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THE IMPLEMENTATION OF TECHNICAL INTEROPERABILITY MODELS IN LARAS VERSION 1.0 DIGITAL LIBRARY APPLICATIONS: A CASE STUDY IN THE CENTER FOR SCIENTIFIC DOCUMENTATION AND INFORMATION – INDONESIAN INSTITUTE OF SCIENCES

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ABSTRACT
This study aims to find out models implementation of the technical interoperability applied and developed on the Digital Library Applications of the Library and Archive Analysis System version 1.0 (LARAS v 1.0) by the Center for Scientific Documentation and Information-Indonesian Institute of Sciences (PDII-LIPI). The other goal of this study is to determine why PDII-LIPI tries to develop LARAS v 1.0 and has changed the previous application of WINISIS. This study was done by using a case study method with qualitative approach. Data was collected by documents analyses and in-depth interviews. This result of the study shows that LARAS v 1.0 was created by developers at PDII-LIPI to avoid the obsolescence of information and technology communication (ITC), in this case, is the digital library application. In fact, the conflicts between the developers and the librarians in developing LARAS v 1.0 still exist. Models implementation of technical interoperability applied to LARAS is a combination of several levels of Level of Information System Interoperability (LISI) model. Nevertheless, in practice, LARAS v 1.0 is still not perfect, especially from the point of view of system development of metadata, encoding, communication protocol, databases, and indexing.

ABSTRAK
Penelitian ini bertujuan untuk mengetahui model implementasi interoperabilitas teknis yang diterapkan dan dikembangkan pada aplikasi perpustakaan digital *Library and Archive Analysis System* versi 1.0 (LARAS v 1.0) oleh Pusat Dokumentasi dan Informasi Ilmiah - Lembaga Ilmu Pengetahuan Indonesia (PDII- LIPI). Tujuan lain dari penelitian ini adalah untuk menentukan mengapa PDII-LIPI mencoba mengembangkan LARAS v 1.0 dan telah mengubah aplikasi WINISIS sebelumnya. Penelitian ini dilakukan dengan menggunakan metode studi kasus dengan pendekatan kualitatif. Data dikumpulkan dengan analisis dokumen dan wawancara mendalam. Hasil penelitian ini menunjukkan bahwa LARAS v 1.0 dibuat oleh pengembang di PDII-LIPI untuk menghindari usangnya teknologi informasi dan komunikasi (TIK), dalam hal ini, adalah aplikasi perpustakaan digital. Bahkan, konflik antara pengembang dan pustakawan dalam mengembangkan LARAS v 1.0 masih ada. Model implementasi interoperabilitas teknis yang diterapkan pada LARAS merupakan kombinasi dari beberapa level model Level of Information System Interoperability (LISI). Namun demikian, dalam praktiknya, LARAS v 1.0 masih belum sempurna, terutama dari sudut pandang pengembangan sistem metadata, pengkodean, protokol komunikasi, database, dan pengindeksan.

Keywords: digital library applications; interoperability; technical interoperability models; special libraries.

1. INTRODUCTION

In this decade, the rapid development of digital libraries raises the issue of interoperability. Interoperability is a fundamental challenge in all aspects of digital libraries. Interoperability refers to the efforts to develop services or integrated services for digital library users such that they can take advantage of the resources provided by various systems and institutions (Arms, 2000). This interoperability issue then has led into the creation of digital library applications (software) that are sharable in their use; one of which has been built by the Scientific and Documentation Information Centre at Indonesian Institute of Sciences (PDII-LIPI), the Library and Archive Analysis System version 1.0 (LARAS v 1.0). LARAS v 1.0 is an application based on open source digital library that can be downloaded and used freely by any parties.

PDII-LIPI officially uses LARAS v 1.0 to replace Windows version of the CDS/ISIS system (WINISIS) starting from January 2011. The problem proposed in this study is related to the background of PDII-LIPI to develop LARAS v 1.0 as well as technical interoperability models applied and developed in LARAS v 1.0 in PDII-LIPI. While the purpose of this research is to know the background of the development of LARAS v 1.0 in PDII-LIPI; and to know the technical interoperability model implementation of LARAS v 1.0 applied and developed by PDII-LIPI. This study is expected to be practically and academically beneficial for two things, there are academic benefits: to provide information that a model implementation of technical interoperability is an integral aspect in digital library applications; and practical benefits: the study can be one of the basic guidelines and considerations for libraries and other information agencies in implementing and developing technical interoperability models in digital library applications in the future.

Digital Library Federation (2013) defines a digital library as an organization that provides resources—including specialized staff and selection structure, offers intellectual access to, interprets, distributes, preserves the integrity, and ensures the over time persistence of collections of digital works so that they available for use by the community. The above definition involves three key components as the theoretical framework underlying digital library existence, namely:

1. the person or people;
2. information resources; and
3. technology.

Therefore a digital library was built with the aim to create a system that expands the user's access to the information retrieval process especially for the digital world (Hendrawan, 2012). Arms (2000) provides an informal definition of a digital library: it is a collection of information that is managed by an integrated service where the information is stored in digital format and can be accessed via the network. An important part of this definition is that information is managed. With reference to the three definitions above it can be seen that even in the realm of digital libraries, computers and networks are very important and fundamental. The very real picture of a digital library is the interaction between people, organizations, and technology.

For public users, leading to interoperability should be seen as something that is very helpful. Interoperability Solutions for European Public Administration (2010) states: "*Interoperability is the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organizations via the Business processes they support, by means of the exchange of data between their respective Information and Communications Technology (ICT) systems*."

The definition brings stakeholders in a desire to share data, information, and knowledge so they build standards for interoperability systems that can be used by anyone, anywhere and anytime. Connectedness between digital library applications and services implemented by the library as an information organization reflects the interoperability model applied.

Miller (2000) states that technical interoperability refers to various similarities in the use of procedures and mechanisms of the hardware and the application or software, including communication protocols, data transfer, storage procedures, indexes, and so on. The technical interoperability will drive to services and data sharing or collective agreements in some standards that must be understood by developers and organizations using the technical interoperability.

There is a model of technical interoperability, according to Tolk (2003), which is used further as the theory in this study, namely, the Model Level of Information Systems Interoperability (LISI). LISI model provides a framework for the scope and level that is applied to the connectivity in the domain of technical interoperability. LISI model is created by the U.S. DoD C4SIR Framework Architecture. As outlined in Table 1, the LISI interoperability model identified four types of attributes, as follows:

1. Procedures and policies: this attribute discuss the implementation of the system or the overall standard

selected in addition to the instructions of the built architecture system.

2. Applications: covering the basic purpose and function of the built system. Applications that support and function achieved represent the ability of the system to the users.
3. Infrastructure: an attribute that supports the creation and use of the connection between systems or applications.
4. Data: This attribute focuses on the information processed by the system. This includes all forms of data to support operational systems.

Table 1. Technical Interoperability Model of LIS

LEVEL (Environtment)			Interoperability Attributes			
			Procedures	Applications	Infrastructures	Data
Enterprise Lavel (Universal)	**4**	**c**	Multi-National Enterprises	Interactive (Cross applications)	Multi-Dimensional Topologies	Cross Enterprise Models
		b	Federal Enterprises			
		a	DoD Enterprises	Full Object Cut and Paste		Enterprise Model
Domain Level (Integrated)	**3**	**c**	Domain Service/agency doctrine, procedures, training, etc	Shared Data (Situation displays direct DB exchanges)	WAN	DBMS
		b		Group Collaboration (White boards, VTC)		Domain Models
		a		Full Text Cut and Paste		
Functional Level (Distributed)	**2**	**c**	Common Operating Environment (DII-COE Level 5) Compliance	Web Browser	LAN	Program Models and Advanced Data Formats
		b		Basic Operations (Documents, maps, briefings, pictures, spreadsheets, data)		
		a	Program Standard Procedures, Training, etc.	Advanced Messaging (Parser, email+)	Network	
Connected Level (Peer to peer)	**1**	**d**	Standards Compliant (JTA, IEEE)	Basic Messaging (Plain text, email w/o attachments)	Two Way	Basic Data Formats
		C		Data File Transfer		
		b	Scurity Profile	Simple Interaction Text chatter, voice, fax, remote access, telemetry	One Way	
		a				
Isolated Level (Manual)	**0**	**d**	Media Exchange Procedures	N/A	Removable Media	Media Formats
		c	Manual Access Controls: NATO Level 3		Manual Re-entry	Private Data
		b	Manual Access Controls: NATO Level 2			
		a	Manual Access Controls: NATO Level 1			
		o	No Known Interoperability			

Source: Tolk (2003)

The term metadata is used differently in various communities. Some use it to refer to a machine that is able to understand the information (machines understandable information), while some use it simply for listing or record describing electronic resources (NISO, 2017). Metadata needs to be arranged in a set of standard sections and use some standards of encoding in a way that data can be processed by computer.

The protocol that is widely used in today's digital library environment is Open Archive Initiative-Protocol Metadata Harvesting (OAI-PMH). OAI-PMH is an initiative to develop and promote interoperability standards that facilitate the deployment of Web content that is accessible via the repository for content dissemination and sharing metadata efficiently (The Open Archives Initiative Organization, 2013).

Encoding is a means of manipulation of digital library applications when the listing of bibliographic or metadata of digital library applications will be placed in the online database, so they can be read, searched, and exchanged by various types of applications of digital libraries, and can be understood by human beings. Encoding uses mark-up languages to create web pages and to allow digital library applications to be modified by developers or end-users suitable with their needs and changes happen.

The database serves as a computerized system whose sole purpose is to preserve information and make that information available when needed (Banerjee and Parks, 2017). The database checks as well as verify the exact type of information, representing the values allowed in an acceptable state. According to Chowdhury (2010), databases can be classified based on the type of data record and scope of subject loaded. Its major divisions, namely:

1. Reference databases: the database is directing users to resources such as documents, people or organizations. The database is divided into three categories, namely:
   a. Bibliographic databases, which include citations or bibliographic references, and sometimes abstracts of the literature;
   b. Catalogue databases, which show the catalogue of the given library or a group of libraries in networks; and

   c. Referral databases, which offer references to information such as name, address, specialization of individuals, institutions, information systems, and so on.
2. Source databases, this database contains information in the form of readable machine and can, therefore, be considered as a kind of electronic documents. This database can be grouped according to the scope of the content, for example:
   a. Numerical databases, which contain various types of numerical data, including statistical and survey data;
   b. Full-text databases, which contain the full text of the document;
   c. Numeric text databases, which contain a combination of numerical and textual data, such as annual reports of the library or handbook; and
   d. Multimedia databases, which contain information that includes text, images, sound, and video.

Taylor and Joudrey (2008); Chan (2007) states that the indexing is able to become an access developer in analyzing the content of the document. The analysis activity and translation of documents being indexed is an intellectual activity and mechanical activity more closely related to activities which include alphabetical sorting and creation of index entries. Specifically, with computerization, Pendit (2007); Chan (2007) states that indexing applications can also be in forms of:

1. Derivative indexing, a term for the index taken directly from the text of the document, also called as a synonym for keyword indexing because the index is taken directly from keywords and there is no controlled vocabulary (vocabulary list) as a reference, as it is often known as free indexing.
2. Assignment indexing, a term for the index given from outside. In this case, the index creation is taken directly from the existing keywords and controlled vocabulary (vocabulary list) as a reference.

Once the indexing process has been completed, documents and indexing records are entered into some forms of document storage such as a database, where it is arranged so that it can easily be searched in response to various requests of subjects and others.

2. METHOD

This study used a qualitative approach with case study method. The study was conducted at the Center for Documentation and Scientific Information-Indonesian Institute of Sciences (PDII-LIPI) located at Jalan Jenderal Gatot Subroto 10, Central Jakarta. The informants in this study were eleven people, chosen through purposive sampling. In the process of collecting data, the researcher used two methods, namely:

1. Analysis of documents, documents used include sources attached (online), relevant books such as manual of LARAS v 1.0, and scientific articles as a reference in this study.
2. Interview, the type of interview method used is in-depth interviews because the interviews provide primary data on subjective and qualitative perceptions or judgments. Interview questions were raised according to the guidelines that had been developed previously.

Analysis of the data in this study was carried out by following the procedure for qualitative data analysis based on the method developed by Miles, Huberman and Saldana (2014), under three main steps, namely:

1. Data reduction;
2. Presentation of data; and
3. Conclusion drawing/verification.

The three components of the data analysis above can be done interactively i.e. interconnected during and after data collection. This data analysis process flows, so it is flexible from the initial stage to the final stage of the study.

3. RESULTS AND DISCUSSION

PDII-LIPI is one of special library type in Indonesia, it has a diverse collection of scientific papers in the form of research reports from various institutions apart from LIPI itself. The collection is certainly intended for various users—i.e. researchers, academicians, and practitioners. The process of dissemination of any scientific work has been carried out through the use of web-based digital library application namely LARAS v 1.0. Before LARAS v 1.0 started to be used in 2011, PDII-LIPI used WINISIS applications started to be adopted in 1996.

Figure 1. The Initial View And A Simple Search Of LARAS V 1.0

In the view of the developer of LARAS v 1.0, WINISIS application should be replaced, because there are many constraints on WINISIS rules and inconsistent data entry, stacked databases, difficulty in reporting, and the latter is that the content in WINISIS database cannot be found when searched using the search engine on the internet. To overcome these problems, the 2008-2012 chairperson of PDII-LIPI in the year of 2010 issued a policy to develop LARAS v 1.0.

According to the developer of LARAS v 1.0, PHP, Apache, and MySQL were chosen as the applications to build LARAS v 1.0 because these three programs are included in the open source platforms and easily understood by programmers, and they also support the ease for the next stage of development. According to the 2008-2012 chairperson of PDII-LIPI, WINISIS application has been found to be bad in terms of accessibility exacerbated by policies in the dissemination of information, especially in the dissemination of scientific works. In addition, it is also related to appreciation and freedom for scientific information content managers to create formats that suit the needs of their institution. In the end, the Developer Team of LARAS v 1.0 was formed, and this team got the instruction to learn almost any digital library application that has been and is being developed at that time such as WINISIS, SLiMS, LONTAR, and others.

When LARAS v 1.0 was at the beginning to be developed, there was a conflict between the developers and librarians, due to different thoughts and interests, in addition to the absence of intensive communication between the developers and the librarians. Over time the development of LARAS v 1.0 continued to run even though in a perfunctory manner; the developers considered what was being done as one of the forms of community service activities.

According to the chairperson of PDII-LIPI, the other reason why LARAS v 1.0 continued to be developed was that PDII-LIPI continues to follow the development of the information system without relying on outside application developers, in addition to the notion of freedom to be creative because LARAS v 1.0 was built under open source. However, currently, the chairperson of the policymakers and functional librarians actually realize that the initial application of LARAS v 1.0 in PDII-LIPI was simply too hasty because only it was built in such a short period of one year. There was a discrepancy between the process and the purpose of creation of LARAS v 1.0 prior to its launching to be widely used by the community, especially considering the number of some shortcomings in terms of PDII-LIPI needs, in addition to action underestimating elaboration of readiness of an application because it was designed unilaterally by the Developer Team LARAS v 1.0.

Currently, LARAS v 1.0 at least has been able to assist the process and the effort put in by PDII-LIPI to make information dissemination activities more broadly in terms of coverage and scope, in addition to indirect prestige increase through the increasing the webometric ranking of LIPI as the institutional parent for PDII itself. The purpose and benefits of LARAS v 1.0 built by PDII-LIPI found by the researcher are as follows:

1. Specific objectives: (a) the entire scientific papers collected by PDII-LIPI can be widely publicized primarily through the Internet, (b) PDII-LIPI can have and develop open source applications independently to avoid dependence on artificial applications from outside and (c) LARAS v 1.0 is set to be one of the PDII-LIPI icons in the community.

2. The common goal: to be able to save, manage, and sustain any scientific work submitted to PDII-LIPI, so that the work can be quickly and easily accessed by the user community.

Technical interoperability model implementation to LARAS v 1.0 is included in the combined level, which is a combination of **Level 1**, **2**, and **3** in the **LISI model**, and of course, in this study, it has been adjusted or matched by seeing the attributes that exist in LISI model.

1. Procedure and Policies

In the case of building technical interoperability of LARAS v 1.0, it was marked with procedures and internal policies from the top level of PDII-LIPI, which is the chairperson. This covered the use and conformance to standards used by the developers in the field, although there were internal conflicts because of the lack of involvement of librarians in the case. In terms of existing policies and procedures, the emphasis was one security application, it was in line with the **Level 1 point a** and **point b** of **LISI model**.

Given that the security level is absolutely necessary in the world of a global network, its existence becomes one of the first steps towards a procedural step that allows direct connectivity between systems built by PDII-LIPI. Technical interoperability system directly built to be interconnected in terms of security procedures has at least applications or tools used by PDII-LIPI, as an example is the standard encoding XML application as security engineering, although the security system used sometimes is not related to the written policy.

The combined application used implies that the choices made when applying the system followed the appropriate standards, where such standards exist and studied previously by the Developer Team of LARAS v 1.0. For example, to connect LARAS v 1.0 with other databases, the help of OAI-PMH as the data communication protocol should be used. Because all options selected complied with these standards, the system is considered to meet the requirements and procedures, and this case includes in **Level 1 point c** and **d** in **LISI model**. The application of OAI-PMH is quite a cleary in terms of the use and function on the manual of LARAS v 1.0 given by the developers.

2. Application

In terms of the application of technical interoperability, PDII-LIPI has had a portal called PDII-LIPI Central Repository since 2012. This portal is a collection of data from various kinds of metadata, owned by PDII-LIPI and other institutions that apply LARAS v 1.0 and other digital library applications. All metadata in the portal is collected by implementing Open Harvester System (OHS) application. OHS application is the creation of a world Non-Governmental Organization (NGO) which is engaged in the research called Public Knowledge Project (PKP).

OHS-PKP is an open source application that serves as a harvester and a collector or reader (aggregator) metadata; this application supports multiple metadata formats and protocols and is designed to be flexible because it is more focused on performance and simplicity of use for the public good on a global scale. This application supports the concept of open access interoperability using the standard OAI-PMH protocol and HTTP, the Dublin Core metadata standard format, XML encoding and PHP. At this time the number of databases belonging to units in LIPI and outside incorporated institutions in the portal database are as many as 14 and now PDII-LIPI Central Repository Portal has a total of **32,847 records**.

PDII-LIPI applying LARAS 1.0 V itself donates 18,519 records; in order to make communication among the data providers, data communication protocol across databases of digital library applications are equally incorporated. The available data can be accessed by both internal and external of PDII-LIPI. Each incorporated digital library application has its own metadata standard format for its collection. This metadata can be harvested by the service provider, the OHS-PKP, and then processed into information or links references through services provided. OAI-PMH is a basic support metadata harvesting process. This model allows PDII-LIPI to cooperate with other organizations to share metadata.

Table 2. Statistics Of Record Availability Of Data Providers At The PDII-LIPI Central Repository Portal

No	Data Provider	Database Contributors	Number of Records
1	Library of Research Center for Geotechnology LIPI	SENAYAN - OPAC GEOTECHNOLOGY LIPI	2,459
2	Center for Technology and Chemical Process Development LIPI Digital Library	LARAS UPT BPPTK-LIPI	79
3	Library of PDII-LIPI	LARAS-ELIB PDII-LIPI	18,519
4	Indonesian Scientific Journal Database PDII-LIPI	ISJD PDII-LIPI	614
5	Library of Biotechnology LIPI	SENAYAN-Bioteklib Library Management System	100
6	LIPI Journal of Electronic	E-journal of LIPI	19
7	Bogor Botanical Garden Library	SENAYAN - OPAC KRB	109
8	LIPI Library of Research Center of Quality System and Testing Technology	LARAS Pustaka SMTP-LIPI	24
9	PDII-LIPI Electronic Book	E-Book PDII LIPI	95
10	Library of Nuclear Energy Agency	BAPETEN Library	103
11	BACA Journal of PDII-LIPI	BACA: Journal of Documentation, Information and Library	114
12	Journal of the Faculty of Teacher Training and Education, University of Sebelas Maret Surakarta	FKIP UNS Journal Systems	270
13	Diponegoro University Institutional Repository	UNDIP-IR	3,397
14	Library of the Agency for the Assessment and Application of Technology	Local Content of BPPT	6,945
Total 32,847 Records			

Metadata from the incorporated databases in the portal periodically harvested and sustained by Sub Staff Computer at PDII-LIPI. However, in time or schedule for metadata harvesting is not specifically supported by specific policies of the leaders—meaning that what happens on the field is mostly in the form of a verbal agreement between the developers and the agencies that joined; and this also happens due to limitation in infrastructure, in terms of data storage of PDII-LIPI server. In terms of application attributes, PDII-LIPI has provided the ability to share data with other applications through a common repository intended for users with global supported network infrastructure, which is included in the **Level 3 of LISI model of Technical Interoperability point a**, **b**, and **c**.

3. Infrastructure

Infrastructure built by PDII-LIPI is associated with Wide Area Network (WAN). Therefore, it can be said that infrastructure attributes are included in **Level 3 point a**, **b**, and **c in LISI model of Technical Interoperability**. Infrastructure built PDII-LIPI has characteristics that any library database connected in a network can communicate with each other. Each library provides a service that can be given to other libraries.

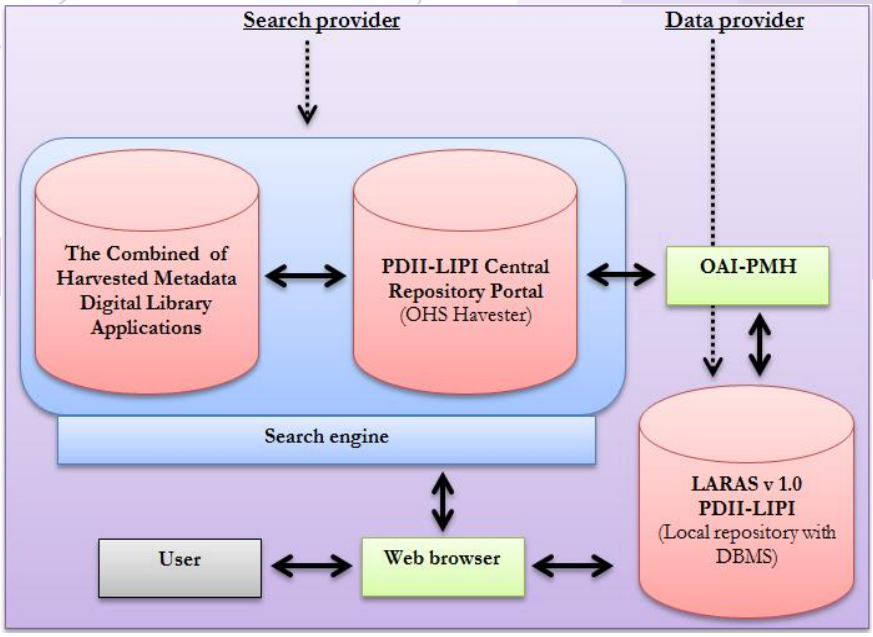

Figure 2. The Architecture Of Technical Interoperability Model Implementation Of LARAS V 1.0 PDII-LIPI

Architectural of interoperability model that is seen in the picture above shows how the interconnection between LARAS v 1.0 PDII-LIPI and other library applications which is the provider of data to the Central Repository Portal of PDII-LIPI as the service provider is run; the program can be run as it is supported by the WAN network infrastructure.

4. Data

In this data attribute, LARAS v 1.0 PDII-LIPI includes data format or structure of the file specified for use by the application. This format is often mutually exclusive, especially in terms of the use of the application. For example, a data file from a digital collection of scientific papers of PDII-LIPI in a form of Portable Document Format (PDF) actually can be downloaded, as for some of the programs covered by these data attributes such as PHP and XML both have contributed to the exchange of content or each data on LARAS v 1.0. The model of data attribute on LARAS v 1.0 is included in the type of **Level 2 point a**, **b**, and **c of LISI model of Technical Interoperability**. At this time there is a policy of the chairperson of PDII-LIPI from 2012 up to now that is to close the digital file download in PDF format, mainly for scientific works produced by authors from institutions outside LIPI; this is to respect copyright reasons the authors. We also have to consider the commitment of policy and knowledge transfer problems at PDII-LIPI, especially with regard to the rather hampered task of achieving the mission and vision of the organization, because users wanting to obtain scientific papers in a full-text digital format must come directly to PDII-LIPI. To find the technical interoperability model implementation of LARAS v 1.0 developed by PDII-LIPI, the researcher looked at the aspect of the technology foundation and technical interoperability standards.

1. Metadata

By looking at every part of metadata (metadata fields) in LARAS v 1.0, the researcher found that LARAS v 1.0 metadata itself is a result of adjustments (customization) and the adoption of some of the fields contained in the metadata used by the previous application of PDII-LIPI, WINISIS. WINISIS used Common Communications Format (CCF) metadata standards developed by UNESCO and the format of the structure is in accordance with ISO 2709 (Chowdhury and Chowdhury, 2007), which means that in this case LARAS v 1.0 does not use any new standard. The developer of LARAS v 1.0 has made its own metadata elements according to the interpretation of PDII-LIPI needs to be made earlier. This has made LARAS v 1.0 metadata does not use any new scheme and standards, but it can only be referred to as an adjustment or modification of the existing metadata elements. Since the metadata schema itself is a concept used to build metadata, the scheme can be said to be a standard if it is a result of a convention which is adhered to and implemented (Pendit, 2008).

LARAS v 1.0 uses Indonesian as the interface to facilitate its users. Librarians in PDII-LIPI are reluctant in using Machine Readable Cataloging (MARC) as the standard metadata for LARAS v 1.0, although MARC has been long known as an internationally acknowledged metadata standard among librarians. Library metadata standards such as MARC are considered too complex and detailed, while the Dublin Core is still not sufficient because it has limitations in terms of the segment and is designed more specifically for the web.

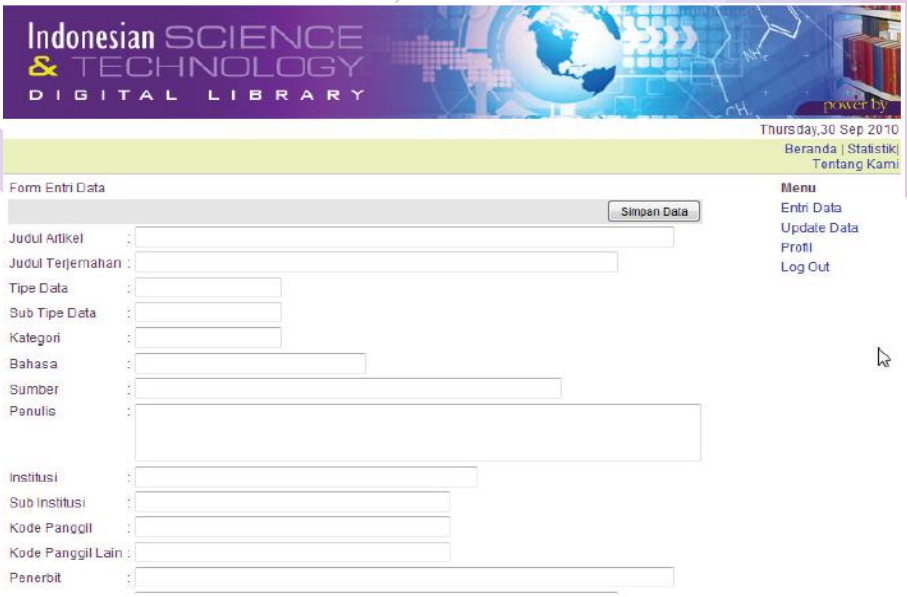

Figure 3. Metadata Elements Of LARAS V 1.0

LARAS v 1.0 is still experiencing problems on metadata. Input from librarians as the end-users is very relevant. Because they have long worked using WINISIS, the librarians expect that LARAS v 1.0 metadata will continue to be adjusted as it was for WINISIS, with some customization in some fields and some fields that must exist. The developer has to connect LARAS v 1.0 to Central Repository Portal of PDII-LIPI by taking only a few customized fields to the Dublin Core format. The information content filling each metadata field seems to be seen as not so important.

It seems that the developer did not carefully consider the impact of this; users accessing the information either from Central Repository Portal of PDII-LIPI or directly from OPAC LARAS v 1.0 will have confusion in acquiring information on the records, and searching time will be too long as it requires an analysis of the information obtained. Efforts are currently being made to fix LARAS v 1.0, which is having one of the technicians to fix the LARAS v 1.0 system. In this case, the main task of the technician is to fix the database content, including the accessibility and content of information on each metadata field results of the previous database migration, which is WINISIS.

2. Communication Protocol

OAI-PMH is a vital supporter of PDII-LIPI LARAS v 1.0 in running technical interoperability developed. At the beginning of creating a combined content from multiple databases, OAI-PMH was studied step by step, coupled with the effort to make advance modifications by LARAS v 1.0 Developer Team. Technical problems and the solutions were found in the field according to the developer after applying OAI-PMH in LARAS v 1.0. Because the protocol is an open source, it allows for independent development based on the intended use and objectives; method of managing digital resources that already exist at OAI-PMH makes it easier for the developer to adjust the specification of metadata between the Dublin Core and the metadata of LARAS v 1.0 connected to the network.

3. Encoding

PHP is an encoding implemented by LARAS version 1.0 and OHS-PKP on Central Repository Portal of PDII-LIPI as the manipulation of the display on the web, while XML encoding plays a role in terms of representation. XML is combined with the performance of PHP language. In this case, the OHS-PKP communicates directly with LARAS v 1.0 through OAI-PMH containing the XML encoding. XML unites the data received while still using each native interface with the help of PHP. When viewed in terms of language and structure of the data, XML encoding provides easy, neutral, and self-contained description of the associated syntax for data structures such as the heterogeneous nature of LARAS v 1.0 which uses PHP. As stated by Chowdhury and Chowdhury (2007), XML uses tags only to restrict parts of the data and leave the interpretation of the data completely to the application reading it.

XML provides easy listing and reference of metadata as a representation of the descriptions of the data and semantics, for example on LARAS v 1.0 which mentions the title and OHS-PKP with the Dublin Core standard mentions "*title*". It can be modified and adapted to suit the future and advanced needs. Heterogeneous metadata elements between LARAS v 1.0 and the Dublin Core on OHS-PKP are easy to map because there is a mechanism for expressing mappings between elements with the help of OAI-PMH.

4. Database

Database for LARAS v 1.0 belongs to the reference database and source database. In the classification of referral database, the database of LARAS v 1.0 belongs to the category of the bibliographic database. The bibliographic database becomes the representative of the original documents that show the kind of information included in the original documents, as well as how to incorporate the rules of the bibliographic information from the original documents to create structured information in the form of records. In the classification of the source database, the database of LARAS v 1.0 can be classified as a numerical database seen from the scope of the content published. LARAS v 1.0 database provides information in the form of statistics and graphs to represent access to documents by users.

5. Indexing

Indexing on LARAS v 1.0 is derivative indexing since the process is done by taking index directly from text documents such as the title of the document, not using keywords feature or special vocabulary list as a reference; in other words, this activity can be referred to as the free indexing. On LARAS v 1.0 there is a problem in terms of differences in the total number of records, in which the number of records based on category or field of study is 256,507 and the number of records based on total collections is 266,732. In

addition, there are records whose categories have not been defined or verified (unknown category), as many as 10,383 records. It thus becomes a serious concern for the developer and librarians that it needs more validation efforts. In its application of indexing derivative in LARAS v 1.0 the category of scientific fields is used. The total number of existing disciplines in LARAS v 1.0 now is 59, dominated by the natural sciences and social sciences.

In determining the category of the scientific fields, PDII-LIPI uses classes of Dewey Decimal Classification (DDC) as the reference. In this case, not all the classes of DDC are used but is based more on the number of collections of scientific works owned or kept by PDII-LIPI. When determining classes of DDC used, the Department of Literature Processing holds an internal meeting at the beginning and end of the month with the involvement of senior librarians, heads of the department, and the heads of internal department in PDII-LIPI. It is thus considered as an effective measure to explain the working procedures and results to be achieved.

The language used for the output category and type of collection is Indonesian; this was chosen because librarians and users search a document or collection mostly by using Indonesian terms. To optimize the process of indexing and retrieval of information based on the category of scientific fields, PDII-LIPI should use certain programs to determine the subject code such as the Library of Congress Subject Headings (LCSH) and implement keywords searching features by employing the rules of the thesaurus and DDC is enough only for numbering classification. LCSH incorporates control over synonyms and is able to demonstrate broader or narrower terms inter-related to the subject (Chan, 2007).

4. CONCLUSION

The human aspect in the case of technical interoperability model implementation in the Digital Library Application of LARAS v 1.0 in PDII-LIPI is a fairly complex problem. This is due to the cooperation undertaken by various institutions in developing, implementing, and developing a system of documentation and information which will always lead to conflicts of interests. Each party has an interest as well as the different approaches in solving all the problems and misunderstandings that arise. Therefore, the development of LARAS v 1.0 is very dependent on the readiness of human resources and other resources available.

Based on the results of the analysis of this study, it can be concluded that LARAS v 1.0 is built because of the condition of PDII-LIPI wanting to catch technology advancement in digital library applications—even though the effort created a conflict in the organization of PDII-LIPI. Such conflict is in line with what was said by Stoner (2012), that organizational conflict is a disagreement between two or more of the members of an organization or group, which is caused of different statuses, objectives, assessments or views. LARAS v 1.0 seems to be developed and launched hastily and some parties or groups took over the economic advantages of the project. This causes the Digital Library Application of LARAS v 1.0 does not run perfectly.

The technical interoperability model implementation to LARAS v 1.0 in PDII-LIPI includes the combined level of LISI model level 1, 2, and 3. The problem of the technical interoperability model implementation to LARAS v 1.0 in PDII-LIPI is actually related to its development and application, which is not maximum, especially in terms of metadata, encoding, communication protocols, databases, and indexing.

PDII-LIPI is still very likely to develop better technical interoperability models in the future. Such efforts can run smoothly when there is synergy between policy makers, librarians, and Developer Team of LARAS v 1.0. The parties shall all comprehensively understand the technical aspects of interoperability models and work cooperatively in developing the best model possible. The chairperson of PDII-LIPI must activate the role of the Planning Monitoring Evaluation Team, which is specifically designed to monitor the activities of PDII-LIPI in conducting any programs, especially those related to the development and interoperability of LARAS v 1.0, both for short term and long term. In building and determining the technical interoperability models, it should be based on the needs of users, librarians, and institutional policies.

The academic world also promises the potential for cooperation, both with higher education institutions and individuals to perform interoperability studies. The assessment is not only limited to the field of the library alone, but other institutions related to the development and user needs should also be assessed. The academic world, as the centre of scientific research, the pillar for the development of library and for the dissemination of information and science in particular, needs to do more research on interoperability issues in particular and digital library environment in general. A number of studies on interoperability are expected to bring out the good impact on the implementation of a number of standard practices, collaboration, and strategic planning policies related to the growth and development of technology and human beings to changes in information technology itself.

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