All key informants do not have basic and specific knowledge about metadata schema and interoperability.

For instances, key Informant-1 said that he did not have sufficient knowledge on technology about standard metadata. For this reason, he could not maintain the problems of the current FORDA metadata schema for securing interoperability activity among their digital libraries. And he misunderstood about metadata schema. He thought that metadata schema is one kind of library management system (LMS) that could be used in digital library such as Senayan library software or other systems. Key informant-2 said that she did not know about metadata and metadata schema. She only knew about bibliographic data. Key

informant-3 thought that metadata schema is an international standard for classification collections, such as UDC 1971, but he is familiar with bibliographic data of collections. Key informant-4 and key informant-5 also have same problems.

Even they did not know about metadata schema, but all of them are familiar with "*bibliographic data*" term. Without mastery of metadata, they could not use the current FORDA metadata schema properly and address the issues that arise with that schema.

4.4.5 Language Problem

Language is also the issue that prevents partner libraries from using the FORDA metadata schema. Four key informants mentioned that they had problems with language. Language is a problem because the current FORDA metadata schema is written in English language, both in *the vocabulary elements* and *the direction* too.

It was problems because they are limited in using English language. Even they are not familiar with the vocabulary used in the current FORDA metadata schema because most of them do not have LIS background.

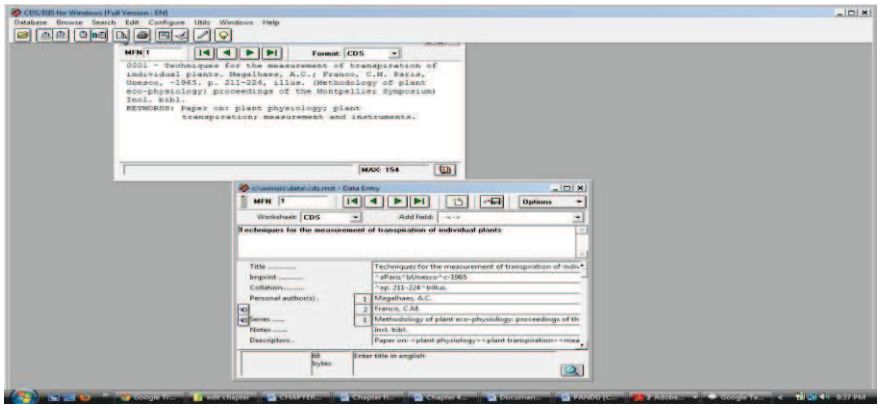

Figure 4.5: Display the language of vocabulary elements and direction in FORDA metadata schema

For instance, key informant-1 said that there is no problem with the vocabulary of the new FORDA metadata schema, but he has language problem, especially when entering and editing metadata because the direction of the current FORDA

metadata schema is written in foreign language. He also mentioned that if there is manual to discuss that problem, perhaps it would be fixed soon. Key informant-2 mentioned that currently they are doing their bibliographic entry in Indonesian language. Due to lack of English language proficiency, they have difficulty to use the FORDA metadata schema. It usually happens especially when they entry metadata because all direction are in English.

Key informant-3, key informant-4 and key informant-5 also mentioned that language is one of the problems for which they did not use the current FORDA metadata standard because their staffs are not fluent in English language.

Actually WINISIS is multi-language system, but there is no Indonesian language in the feature option. The FORDA digital libraries only provided the foreign language, such: English, French, Spanish, Polish, Arabic, Ukraine, etc.

4.4.6 Limited Number of Metadata Elements

The current FORDA metadata schema did not cover all important metadata elements. We have found that there are some important metadata elements in the partner libraries collections that are not covered by that metadata schema (see Tab. 4.3 and Tab. 4.4).

Firstly, *the current FORDA metadata schema only supports for book, undergraduate thesis, thesis, and dissertation collections*. Whereas, collection in BBPBPTH Yogjakarta digital library has not only books, it also covers for magazine, articles and journals. BPHPS Kuok digital library has a similar problem since their collections are very varied, e.g. beside books they have articles, magazine, maps, reports, series, booklet or leaflet and audio visual collections. BPK Solo also has similar problem because their metadata schema includes elements not only for book, but also journal and magazine, etc. BPK Ciamis also has similar problem in which the important metadata elements, e.g. reference, booklet or leaflet, CD and Cassette were not covered by the current FORDA metadata schema. Same problem also happened in BPK Manado where their metadata elements for journal and series collections were not covered by FORDA

metadata schema. Additional information in RI Ardi Koesuma digital library collections, that the current FORDA metadata schema also were not covered such as: old collections, maps, audiovisual, reports, magazine, bulletin, journal and newspaper. The following table presented the collections types of FORDA digital libraries.

Table 4.3: Type of Collections in FORDA Digital Libraries

NO	The Current Standard Metadata Schema	BBPBPTH Yogjakarta	BPHPS Kuok	BPK SOLO	BPK CIAMIS	BPK MANADO	RI ARDI KOESUMA
1	Book	Book	Book	Textbook	Textbook	Book	Reference
2	Undergraduate Thesis	Magazine	Articles	Journal	Reference	Journal	Reserve
3	Thesis	Articles	Magazine	Magazine	Leaflet/ Booklet	Series	Textbook
4	Dissertation	Journal	Maps	Reference book	CD		Old Collections
5			Reports	Bulletin	Cassette		Maps
6			Series	Undergraduate thesis			Audio Visual
7			Booklet/ leaflet	Thesis			Reports
8			Audio Visual	Dissertation			Magazine
9				Research report			Bulletin
10				Other information			Journal
11							Newspaper

In table 4.3 the metadata elements of partner libraries that was not covered by FORDA metadata schema is remarked by green colour. The table shown that metadata elements in the partner libraries and central library beside books and dissertation could not be covered by the FORDA metadata schema.

Secondly, the *current FORDA metadata schema did not cover the important metadata elements for book metadata itself of partner libraries* (see Tab. 4.3). For instance, key informant-1 mentioned that the current FORDA metadata schema did not cover all the important bibliographic data in their digital library. Other

partner libraries also have same problems. The following table presents the detail about different metadata elements for books collection in partner digital libraries.

Table 4.4: Metadata elements of Book Collection in Partner Digital Libraries

NO	The Current Standard Metadata Schema	BBPBPTH Yogjakarta	BPHPS Kuok	BPK SOLO	BPK CIAMIS	BPK MANADO
1	Main Entry	Title	Category	Parent Number	Main Entry Author	Title
2	Title	Subtitle	Title	Classification Number	Main Entry Cooperate Bodies	ISBN
3	Edition	Classification Number	Author	Title	Main Entry Conference	Copies or Last Update
4	Imprint	ISBN	ISBN	Author	Title	Classification Number
5	Collation	Edition	Publish City	Subject	Edition	Item Code
6	Series	Language	Publish Year	Publisher	Imprint	Location
7	Notes	Binding	Publisher	Publish Year	Physical Description	Topic
8	Keywords	Publish Year	Call Number	Number of Stock	Series	Author
9	Personal Author	Publisher	Location	Item Status	Note	Supplier
10	Cooperate Bodies	Publish City	Language	Image	Subject	Publisher
11	Meetings	Author 1,2,3,4	Image	Card Book	Keywords	Publish Place
12	Added Title	Editor 1,2,3,4	Item status	Collection Type	Additional Main Entry Author	Publish Year
13	Other Language Title	Keywords	Abstract		Additional Main Entry Cooperate Bodies	Collection Type
14		Category			Additional Main Entry Conference	
15		Index status			Call Number	
16		Dimension			ISBN	
17		Illustration Status			Language	
18		Notes			Number of Stock	
19					Parent Number	
20					Shelves Code	
21					Source	

In table 4.2 below, metadata elements of partner libraries institution was not covered by the current FORDA metadata schema remarked by the green color, such as: Classification Number, ISBN, language, binding, category, index status and illustration status. Some of these elements were registered by the BBPBPTH Yogjakarta digital library. BPHPS Kuok digital library has a similar problem since metadata elements such as: ISBN, code of book, language, rating, image and availability were not covered by the FORDA metadata schema. The digital libraries of BPK Solo, BPK Ciamis digital library and BPK Manado digital library also experienced similar problems.

This issue made interoperability problem among their digital libraries.

4.4.7 Losing metadata elements

Partner libraries experienced *metadata elements loss* when they used the FORDA metadata schema. The metadata elements loss of partner libraries could be seen in table 4.3 and table 4.4 with green color remark. This issue happened because partner libraries could not able to extend the metadata elements in the FORDA metadata schema.

For instance, key informant-1 mentioned that they faced the loss of important information that cover in their local metadata elements when they tried to use the current FORDA metadata schema. The reason was that metadata schema did not support extensibility facility. Key informant-2 says that they had tried to use the current FORDA metadata schema that based on default WINISIS database system, but they experienced metadata elements loss. Other key informants also met the similar problem.

Because of this issue, partner libraries did not use the current FORDA metadata schema and it makes interoperability problem among them.

4.4.8 Technological problem

Technological problem refers to the software and hardware issues. Technology is very much important for any digital library. If there is no good technological

facility the digital library cannot do all functions of library systems. Furthermore, due to technological unavailability one library of FORDA cannot use the current FORDA metadata schema. For instance, key Informant-4 mentioned that the metadata elements in his library were lost because the server was broken and data could not be recovered. And they did not have any back up copy of those data. They need fine computer to use the current metadata standard, need other storages or device or mirror server to back up their data. Due to lack of hardware and software that supporting the standard metadata schema were causes the partner libraries could not used and maintained the current FORDA metadata schema.

But there is no technological problem with four other partner libraries in FORDA because they have good hardware, software and facility system.

Table 4.5: The issues of metadata interoperability in FORDA metadata schema

No	Key Informant / Issues	KI-1	KI-2	KI-3	KI-4	KI-5
1	Complexity of the current FORDA metadata schema	X	X			
2	Different metadata format files and unavailability import metadata facility	X	X	X		X
3	Different metadata schema	X	X	X	X	X
4	Lack of Expertise					
	• Lack of LIS Background study		X	X	X	X
	• Lack of Mastery of basic and specific knowledge	X	X	X	X	X
5	Language problems					
	• Vocabularies		X	X	X	X
	• Directions	X	X	X	X	X
6	Limited Number of Metadata Elements	X	X	X	X	X
7	Losing metadata elements	X	X	X	X	X
8	Technological Problems				X	

Symbol “X” means that the key informants had experiences with the issues.

Table 4.5 shows all those issues for which the partner libraries did not use the current FORDA metadata schema, and it creates interoperability problem among FORDA digital libraries.

4.5 The requirements of the new FORDA metadata schema for securing interoperability among FORDA digital libraries

This part presents the requirements of the new FORDA metadata schema in order to secure interoperability among FORDA digital libraries. Standard metadata schema is strongly encouraged to consider for the requirements of the institution. It is expected that the standard metadata schema would provide satisfied services and fit with existing requirements. "*Metadata standards have generally been developed in response to the needs of specific resource types, domains or subjects*" (Kelly, 2006).

Standard metadata schema should be created basing on the requirements of those institutions.

> "*Recent decades have witnessed a proliferation of metadata schemas for description of digital resources. Each has been designed based on the requirements of the particular user community, intended users, type of resources, depth of description, etc. And problems arise when building a large digital library or repository with participants using different description methods or metadata records prepared according to diverse schemas*" (Chan, 2005, p.2).

Finding of this study have shown several requirements of FORDA metadata schema: *covers all important metadata; simplicity; extensibility; securing interoperability activity; supporting with training and user manual facility;* and *written in local language*. Each partner libraries have different requirements because it depends on their demands, objectives and priorities. It was major problem to maintain standardization, while they perform interoperability in digital libraries. Those requirements are explained below.

4.5.1 Cover all important metadata elements

Partner libraries required the new FORDA metadata schema should cover all their important metadata elements and collections in their libraries. The reason is they want their important metadata elements could be covered by the current FORDA metadata schema and displayed in their integrated search engine to provide complete and relevance access to their users. For example, BPHPS Kuok required some metadata elements, such as: *ISBN, Publish City*, and *Publish Year, Publisher, Call Number, Location* and item status, covered by the new standard metadata schema. Detail of metadata elements which were required to cover by the new standard metadata schema could be seen at Table 4.2 with green color remark.

In the interview, key informant-1 mentioned that firstly, their library wants new standard metadata schema cover all bibliographic data according to the collections. Secondly they required the new standard metadata schema to address data loss issues. Key informant-2 stated that they required the standard metadata schema to encompass all their important bibliographic data and all type of collections, e.g. maps, image, audio visual, magazine, etc. Key informant-3, key informant-4 and key informant-5 also have the similar requirement.

4.5.2 Extensibility (ability to extend the metadata elements)

Partner libraries required the new standard metadata schema ability to extend the metadata elements. All partner libraries have this requirement. They expected to this because of with qualified metadata, it is thought to minimize the problems and to give the possibility of customizing the metadata elements in future.

For example, key informant-1 said that their library wants the new standard metadata schema allow extending the metadata elements such as editing and adding metadata elements according to their requirements.

Basing on the extensibility, a metadata schema become flexible than just documentation or a guide formulation manufacture system. It is also an effort to meet the specific needs of institutions. Extensibility allows institutions to

customize their metadata elements. For instance with extensibility, we can define new metadata elements that we need.

> "*The schema may be more extensive because the relationships between search terms are as yet unknown, and a developer will want to provide for as many possibilities as are reasonable, in order to provide a satisfactory search result*" (Kennedy, 2008, p.3).

Duval, et.al (2002) described that: "*Metadata systems must allow for extensions so that particular needs of a given application can be accommodated*."

4.5.3 Provide metadata import tool

Metadata import tool allow combining the existing metadata elements with metadata elements from other systems. Four partner libraries expected the new standard metadata schema in FORDA to support metadata import tool which allow them to convert their existing metadata schemata to the new metadata schema with easy, simple and automatic process.

For instance, key informant-1 said that the new standard metadata schema should support tools that can import local metadata elements to the new one. Because of the unavailability of metadata import tool automatically from their local metadata schema to the current FORDA metadata schema, they had to re-enter their metadata value. The difficulties could be seen in section 4.3.4.3 in this chapter. In addition, he said that without automatic tool, their staffs have to re-entry metadata value. Furthermore, it was disturbing other library activities because they have limited number of staff and working time. Key informants-2 stated that it will very useful if the new standard metadata schema has some tools or equipments that can convert metadata automatically from Athenaeum Light 8.5 digital library system database to the new schema. In addition, she said that metadata imports tool made their job easier, faster and simpler. Key informant-3 and key informant-5 have same requirement.

But key informant-4 did not require this because she felt satisfied with the current FORDA metadata schema about this facility.

Basing on the interview results, there are several benefits when we used metadata import tool automatically, such as:

- Process of metadata integration became simple, easy and fast.
- Less human interference because the machine would do it.
- Save time and effort because of the run process in one time.

4.5.4 Simplicity (Simple and easy to use)

Simplicity means the metadata schema is understandable for their users. Partner libraries required simplicity in the standard metadata schema that made them easier to do their work. Four key informants required simplicity for the new standard metadata schema in FORDA digital libraries.

For instance, key informat-1 stated that standard metadata schema that suitable with their requirement should not complicate, understandable. It should be simple easy to use and maintain. Key informant-2 mentioned that the standard metadata should be simple, ensured easy to use and maintain. Key informant-3 mentioned that standard metadata schema that suitable with their library requirement should be simple, uncomplicated and easy that would make their staff easy to do their work. Key informant-4 required the standard metadata schema should be simple, make information retrieval easier and not complicated.

But one key informant did not require the simplicity as an aspect which should be considered in creating the new metadata schema because she felt satisfied with the current FORDA metadata schema.

Basing on the interview result, the simplicity of new standard metadata schema should be simple, uncomplicated, understandable, easy to use and maintain. QA Focus Team (2004) mentioned that easy to use is a key attributes of resource which could be matched against in turn to find the best fit of standard metadata schema.

But simplicity in the standard metadata schema is also problematic because it could make missing data elements.

> "*Because we were interested in providing simple search limits based on resource type and format, data missing from the Dublin Core "format" and "type" elements were particularly. In many cases, the entire collection consisted of materials in one format or of one type, and the missing information was deemed and the missing information was deemed unnecessary for the collection's local purposes. In other cases, the metadata was very brief, or was taken from an earlier store of metadata that did not include the information*" (Dushay and Hillmann, 2003, p.2).

4.5.5 Securing interoperability activity

Basing on the issues discussed in section 4.4 in this chapter, interoperability activity among FORDA digital libraries was not going well. Therefore, partner libraries and central library required a new standard metadata schema for securing the interoperability among them.

This requirement provides digital libraries in FORDA the possibility to know each other about the current status of the collections. It would make a better and new service for their users.

For instance, key informant-1 mentioned that they expected to have a new standard metadata schema which securing interoperability among digital libraries in FORDA because they want to share their data to provide complete and better services. In addition, he also mentioned that with metadata interoperability they want to know the status of the collections of other libraries to provide information for their institutions. Other key informants from BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado also have same requirement.

4.5.6 Supported by training and user manual facility

Partner libraries required training and user manual facility to use and maintain the new standard metadata schema. The training and user manual would give necessary knowledge and expertise to those staff regarding usage; maintain and necessary technological knowledge regarding the new standard metadata schema

because the most sophisticated technologies and newest software are useless without necessary knowledge or expertise and training to use them.

For instance, key informant-1 mentioned that due to lack of expertise and direction in the current FORDA metadata schema, the libraries were not able to use it. He expected to have training and user manual when a new standard metadata is created which would help him to understand the new standard.

Key informant-2 mentioned that they want the new standard metadata schema supported by user manual facility which was written in Indonesian language to make them easy to follow the new standard. They could reopen that manual when there is a problem in the future. Key informant-3 and key informant-5 also have similar requirement where they required both training and user manual of the new standard. They mentioned that it would make them able to use the new standard.

Key informant-4 required the training about the new standard to make them familiar with that standard but they do not mentioned the user manual.

4.5.7 Written in Local and Multi Language

Local language refers to Indonesian language. All key informants required the standard metadata schema written in Indonesian language. Due to lack of English language proficiency, it was troublesome to use the current FORDA metadata schema, which is written in English, both vocabulary and directions. Using local language expected to make the staff understand to use and to maintain the new metadata schema.

For example, key informant-1 mentioned that he preferred the new standard metadata schema in Indonesian language, both the vocabulary and the directions for understandable. It also provides with multi language facility to make possibility to change in other language. Key informant-2 mentioned that she required the new standard metadata schema written in Indonesian and in English. Key informant-3, key informant-4 and key informant-5 mentioned that their institutions required the new standard metadata schema which written in

Indonesian language because it would more understandable and make their work easier, they do not required in multi language.

Table 4.6: The requirements of the new FORDA metadata schema

No	Key Informant / Requirements	KI-1	KI-2	KI-3	KI-4	KI-5
1	Cover all important metadata	X	X	X	X	X
2	Extensibility (ability to extend the metadata elements)	X	X	X	X	X
3	Provide metadata import tool	X	X	X		X
4	Simplicity (Simple and easy to use)	X	X	X	X	
5	Securing interoperability activity	X	X	X	X	X
6	Supported by training and user manual facility					
	Training	X		X	X	X
	User manual	X	X	X		X
7	Written in local and multi language					
	Local language	X	X	X	X	X
	Multi language	X	X			

Symbol “X” mean that key informant expected the requirement.

Table 4.6 shows all the requirements of the new FORDA metadata schema for securing interoperability among FORDA digital libraries.

4.6 Summary

In this chapter attempt has been made to analyze and discuss the data from the interviews results which based on the interactive model by Miles and Hiberman (1994). Finding of this study shows there are several issues of interoperability in the current FORDA metadata schema, such as: complexity of the current FORDA metadata schema, different metadata format files and the unavailability of

metadata import facility different metadata schema, losing data, lack of expertise, language problem, limited number of metadata element and technological problem.

And there are several requirements of the new standard metadata schema of FORDA digital libraries, such as: cover all important metadata, extensibility (ability to extend the metadata elements), provide metadata import tool, simplicity, securing interoperability activity, supported by training and user manual facility, written in local and multi language.

5.0. CHAPTER FIVE: DISCUSSION AND CONCLUSION

5.1. Introduction

This chapter presents the discussions and the conclusions of the study. The conclusions consist of the findings to the two research questions of this study. It also presents implications of the research.

5.2 Discussion of the Research Questions

The aim of this study is to find out the issues of metadata interoperability for FORDA digital libraries and to give recommendation to secure the interoperability among them. This research is conducted in a specific domain, which is: FORDA digital libraries as a representative to the similar institutions with interoperability problems. In doing that, it leads to two research questions presented below.

5.2.1 What are the issues of interoperability in the current home-grown metadata schema used in FORDA digital libraries?

According to the findings, there are several issues which create interoperability problems in the current FORDA metadata schema, such as:

- Complexity of the current FORDA metadata schema

  Complexity means the partner libraries were confused to use the FORDA metadata schema. There are two points in this issue. Firstly, the current FORDA metadata schema has confusing symbol. Secondly, the current FORDA metadata schema required to use some programming language in application. Because of this issue, BBPTPH Yogjakarta and BPHPS Kuok did

not use FORDA metadata schema. Therefore, it's hard to achieve the interoperability in FORDA digital libraries.

- Different metadata format files and unavailability metadata import facility.

  There are two main points in different metadata format files and unavailability import metadata facility issues. Firstly, partner library have different metadata format files with the FORDA metadata format file. Secondly, the current FORDA metadata schema does not have import metadata facility. Import metadata means an ability to combine the existing metadata with other metadata from other system. Four partner libraries experienced this issue, which are: BBPTPH Yogjakarta, BPHPS Kuok, BPK Solo and BPK Manado.

- Different Metadata Schema.

  One main issue that partner libraries did not use the current FORDA metadata schema has different metadata schema which each library has their own metadata schema that was developed specifically. All partner libraries experience this issue.

- Language problem

  Language is also the issue that prevents partner libraries from using the FORDA metadata schema. Four key informants mentioned that they had problem with the vocabularies (BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado). All key informants mentioned that they experience problem with directions.

- Limited number of metadata element

  The current FORDA metadata schema has limited number of metadata elements. Firstly, the current FORDA metadata schema only supports for book, undergraduate thesis, thesis, and dissertation collections. Secondly, the current FORDA metadata schema did not cover the important metadata

elements for book metadata itself of partner libraries. All partner libraries experience this issue.

- Lack of expertise

  It is refer to a lack of understanding of the task or specific knowledge and the technological issue about metadata elements, metadata schema, interoperability, and also about LIS field. There are two main points in lack of expertise issues, which are: firstly, the partner libraries staff was lacking in Library Information Science (LIS) background study (BPHPS Kuok, BPK Solo, BPK Ciamis and BPK Manado). Secondly, all partner libraries experience with lack of the mastery of basic and specific knowledge about metadata schema and interoperability problem.

- Losing metadata elements

  All partner libraries experienced metadata elements loss when they used the FORDA metadata schema.

- Technological problem refers to the software and hardware issues (BPK Ciamis).

Those issues are the important issues that must be considered when we create and develop the new standard metadata schema for secure interoperability among digital libraries.

5.2.2 What are the recommendations to secure the interoperability of metadata among digital libraries in FORDA?

According to the findings and discussion about recommendation in section 5.2 in this chapter, there are three recommendations for securing interoperability of metadata schema among FORDA digital libraries which have multiple metadata schemata and different requirements, which are:

1. **Determine a standardized metadata schema for securing interoperability among FORDA digital libraries.**

The new FORDA metadata schema for securing interoperability among FORDA digital libraries should meet the requirements of FORDA digital libraries. Basing on the findings in chapter 4, these requirements include:

- Cover all important metadata
- Extensibility (Ability to extend the metadata elements)
- Provide metadata import tool
- Simplicity
- Securing interoperability activity
- Supported by training and user manual facility
- Written in local and multi language

Table 5.1 below describes different standard metadata schemas which cover the requirements of FORDA digital libraries.

Firstly, Dublin Core covers the requirements of extensibility, considering simplicity of the metadata elements, securing interoperability activity, supporting with training and user manual, multi language. The major disadvantage is that Dublin Core is not available in Indonesian language. There is no facility to mapping from metadata schema elements which used Athenaeum Light 8.5 to Dublin Core without losing any data because there are some metadata elements which does not covered by Dublin Core, such as: dimension and supplier.

Secondly, INDOMARC covers all the requirements except simplicity, but this requirement would be addressed in INDOMARC by metadata aggregator or harvester tool. Partner libraries will be supported about it because central library is responsible for the aggregation process. Thus partner libraries just send their metadata to them.

Thirdly, METS cover all the requirements of FORDA digital libraries beside three aspects, such as: provide metadata import tool, simplicity and written in local

language. Finally, MPEG does not meet the requirement for cover all the important metadata elements in FORDA because it was a standard metadata schema for audio and video recordings in digital form. It also does not cover the simplicity aspect and it does not written in local language.

Table 5.1: the different standard metadata schemas which cover the requirements of FORDA digital libraries

NO	Standard Metadata Schema / Requirements	DUBLIN CORE	INDOMARC	METS	MODS	MPEG
1	Cover all important metadata		X	X	X	
2	Extensibility (Ability to extend the metadata elements)	X	X	X	X	X
3	Provide metadata import tool		X		X	X
4	Simplicity	X			X	
5	Securing interoperability activity	X	X	X	X	X
6	Supported by:					
	• Training	X	X	X	X	X
	• User manual	X	X	X	X	X
7	Written in:					
	• Local language		X			
	• Multi language	X	X	X	X	X

From the above analysis of advantage and disadvantage of each standard metadata schema, *INDOMARC might be a standard metadata schema to securing interoperability among FORDA digital libraries*. INDOMARC could address the requirements of suitable metadata schema for FORDA digital libraries, e.g. cover all important metadata elements; extensibility; securing interoperability activity; provide training and user manual facility also written in local language.

Firstly, *INDOMARC could solve the issue of cover all important metadata element because INDOMARC have rich metadata elements*. It has 700 classes of metadata elements covering books, serials, computer files, maps, audio visual, etc. The following table is an example of the integration all FORDA book metadata elements to INDOMARC and the description of the leader and fields name of INDOMARC using metadata aggregation model. The most part, "*Supplier*"

metadata elements in FORDA have no equivalents in INDOMARC, but these could be mapped to locally-defined INDOMARC elements.

Table 5.2: Integrated book metadata elements of FORDA to INDOMARC

No	FORDA Metadata Element	Source of Elements	INDOMARC Leader	INDOMARC Metadata Element Fields	Repeatability
1	<Author1,2,3,4Type>	BBPBPTH Yogjakarta	100 & 700	Main Entry Personal Name & Added Entry Personal Name	R
2	<AuthorType>	BPHPS Kuok, BPK Solo, BPK Ciamis, BPK Manado	100	Main Entry Personal Name	R
3	<AbstractType>	BPK Solo	520	Summary	R
4	<AdditionalMainEntryAuthorType>	BPK Ciamis	700	Added Entry Personal Name	R
5	<Additional Main Entry Conference>	BPK Ciamis	711	Added Entry Meeting Name	R
6	<AdditionalMainEntryCorporateBodiesType>	BPK Ciamis	700	Added Entry Corporate Name	R
7	<BindingType>	BBPBPTH Yogjakarta	01	Specific Material Designation	R
8	<CallNumberType>	BPHPS Kuok, BPK Ciamis	080	Universal Decimal Classification (UDC) Call Number	R
9	<CardBookType>	BPK Solo	035	Other System Control Number	NR
10	<CategoryType>	BBPBPTH Yogjakarta, BPHPS Kuok	00	Category of Material	R
11	<Clasiification NumberType>	BBPBPTH Yogjakarta, BPK Solo, BPK Manado	080	Universal Decimal Classification (UDC) Call Number	R
12	<CollectionType>	BPK Solo, BPK Manado	00	Category of Material	R
13	<CopiesorLastUpdateType>	BPK Manado	310	Current Frequency	R
14	<DimensionType>	BBPBPTH Yogjakarta	04	Dimension	R
15	<EditionType>	BBPBPTH Yogjakarta, BPK Ciamis	250	Edition	R

16	<Editor1,2,3Type>	BBPBPTH Yogjakarta	100	Main Entry Personal Name & Added Entry Personal Name	R
17	<ImageType>	BPHPS Kuok, BPK Solo	300	Physical Description	R
18	<IlustrationStatusType>	BBPBPTH Yogjakarta	300	Physical Description	R
19	<IndexStatusType>	BBPBPTH Yogjakarta	300	Physical Description	R
20	<ItemStatusType>	BPHPS Kuok, BPK Solo	310	Current Frequency	R
21	<ISBNType>	BBPBPTH Yogjakarta, BPHPS Kuok, BPK Ciamis, BPK Manado	015	ISBN	NR
22	<ImpresumType>	BPK Ciamis	260	Imprint	R
23	<ItemCodeType>	BPK Manado	035	Other System Control Number	NR
24	<KeywordType>	BBPBPTH Yogjakarta, BPK Ciamis	600	Subject	R
25	<LanguageType>	BBPBPTH Yogjakarta, BPHPS Kuok, BPK Ciamis	041	Language	R
26	<LocationType>	BPHPS Kuok, BPK Manado	852	Location	R
27	<NotesType>	BBPBPTH Yogjakarta, BPK Ciamis	500	Note	R
28	<NumberofStockType>	BPK Solo, BPK Manado	310	Current Frequency	R
29	<MainEntryAuthorType>	BPK Ciamis	100	Main Entry Personal Name	R
30	<MainEntryConferenceType>	BPK Ciamis	120	Main Entry Meeting Name	R
31	<MainEntryCooperateBodiesType>	BPK Ciamis	110	Main Entry Cooperate	R
32	<ParentNumberType>	BPK Solo, BPK Ciamis	035	Other System Control Number	NR
33	<PublishCityType>	BBPBPTH Yogjakarta, BPHPS Kuok	260	Publication, Distribution, etc	R
34	<PublishPlaceType>	BPK Manado	260	Publication, Distribution, etc	R
35	<PublishYearType>	BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo, BPK Manado	260	Publication, Distribution, etc	R
36	<PublisherType>	BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo, BPK Manado	260	Publication, Distribution, etc	R
37	<PhysicalDescriptionType>	BPK Ciamis	300	Physical Description	R
38	<SeriesType>	BPK Ciamis	410	Series	R
39	<ShelvesCodeType>	BPK Ciamis	852	Location	R
40	<SourceType>	BPK Ciamis			
41	<SubjectType>	BPK Solo, BPK Ciamis	600	Subject	R

42	<SuplierType>	BPK Manado	037 $b	Supplier	R
43	<SubTitleType>	BBPBPTH Yogjakarta	740	Added Entries Analytical Title	R
44	<TitleType>	BBPBPTH Yogjakarta, BPHPS Kuok, BPK Solo, BPK Ciamis, BPK Manado	130	Uniform Title	R
45	<TopicType>	BPK Manado	600	Subject	R

Table 5.3: Description of Leader INDOMARC

Leader	Fields Name
00	Category of material
01	Specific material designation
02	Original versus reproduction aspect
03	Positive/negative aspect
04	Dimension
06-08	Reduction ratio
09	Colour
10	Emulsion of film
0XX	Control information, numbers, and codes. It includes standard number, classification number and call number
1XX	Main Entry
2XX	Title and title related files (title, edition, imprint)
3XX	Physical description, etc
4XX	Series statements
5XX	Notes
6XX	Subject access fields
7XX	Added entries or series
8XX	Series added entries
9XX	Reserved for local implementation

Secondly, INDOMARC could meet the extensibility issue because INDOMARC is supported with extends specifications in detail for encoding elements of any description, shape and material type.

Thirdly, since INDOMARC is a national standard metadata schema for Indonesian, it could be covered the language requirement. And it is possible for customization in other language because INDOMARC is series of MARC standard format. Both local language and international language could be resolved

using INDOMARC. Other advantage is one of partner libraries using it, e.g. BPK Ciamis.

Fourthly, INDOMARC satisfies the requirement of training and manual facility because INDOMARC is supported by user manual and written in Indonesian language. Regularly, the training facility of INDOMARC is provided by National Library Republic of Indonesia.

Even though this suggestion could not address the simplicity issue because INDOMARC is a metadata schema format with rich elements, it expected to make the staff of partner libraries familiar, understand and able to use INDOMARC with the training and user manual facility.

Fifthly, using INDOMARC for uniform standard metadata schema would be ensuring the high level consistency.

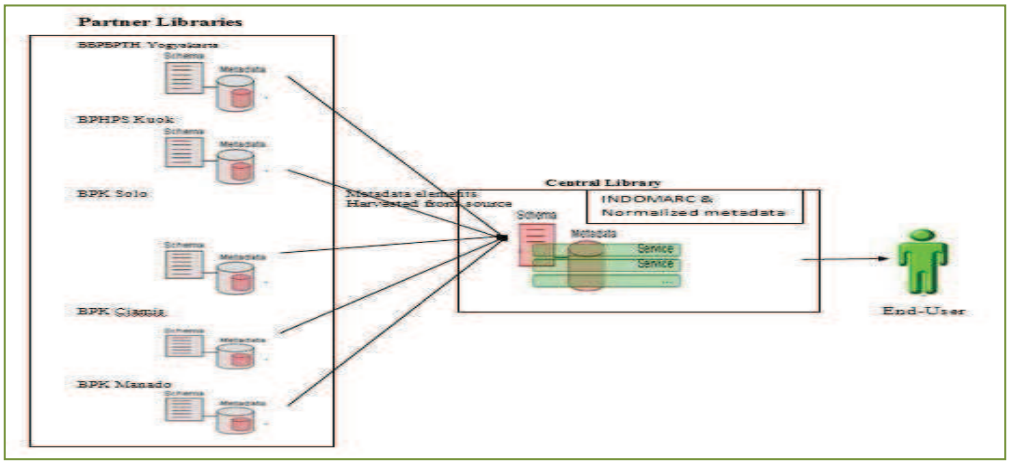

Figure 5.1: The aggregation model with a standard metadata schema (INDOMARC) for securing interoperability in FORDA digital libraries

Finally, for the sake of simplicity, we would use the harvester or aggregator for integrating the FORDA metadata elements to INDOMARC without re-entering data. The central library could support librarians in partner libraries to deal with this (see Fig.5.1). It would not disturb the other activities in partner libraries because the central library manages this process. The partner libraries are only responsible to send their original metadata elements to the central library.

FORDA DLs are recommended for using OAI-PMH with INDOMARC record structured from ISO2709, also known as ANSI/NISO Z39.2 for aggregation metadata.

2. **Aggregation approach for securing interoperability among digital libraries which have multiple metadata schemata and different requirements without determining a standard metadata schema.**

This approach is another approach for securing interoperability among FORDA digital libraries. The reasons for this recommendation are:

Firstly, FORDA digital libraries are using different metadata schema and they have different requirements for standard metadata schema.

Secondly, it is the solution which could be implementing when it was too late to suggest any standard metadata schema.

In figure 5.2, it could be seen that metadata elements of different metadata schemata in all partner libraries could be integrated in a central aggregator without using a standard schema. The central aggregator is managed by central library. Each of content vendors/sources provides their metadata in their existing format together with their schema.

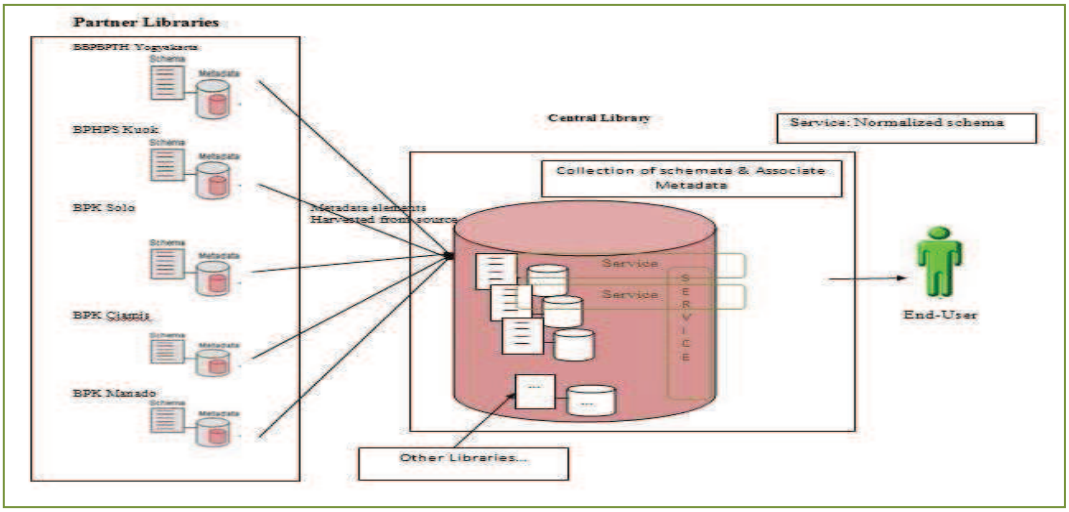

Figure 5.2: The aggregation model without a standard metadata schema for securing metadata interoperability in FORDA digital libraries

The following figure shows the detail reciprocal interoperability metadata between central library and partner libraries of FORDA digital libraries with or without a standard metadata schema.

Firstly, all metadata elements in partner libraries' repository or database would be extracted to reduce the capacity of the file, for instance: extract to WinZip file. Secondly, those metadata would be sent via email directly or stored in CD/DVD or other storage and then sent it via post to operator in central library. Thirdly, operator from central library would organize those metadata elements and they are stored in staging area. Fourthly, the operator would extract the metadata to the original file, transform and load to the temporary database catalogue or temporary repository. Fifthly, the librarian of central library would validate those metadata. Sixthly, after confirming the validation of those metadata, the librarian would store those metadata in the FORDA digital library repository.

Finally, those metadata could be accessed by end user and sent back to the partner libraries to get the complete version of the FORDA digital libraries metadata copy.

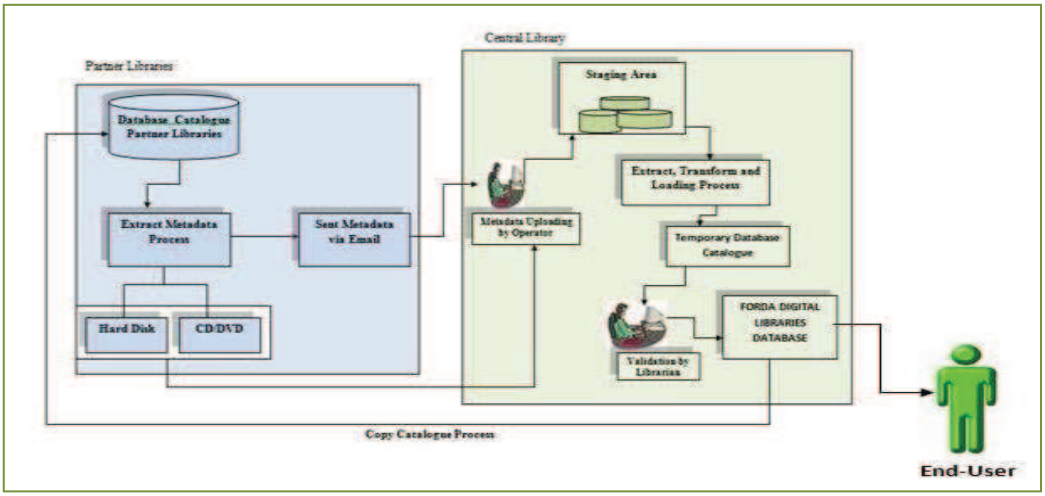

Figure 5.3: the detail reciprocal interoperability metadata between central library and partner libraries of FORDA digital libraries

This process always continues whenever there is update metadata from each partner libraries and would be securing interoperability among FORDA digital libraries.

3. **The authority (leaders/stakeholders) of FORDA digital libraries should take some initiative for securing interoperability among them**

Firstly, we suggest the authority of FORDA digital libraries to take initiative to create the agreement among them about securing interoperability in their institutions. By this action, it is expected to get the agreement about legal, intercommunity, political and technical interoperability aspects among them.

Secondly, we suggest the authorities to accommodate and grant permission to supply and to install the proper hardware and software in their libraries. By this action, the technological issue among them is addressed.

Thirdly, we suggest the authorities to accommodate and to provide training about cataloguing, basic and specific knowledge about metadata, the new FORDA metadata schema (INDOMARC) to get familiarity with the system and the new FORDA standard metadata schema.

5.3 Conclusions

There are several issues which make issues of interoperability in the current home-grown metadata schema used in FORDA digital libraries, which are: complexity of the current FORDA metadata schema, different metadata format files and unavailability metadata import facility, different metadata schema, lack of expertise, language problems, limited number of metadata elements, losing metadata elements and technological problems.

The requirements of the new FORDA metadata schema for securing interoperability among FORDA digital libraries include: cover all important metadata, extensibility (ability to extend the metadata elements), provide metadata import tool, simplicity, securing interoperability activity, supported by training and user manual facility and written in local (Indonesian) and multi language.

There are three recommendations for securing the interoperability of metadata schema among digital libraries in FORDA, which are:

1. We recommend determining a standard metadata schema (INDOMARC) for securing interoperability among FORDA digital libraries.
2. We suggest using aggregation approach for securing interoperability among digital libraries which have multiple metadata schema and different requirements without determined a standard metadata schema.
3. We propose the authority of FORDA digital libraries should take some initiative for securing interoperability among them

5.4 Implication of Research

The results of this study can be used for library within the same domain and similar cases with interoperability problems. It could be a reference to study the same fields and to consider securing interoperability among different libraries with different requirements. From the results of this study, we could get the information about the issues of interoperability in the current metadata schema used in FORDA digital libraries and some recommendation could be made for securing interoperability among them in which have multiple metadata schemata and various requirements.

5.5 Implications of Further Research

This study considered one specific domain, which is: FORDA digital libraries. It would be more interesting to conduct further study by taking and considering more libraries in the Ministry of Forestry Republic of Indonesia to get deep and complete information about the issues of interoperability.

The further study could be conducted by taking additional issues related to general problems of interoperability e.g. copyright, legal, political and financial.

The recommendations of this study are theoretical base. It is needed in further study to do practical and experimental to find out the other issues of the interoperability problems for securing interoperability in FORDA digital libraries.

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APPENDIX 1

Acuan Daftar Pertanyaan Wawancara

Standarisasi Metadata schema untuk Menunjang Kegiatan Interoperability: Studi Kasus di Perpustakaan Digital di Departemen Kehutanan RI

Daftar Istilah

Metadata: data terstruktur yang mendeskripsikan data lain, dalam perpustakaan kita mengenalnya sebagai data bibliografi atau data katalog koleksi.
Metadata Schema:
Standar Metadata/ metadata schema: Standar internasional untuk metadata. Contoh Dublin Core, Marc 21, IEEE LOM.
Interoperability: kegiatan pertukaran data yang dilakukan antara dua atau lebih perpustakaan

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1. Sebutkan Nama Lengkap Anda?
2. Apa jabatan Anda?
3. Berapa NIP Anda?
4. Sebutkan Alamat kantor Anda?
5. Sebutkan latar belakang pendidikan Anda? (misalnya D3/S1/S2 Kehutanan)

Kebutuhan Standarisasi Metadata Perpustakaan

6. Apakah Anda mengetahui dan mengenal tentang istilah standard metadata schema? (Misalnya Dublin Core, EAD, MARC 21, dll)

7. Metadata schema apa yang perpustakaan Anda terapkan?

8. Elemen Metadata (data bibliografi/data catalog/data yang dimasukan dalam buku induk koleksi perpustakaan/kartu catalog online perpustakaan, seperti judul, pengarang, dan sebagainya) apa saja yang dimiliki di perpustakaan Anda? (Mohon berikan jabaran sesuai dengan keadaan yang ada)

9. Apakah perpustakaan melakukan kegiatan pertukaran **data bibliografi** dengan perpustakaan lain? (misal dengan perpustakaan pusat)

Jika YA, silahkan ke pertanyaan No 9 dan 10

Jika TIDAK, silahkan langsung ke pertanyaan No 11

10. Bagaimana kegiatan pertukaran data bibliografi di Perpustakaan digital Anda?

11. Apakah dalam kegiatan interoperability tersebut perpustakaan Anda mengalami kendala dan hambatan?

12. Kenapa perpustakaan Anda tidak melakukan kegiatan pertukaran data bibliografi dengan perpustakaan lain? Apa masalahnya?

13. Sebelum ini, Perpustakaan Pusat Badan Litbang kehutanan (RI Ardi Koesuma) mengharapkan perpustakaan partner (termasuk perpustakaan Anda) untuk mengirimkan daa bibliografi yang berdasarkan pada system WINISIS database. . Apakah perpustakaan Anda mengirimkan data tersebut untuk kegitan pertukaran metadata? Kalau tidak kenapa?

14. Apakah Anda mempunyai system catalog maupun database lain selain CDSISIS/WINSISIS yang digunakan dalam mencatat data bibliografi koleksi perpustakaan Anda?

15. Kalau Ya, kenapa Anda menggunakan system tersebut? Dan kalau tidak mohon juga berikan alasan perpustakaan Anda menggunakan database tersebut? Mohon sebutkan?

16. Baru-baru ini perpustakaan pusat mencanangkan untuk menggunakan metadata yang berbasis pada SIPISIS. Bagaimana pendapat Anda mengenai hal tersebut?

17. Apakah metadata schema yang ada pada SIPISIS sesuai dengan kebutuhan perpustakaan Anda?

18. Berhubungan dengan pertanyaan 16, Bagaimana dengan data bibliografi yang sebelumnya perpustakaan Anda miliki, Apakah Anda harus mengentry data dari awal nantinya/bagaimana?

19. Mengenai bahasa, apakah data bibliografi yang ada pada program WINISIS yang berbahasa ingrris menjadi masalah bagi Anda dalam kegitan penngolahan koleksi dan pertukaran data? (misalnya kalau bahasa dalam catalog koleksi baik yang online/elektronik berbahasa inggris/ bahasa lain selain Indonesia apakah menjadikan masalah bagi Anda?)

20. Menurut Anda apakah kegiatan pemasukan data data bibliografi yang ada pada program WINISIS tergolong rumit atau sederhana? Kenapa rumit dan kenapa sederhana?

Harapan mengenai Standar Metadata schema yang sebaiknya ada

21. Terakhir, Menurut pendapat Anda, metadata schema seperti Apa yang sesuai dengan kebutuhan perpustakaan Anda? (misal: standard metadata yang ada sebaiknya sederhana, tidak rumit udah dimengerti, berbahasa Indonesia, memudahkan kegiatan penelusuran koleksi, mmudahkan/memperlancar kegiatan pertukaran data, yang bisa mengimport dan mengekspor data bibliografi tanpa harus mengentry ulang dari database yang lama dan sebagainya)

APPENDIX 2
OVERVIEW OF THE RESEARCH FOR INTERVIEW

Proposal Penelitian Master Thesis

Standardisation Metadata Scheme Untuk Melakukan Kegiatan Interoperability Sebuah Studi Kasus Perpustakaan Digital Di Lingkungan Departemen Kehutanan Republik Indonesia

Oleh : Amma Naningrum, S.Sos

Pembimbing: Prof. Nils Pharo

1.1. Latar Belakang

Metadata schema sangat penting dan menjadi salah satu hal yang harus dipertimbangkan ketika kita membuat perpustakaan digital. Secara umum metadata adalah data terstruktur mengenai data. Kita mengenal metadata sebagai data bibliografi dari sebuah koleksi perpustakaan, seperti: judul, pengarang, volume, edisi, tahun terbit dan sebagainya. Metadata dalam bidang Informasi dan perpustakaan mempunyai banyak fungsi dan tujuan. Salah satunya seperti yang diungkapkan olek Komisi Eropa yang menyatakan bahwa tujuan dan fungsi metadata adalah untuk memfasilitasi dan meningkatkan proses temu balik informasi. Dan menurut NISO (2004) metadata mempunyai fungsi yaitu sebagai penelusur atau pencari sumber-sumber informasi, mengelola sumber-sumber informasi elektronik, memfasilitasi interoperability (pertukaran, kerjasama antara dua atau lebih perpustakaan), identifikasi digital dan pengarsipan dan pelestarian.

Metadata juga diharapkan dapat mewakili sebagian besar data asli dari sebuah koleksi dan kita harus menggunakan metadata schema yang baik, termasuk didalamnya mempunyai metadata standard dan model. Kita menggunakan standard metadata untuk membuat kemungkinan adanya kegiatan interoperability dan kerjasama/pertukaran data bdalam perpustakaan digital. Kegiatan interoperability, kerjasama atau pertukaran data ini akan berjalan

dengan baik apabila ada standard metadata schema diantara perpustakaan digital tersebut. Hal ini diperkuat oleh pendapat Shiri (2003) yang menyatakan bahwa:

> "The requirement for interoperability generally derives from the fact that various DLs with different architectures, metadata formats, and underlying technologies wish to effectively interact, something they can do through applying a range of common protocols and standards."

Setiap organisasi bebas menentukan model atau standard metadata schema mereka sendiri tetapi akan lebih baik jika bisa mengikuti metadata standard yang telah ada dengan memilih standard yang kira-kira relevan dan sesuai dengan semua kebutuhan dan tujuan kita. Hal tersebut diperkuat pernyataan W3C (2010) yang menyatakan bahwa:

> "If a particular standard metadata schema doesn't meet our needs, then it is usually better to define an additional metadata schema in an existing framework and to use custom metadata schema in combination with standard metadata schema rather than totally ignore the standard schema."

Kerena kebutuhan akan metadata dalam suatu organisasi berbeda-beda tergantung dari kebutuhan, jenis koleksi dan tujuan mereka masing-masing sehingga terkadang sangat sulit untuk melakukan penyeragaman/ standarisasi saat kita melakukan interoperability di antara perpustakaan digital. Bahkan metadata schema yang ada tidak memenuhi kebutuhan perwakilan data koleksi yang dimiliki, sehingga hal itu menimbulkan masalah yang menjadi momok dalam interoperability di antara perpustakaan digital.

Hal tersebut juga berlaku dan terjadi pada perpustakaan di lingkungan Departemen Kehutanan RI. Dimana kegiatan interoperability yang ada terhambat oleh standarisasi metadata schema. Kenyataan di lapangan menunjukan kegiatan interoperability diantara perpustakaan di lingkup Departemen Kehutanan belum terlaksana. Saat ini perpustakaan digital di lingkup Departemen Kehutanan belum mempunyai metadata standard umum yang digunakan di perpustakaan mereka guna mewakili koleksi mereka. Karena kenyataan di lapangan saat ini mereka menggunakan sistem metadata yang berbeda satu sama lain yang berdasarkan pada

kebutuhan perpustakaan mereka. Hal ini menjadi masalah besar dalam kegiatan interoperability perpustakaan digital di lingkungan Departemen Kehutanan.

Peneliti meneliti masalah ini karena peneliti menganggap bahwa fenomena atau masalah ini sangat penting untuk diteliti guna perkembangan ilmu terutama ilmu informasi dan perpustakaan dan membuat serta melancarkan kegiatan interoperability di antara perpustakaan di lingkungan Departemen Kehutanan RI serta kedepannya hasil standarisasi ini diharapkan bisa digunakan untuk membangun sebuah jaringan perpustakaan digital di lingkungan Departemen Kehutanan RI.

1.2. Tujuan

Tujuan penelitian ini adalah:

1. Untuk mengetahui Standard metadata schema seperti apa yang sesuai dengan kebutuhan, tipe koleksi dan tujuan Perpustakaan Digital Departemen Kehutanan Republik Indonesia
2. Untuk memberikan rekomendasi mengenai hal ini

1.3. Kegunaan Penelitian

1. Hasil penelitian diharapkan memberikan informasi dalam hal standarisasi metadata guna menunjang kegiatan interoperability di Perpustakaan Digital Departemen Kehutanan Republik Indonesia
2. Kedepannya hasil standarisasi ini diharapkan bisa digunakan untuk membangun sebuah jaringan perpustakaan digital di lingkungan Departemen Kehutanan RI

APPENDIX 3

The Current status of Metadata schema elements in FORDA Digital Libraries - Indonesia

1) The Current Metadata Schema that used in Interoperability among The Ministry of Forestry Republic of Indonesia Digital Libraries that based on default WINISIS database

Tag	Name	Type	Rep	Pattern or Sub Field
12	Conference Main Entry	Alphanumer		npdz
24	Title	Alphanumer		z
25	Edition	Alphanumer		
26	Imprint	Alphanumer		abc
30	Collation	Alphanumer		abc
44	Series	Alphanumer	R	vz
50	Notes	Alphanumer		
69	Keywords	Alphanumer		
70	Personal Authors	Alphanumer	R	
71	Corporate Bodies	Alphanumer	R	
72	Meeting	Alphanumer	R	npdz
74	Adding Title	Alphanumer	R	z
76	Other Language Title	Alphanumer	R	z

2) The Digital Library of BBPBPTH Yogjakarta metadata schema entities

Category: Book

Entry New Data Book	
Title	
Sub Title	
No.UDC (max 16 Char)	
ISBN	
Edition	
Language	
Binding	
Published Year	2011

Publisher	
Published City/Place	
Author1	
Author 2	
Author 3	
Author 4	
Editor 1	
Editor 2	
Keyword	
Category	
Index Status	Yes No
Dimension	

Illustration Status	Yes No
Other Notes	

Category: Magazine

Entry New Data	
Title	
Sub Title	
No.UDC (max 16 Char)	
ISSN	
Edition	
Language	
Published Year	2011
Publisher	
Published Place	
Index Status	Yes No

Category: Article

Entry New Data	
Title	
Subtitle	
Name of Magazine	
No.UDC (max 16 Char)	
ISSN	
Number of Page	
Edition	
Language	

Author 1	
Author 2	
Author 3	
Author 4	
Editor 1	
Editor 2	
Keyword	
Index Status	Yes No
Other Notes	

Abstracts (ENGLISH)	
Abstracts (INDONESIA)	

Category: Journal

Entry New Data	
Title	
Sub Title	
No.UDC (max 16 Char)	
ISSN	
Edition	
Language	
Binding	
Published Year	2011
Publisher	
Published Place	
Keyword	
Index Status	Yes No

3) BPHPS Kuok digital library metadata schema entities/elements

Category Book:

No	Field Name	Description
1	Category	
2	Title	
3	Author	
4	ISBN	
5	Publish City	
6	Publish Year	
7	Publisher	
8	Call Number	
9	Location	
10	Language	
11	Image	
12	Item status	
13	Abstract	

Category Maps

No	Field Item or Metadata Entities	Description
1	Parent Number	
2	Call Number	
3	Title	
4	Publisher	
5	Published Year	
6	Publisher Place	
7	Type of Maps	
8	Subject	
9	Scale	
10	Image	
11	Location	

12	Notes	Coordinate, Other information about the maps
13	Item Status	
14	Source	
15	Price	
16	Order Date	
17	Receive Date	

Category of Magazine and Journal

No	Field Name or Metadata Entities	Description
1	Parent Number	
2	Call Number	
3	Title	
4	Editor	
5	Sub Title	
6	Edition and Volume	
7	ISSN	
8	Language	
9	Published Year	
10	Publisher	
11	Published Place	
12	Item Status	
13	Number of Copies	
14	Subject	
15	Source	
16	Price	
17	Order Date	
18	Receive Date	

Category of Article

No	Field Name or Metadata Entities	Description
1	Parent Number	
2	Call Number	
3	Title	
4	Subtitle	
5	Name of Magazine or Journal	
6	ISSN	
7	Number of Page	
8	Edition	

9	Language	
10	Main Author	
11	Other Author	
12	Main Editor	
13	Other Editor	
14	Subject	
15	Index Status	
16	Other Notes	
17	Abstracts in Indonesia	
18	Abstracts in English	
19	Item Status	
20	Number of Copies	
21	Source	
22	Price	
23	Order Date	
24	Receive Date	

Category of Audio and Video

No	Field Name	Description
1	Parent Number	
2	Call Number	
3	Item Status	
4	Title	
5	Sub Title	
6	Main Author	
7	Other Author	
8	Subject	
9	Notes	Description about content of the audio or video
10	Type of Collection	DVD, CD, Beta Mac, etc
11	Number of Copies	
12	Time	Duration of the Audio or Video
13	Source	
14	Price	
15	Order Date	
16	Receive Date	

4) The Digital Library of Balai Penelitian Kehutanan Solo metadata schema entities

No	Field Name	Description
1	Parent Number	
2	Classification Number	
3	Title	
4	Author	
5	Subject	
6	Publisher	
7	Publish Year	
8	Number of Stock	
9	Item Status	
10	Image	
11	Card Book	
12	Collection Type	

5) The Digital Library of Balai Penelitian Kehutanan Ciamis metadata schema entities

No	Field Name	Description
1	Main Entry Author	
2	Main Entry Cooperate Bodies	
3	Main Entry Conference	
4	Title	
5	Edition	
6	Imprint	
7	Physical Description	
8	Series	

9	Note	
10	Subject	
11	Keywords	
12	Additional Main Entry Author	
13	Additional Main Entry Cooperate Bodies	
14	Additional Main Entry Conference	
15	Call Number	
16	ISBN	
17	Language	
18	Number of Stock	
19	Parent Number	
20	Shelves Code	
21	Source	

6) Metadata schema of Balai Penelitian Kehutanan Manado Digital Library

No	Field Name	Description
1	Title	
2	ISBN	
3	Copies or Last Update	
4	Classification Number	
5	Item Code	
6	Location	
7	Topic	
8	Author	
9	Supplier	

10	Publisher	
11	Publish Place	
12	Publish Year	
13	Collection Type	