A Semantic Ontology-Based Records Management Approach for Academic Users' Decision Support

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Abstract

Context and purpose of the research project

Within the field of information systems development, enterprise records management (ERM) technologies have largely failed to meet industry's demands, especially for context-sensitive records management and document preservation. Electronic document and record management systems (EDRMS), as an enterprise records management tool, have become well-recognised applications for academic users in higher education institutes. The systems often show limited decision support options for academic users such as educators and students, resulting in a lack of coordination and duplication of academic efforts. For sustainable records management, it is beneficial to have a more context-specific and systematic EDRMS for an individual's effective decision-making. This study intends to make two distinct contributions in the following ways: Firstly, the study outlines a four-phased approach adapting the step-by-step process to conduct the empirical investigation through case study data collection and analysis in order to create a new ontology-based records management approach. Secondly, the study proposes a new architecture of the domain ontology-based ERM approach that satisfies user requirements and promotes the value of using it to meet organisational standards.

Method of analysis used

A single case study approach was used and the main data collection method adopted is based on a number of semi-structured interviews. The study was conducted using a four-phase procedure: 1) problem identification 2) framework development 3) research outcomes and 4) solution development.

Major conclusion reached

Through the semantic technologies, the study found that ontology development is useful as a context-specific approach to enhance vocabulary and meaning that enable decision-makers to find the relevant information quickly about their targeted record items. In addition, the study shows the relevant ontology features have promise to enhance searching and navigating abilities for quick decision-making.

Student Declaration

"I, Ahmad Zam Hariro Samsudin, declare that the PhD thesis entitled *A Semantic Ontology-Based Records Management Approach for Academic Users' Decision Support* is no more than 100,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work".

Signature :  Date: 29 August 2014

Publications

- Samsudin, A.Z.H., Miah, S.J. and McGrath, M. (2014). *An Ontology Development Approach for Enhancing Search-ability of Records Management Systems* - Asia-Pacific World Congress on Computer Science and Engineering 2014, 4-5 November 2014, Plantation Island, Fiji.
- Samsudin, A.Z.H., Miah, S.J. and McGrath, M. (2014). Issues of enterprise records management applications: a semantic ontology-based solution perspective. *Journal of Information and Knowledge Management*, 4(1), 1-8.
- Samsudin, A.Z.H., Miah, S.J. and McGrath, M. (2014). An ontology-based record management systems approach for enhancing decision support. *In the Proceedings of the 20th Americas Conference on Information Systems (AMCIS 2014),* August 7 - 10, Savannah, Georgia, 1-11.
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Glossary of Terms

ECM – Enterprise content management can be defined as 'the strategies, tools, processes and skills an organization needs to manage all its information assets regardless of type over their lifecycle' (Smith and McKeen, 2003).

EDRMS - Electronic document and records management systems is 'a software application that manages a range of digital information, including word-processed documents, spreadsheets, emails, images and scanned documents. An EDRMS can combine both document management and records management functionality' (National Archives of Australia [NAA] , 2011).

ERM – Enterprise records management consists of physical records management plus electronic records management, the two encompassing records in all formats (Sprehe, 2005).

ICT –Information and communication technologies as a term that expresses the use of computer-based information and communications systems to process transmit and store data and information.

KMS - Knowledge management systems can refer to any of the tools and techniques that support knowledge management practices in organisations.

OWL – Web Ontology Language Markup language used to specify ontologies for the Internet.

RDF - A framework for constructing logical languages that can work together in the Semantic Web. A way of using XML for data rather than just documents.

Rule - A loose term for a statement that an engine has been programmed to process. Different engines have different sets of rules.

SDO – Domain Ontology for Web Services

Semantic Web - The Semantic Web means an extension of the current web system, in which information is delivered through their meaning that enable computers and people to work in cooperation. The development will guide significant new functionality as machines become much better able to process and 'understand' the data that they merely display at present (Berners-Lee et al. 2001).

SQL - An ISO and ANSI standard language for database access. SQL is sometimes implemented as an interactive, command line application and is sometimes used within database applications. Typical commands include select, insert, and update.

W3C - A neutral meeting of those to whom the Web is important, with the mission of leading the Web to its full potential.

List of Abbreviations

AIIM	Association for Information and Image Management
AMC	Archives and Manuscripts Control
BI	Business Intelligence
CMS	Content Management Systems
CPMS	Corporate Performance Management Systems
DB	Database
DSS	Decision Support Systems
DW	Data Warehousing
ECM	Enterprise Content Management
EDRMS	Electronic document and record management systems
EIS	Executive Information Systems
ERM	Enterprise Records Management
ERAS	Enterprise Reporting and Analysis System
GSS	Group Support System
ICT	Information and Communication Technology
IDSS	Intelligent Decision Support Systems
IP	Interaction Propensity
IRMT	International Records Management Trust
IS	Information Systems
IT	Information Technology
ITS	Intelligent Tutoring Systems
KM	Knowledge Management
KMDSS	Knowledge Management-Based DSS
KMS	Knowledge Management Systems
MARC	Machine-Readable Catalogue
MIS	Management Information Systems
NAA	National Archives of Australia
NASA	National Aeronautics and Space Administration
NSS	Negotiation Support Systems
OHMS	Oral History Management Systems
OWL	Web Ontology Language

PDSS	Personal Decision Support Systems
PHP	PHP Hypertext Preprocessor
RCM	Records Continuum Model
RDF	Resource Description Framework
RDQL	RDF Data Query Language
S-CMS	Semantic Course Management Systems
SPARQL	SPARQL Protocol and RDF Query Language
SQL	Structured Query Language
STCC	Semantic Tag Clustering Search
SVM	Support Vector Machine
SW	Semantic Web
SWRL	Semantic Web Rule Language Combining OWL and RuleML
UI	User interface
W3C	World Wide Web Consortium
XML	Extensible Markup Language

Chapter 1

Introduction

1.1 Chapter introduction

Organisations have a long history in dealing with various contents and records for their storage and further use. In the current digital era, the requirements of managing records and contents in digital form have been rapidly evolving both for individuals and organisations. Studies on how to manage enterprise records such as Enterprise Records Management (ERM), therefore, became a popular area of research that involves various emerging development of information system (IS) applications. People are now relying more on the availability and accessibility of digital records or content for their effective decision-making through the use of various software applications. While the sheer mass of records available and decision-making requirements are evolving, relevant existing software applications are still too incapable, inflexible and static to provide sophisticated support for organisational users in a context-specific manner.

Many previous studies have identified positive benefits of ERM applications for content or records management. For instance, Katuu (2012) evaluated the implementation of enterprise content management (ECM) in South Africa through a literature survey and revealed that a limited number of studies examined institutional experiences related to implementing electronic document and records management. Katuu (2012) called for further research to develop more practical applications that

may have substantial impact on provisions for end users. Further studies on ERM have supported this growing call (Alalwan and Weistroffer, 2012; Sprehe, 2005).

The objective of this PhD dissertation is to conduct a case investigation in order to identify current issues in an existing ERM application for users such as educators and students in a case organisation. The specific aim of the research is to improve the current capability of the ERM application by enhancing the system's search ability and navigability in order to offer more effective decision support features. This chapter describes the study's motivation, objectives, background, brief research method and its relevance to the target practical case and theoretical issues surrounding the subject area are introduced. After defining the research question and how the question is addressed in order to develop the improved process, the structure of the entire thesis is presented at the end of this chapter.

1.2 Motivation of study

While today's users, in the digital era, rely on more and more smart functionalities for record handling activities such as for maintaining records, retrieving records, and admin activities, the expansion of latest provisions and capacities, through the growth of Internet technologies, offer a more pervasive environment so that users are more motivated to do their tasks using digital media. This leads to increased requirements for better ERM functionalities for their everyday practices. The research identifies problems of ERM applications in order to provide effective decision support features to target users. Sprehe (2005) highlighted three case studies that demonstrate the benefits of ERM applications to non-records management business functions within the context of ECM. According to Sprehe (2005), to bring records management to the optimum position in serving enterprise goals and mission, an ERM application needs

to be fully integrated within ECM. Katuu (2012) revealed that there have been few published sources on institutional experiences related to implementing electronic document and records management. Based on the result of the survey, Katuu's study outlined a clear need to improve the functionalities of ECM, especially for providing features for end users.

On the other hand, Alalwan and Weistroffer (2012) classified the published literature of ECM and identified gaps in improving effective records management approaches for end users. In addition, Svärd (2013) conducted a study to find out whether ECM and Records Continuum Model (RCM) frameworks could be used to lessen long-term preservation challenges. All the above studies reinforce the need to develop an effective enterprise records or contents management application for better management of organisational digital and non-digital records.

In practice within the case organisation, higher education institutes suffer from a range of issues in managing their academic records and relevant digital contents. Most education institutes nowadays use a specific software application in order to enable an effective mechanism for their records management. The effective provision of ERM software applications for managing records of research activities requires decision support features that may be related to choosing the appropriate field of interests, relevant study areas, and determining whether the interviewee (assuming interviews are the part of the selected study agenda) fulfils the complex criteria outlined by universities. Through the use of effective provisions of records management, decision-makers, such as students need to ensure that the selected interviewees perform in accordance with the university mandated criteria. For example, the selected interviewee must be somebody who has made a substantial contribution to

the nation and who has never been interviewed by other students on the same topic area.

However, educators such as lecturers or supervisors need to validate the proposed interviewees within the targeted area of studies to determine their suitability. For this type of decision support, the use of existing approaches of ERM such as EDRMS (Electronic document and records management system[1]) does not provide the required provisions for end users. It is beneficial to have a more context-specific and systematic records management approach for users' effective decision making.

1.3 Aims, objectives and key contribution of the study

The case organisation currently has an EDRMS solution approach in place for storing records and providing user-relevant support. However, the existing EDRMS solution has potential issues within the case organisation. The issues have been experienced mainly in relation to the system's searchability and navigability. These issues for the target end users are considered as a major practical motivation for this research project. Current theories in relation to EDRMS application development are still too general and emergent for addressing these issues, which have been evident in the past (Sprehe, 2005; Katuu , 2012; Alalwan and Weistroffer, 2012). As such, the central research question is: *How can a more context-specific and systematic records management approach be developed for meeting end users decision support? This is followed by two sub-questions: a) what are the key issues affecting effective ERM*

[1] The EDRMS is defined as "an automated system which supports the creation, use and maintenance of paper or electronic documents and records for the purposes of an organization's workflow and processes. An EDRMS includes record keeping functionality and also manages documents of informational rather than evidential value. The EDRMS includes, the whole of documents, records, methods, procedures, tools, [meta] data, (index terms), knowledge, means and persons with which an organization operates and fulfils its requirements to preserve evidence of its activities, maintain its memory, and preserve its knowledge" (Johnston and Bowen (2005, p.133)

system development for education end users? b) what technologies may offer context-sensitive improved records management provisions for end users?

In order to find the answers to question (a) the study conducts a single case study through structured interviewing within the case organisation. To investigate the answer to question (b) the study conducts an extensive literature review on semantic web (SW) technologies as these technologies have been promising to develop user-context sensitive applications. Both findings provide support to the aim of addressing the requirements of developing a more context-specific records management approach.

To address the issues, the ultimate aim is to develop and evaluate a new SW-based (e.g. an ontology[2]-based approach) solution approach as part of the enhancement of records searching-ability supportability. The ontology-based improvement is related to the context sensitivity of records and their appropriate interpretation. The main objective is to conduct development activities in four phases:

- Firstly, the study investigates the issues of current EDRMS through a case study analysis to acquire an in-depth understanding of the problem domain in order to achieve elements of ontology construction;
- Secondly, the study conducts an extensive literature survey on the SW provisions (e.g. ontology techniques) to outline a benefit-issues framework;
- Thirdly, using the framework, the study develops an integrated semantic ontology as the core component of the EDRMS;
- Next, the study evaluates a new semantic domain ontology-based ERM approach according to the context of the target problem; and

[2] Ontologies are defined and used for semantic web applications. The term "ontology" is reffered to as an explicit specification of conceptualization that is aimed to capture the structure of the problem or solution domain. This includes the model of the domain with possible restrictions or provisions for IS solution design (Wand and Weber, 1990)

- Finally, development and evaluation of a proof-of-concept prototype is completed within a real-world environment

The proposed solution demonstrates the potential of using semantic ontology for enhancing the context sensitivity of records especially for appropriate interpretation. As such, this PhD thesis intends to make two distinct contributions as follows:

- First, the study outlines a four-phased approach adapting a step-by-step process to conduct the empirical investigation through case study data collection and analysis in order to create a new ontology-based records management approach.

- Second, the study proposes a solution underpinned by the domain ontology-based ERM approach that satisfies user requirements and promotes the value of using this to meet organisational standards.

1.4 Theoretical position of this study

Records management is relatively new both as a profession and study topic in the IS discipline. Many definitions of ERM have been introduced over time. According to Sprehe (2005), ERM consists of physical RM (pRM) plus electronic RM (eRM), the two encompassing records in all formats. Records can be physical records, or electronic or digital records, both of which can be seen in all formats such as paper, microform, electronic, and optical (Sprehe, 2005). While nowadays enterprises carry on their activities almost universally with the use of information technology (IT), they continue to store older forms as well as the new forms of digital records in electronic repositories for their better management. For instance, some educational organisations such as universities use EDRMS to manage their academic records effectively. However, current EDRMS-based approaches are limited to keyword-based searching

that frequently relies on a different terminology to represent related concepts (Bates, 1977; Rabiyathul Basariya and Jannath Nisha, 2012). This process is often static and does not meet many of the demands of context sensitivity for records searching and enquiry resolution.

Previous studies describe the use of ontologies for the demands of context sensitivity, especially for content management (Euzenat, 2002; Uren et al. 2006). Euzenat (2002) discussed the advantages of the semantic ontology extending capabilities of the web with formalised knowledge and data processing for computer applications. Uren et al. (2006) investigated semantic annotation and how it may recognise the requirements of businesses to show the value of semantic annotation tools to fully address the knowledge management (KM)[3] needs in organisations.

Several recent studies propose approaches of domain ontology for user benefits of decision support. Some examples are:

- Chen, Chu, Chen and Chao (2013) for personalised knowledge searching;
- Liu, He and Lim (2012) for Chinese text classifications; and
- Velardi, Faralli and Navigli (2013) for taxonomy induction.

These imply that the aim of the study can be achieved if a semantic ontology is developed by identifying a set of relevant concepts with a common vocabulary and its definitions for a common and shared understanding of the domain of interest (Uschold and Gruninger, 1996). Moreover, the use of a common and unified domain ontology can improve the decision-making process whereby most of the user's decisions are dependent on the output of the system as a source of reference. As such, organising the domain knowledge in the system is the vital task within the problem domain.

[3] KM is an area of study related to the efforts of exploiting and developing the organisational knowledge asset (explicit and tacit) to achieve organisation objectives (Davenport and Prusak, 2000).

In Decision Support Systems (DSS) literature, Arnott and Pervan (2008) classified major DSS subclasses such as Personal Decision Support Systems (PDSS); Group Support Systems (GSS); Negotiation Support Systems (NSS); Intelligent Decision Support Systems (IDSS); Knowledge Management-Based DSS (KMDSS); Data Warehousing (DW); and Enterprise Reporting and Analysis Systems (ERAS). The EDRMS can be classified as KM based DSS, as according to Arnott and Pervan's (2008) classification, the knowledge management-based DSS *'support(s) decision making by aiding knowledge storage, retrieval, transfer and application by supporting individual and organizational memory and inter-group knowledge access'* (Arnott and Pervan, 2008, p. 658). This definition captures some of the aspects and nature of EDRMS defined by National Archives of Australia (NAA) and International Records Management Trust (IRMT), which highlights the role of EDRMS in managing knowledge storage in an organisation. According to the National Archives of Australia (NAA, 2011), an EDRMS is '*a software application that manages a range of digital information, including word-processed documents, spreadsheets, emails, images and scanned documents. An EDRMS can combine both document management and records management functionality*'.

According to International Records Management Trust (IRMT, 2009) an EDRMS is *'...an electronic system or process – managed with the aid of computers and software – implemented in order to manage both electronic documents and electronic records within an organisation. Electronic document and records management systems combine the functions of document and records management'.*

As a supportive tool of decision support systems for academic users (Aroyo, Dicheva and Cristea, 2002; Sampson, Lytras, Wagner and Diaz 2004), an EDRMS employs various technologies for the effective retrieval, storage, processing and preservation of

documents and other records. The process is often static and does not meet any of the demands of context sensitivity of records. This limitation results from vocabulary inconsistencies in a domain that may lead to mismatches between search desires and content of a system's knowledge repository.

1.5 Research design

An interpretative single case study approach was used in the study. Figure 1.1 demonstrates the four-phase procedures used to conduct the study. This study attempts to find answers to two research questions: 1) what are the key issues affecting effective ERM systems development for education end users, and 2) what technologies may offer context-sensitive improved records management provisions for end users. For the first question, a semi-structured approach (Gorman and Clayton, 1997) is adopted for the data collection. To identify and analyse the current issues of usage, the study interviewed developers, educators and students using guidelines for a case study research approach by Yin and Davis (2007). The interviews were transcribed into MS Word documents and analysed using the Strauss and Corbin's (1998) coding paradigm to develop a framework of current EDRMS issues in the existing system. For the second question, this study conducted a theoretical analysis of SW-related documents to find the potential benefits of using SW technologies to enhance a system's features by adopting the content analysis method to develop a framework of SW-based features. The initial frameworks of existing approaches and SW-based approaches were compared as a guide to achieving the betterment of EDRMS usages. This study looked at how to address the identified issues of the existing systems (such as searchability, navigability, KM and database (DB) management issues) through the use of SW for better decision supportability.

Feng, Jeusfeld and Hoppenbrouwers (2005) identified the importance of searching and browsing features for human decision making and how they can facilitate knowledge components of digital libraries. Bolloju, Khalifa and Turban (2002) analysed the impacts of KM for developing decision support and argued that knowledge should be obtained through various conversions which involve: socialization, externalization, combination and internalization. Socialization and combination both sound promising within the context of this research as the expected benefits of the study include improving supportability of a records management system. Similarly, H. Kim, Zhu, W. Kim and Sun (2014) more recently found the issues of navigation are of paramount importance for decision support development. In addition, the issues of information searching must be at the core of any discussion concerning benefits to decision makers (Aminilari and Pakath, 2005). Hirouchi and Kosaka (1984) discussed the management and planning of DBs from the viewpoint of decision support. Based on this literature, four issues (searching, navigating, KM and DB management) have been defined as heavily related to decision making and the empirical findings of the PhD also support this. Therefore, this study has a focus on these four issues for target users.

The SW framework is based on taxonomy descriptions to show categories and sub-categories of the expected benefits and issues. Taxonomy descriptions as a part of an ontology are useful for easily comparing options in classifications in relation to decision making features. At the end of the phase one, findings are reported and compared with existing findings to identify how a SW development (using ontology) can be used to improve the outcomes of the EDRMS application. Figure 1.1 demonstrates the research procedure, that consists of four phases. In the first phase, qualitative investigation was conducted to identify practical problems within existing

system approaches. The second phase consists of framework development activity where data collection and analysis were conducted to obtain a clear understanding of the issues of existing approaches and benefits of the SW functionalities. The third phase involves justification of the concept development for the prototype. The fourth phase combines the activities of the ontology-based prototype development and its evaluation within a practical environment.

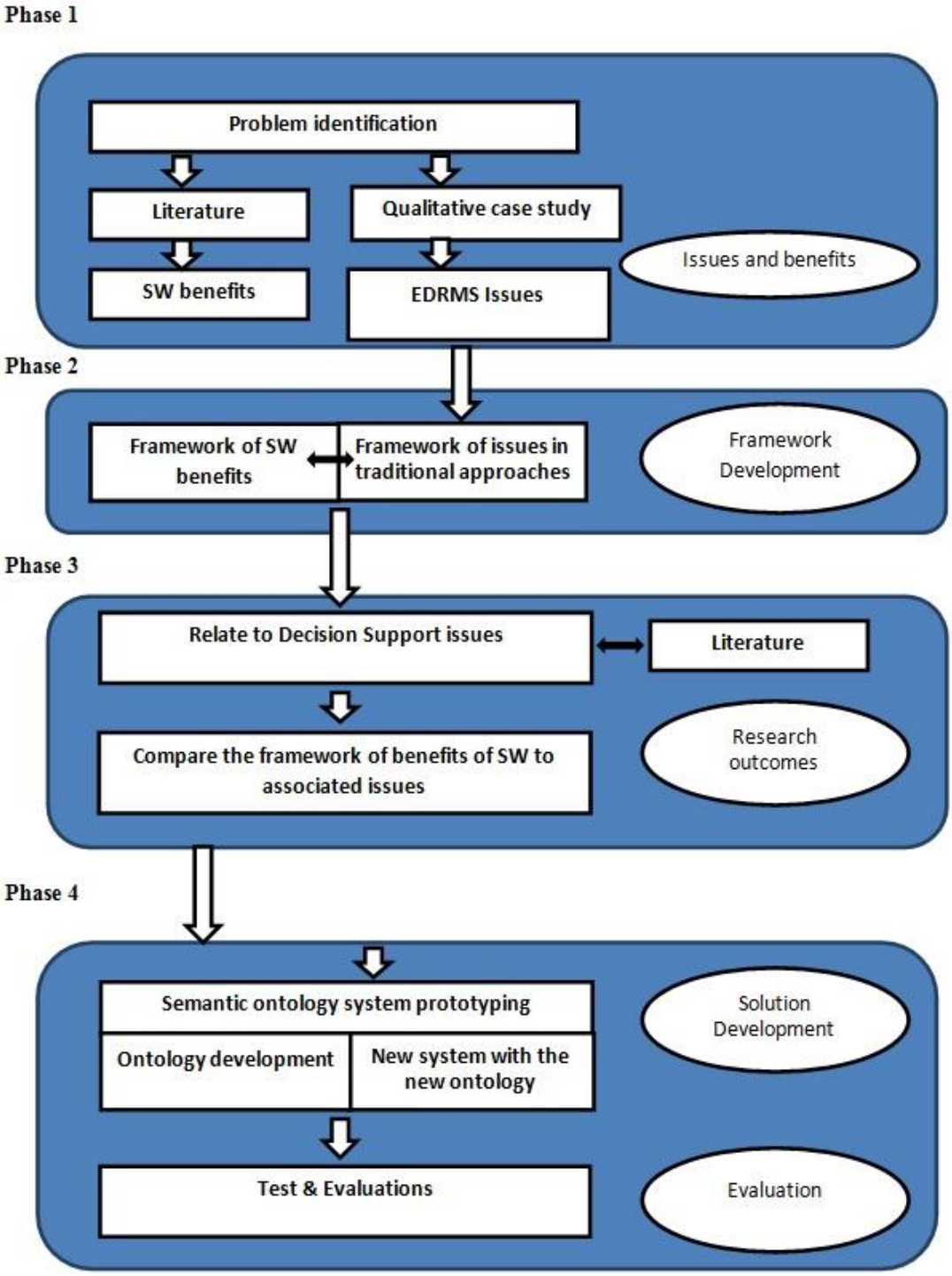

Figure 1.1: Research procedure of the four-phase approach

Through the SW-based approach, the study found that ontology development is useful to enhance vocabulary and meaning, and enables decision-makers to find the relevant information quickly about their targeted interviewees within the records

system. In addition, the study shows the relevant ontology features that promise to enhance searching and navigating abilities for quick decision-making, compared to the current features of the EDRMS application. An approach provided by Haghighi, Burstein, Zaslavsky, and Arbon (2013) is adapted to develop the solution prototype and evaluate it with the target users.

The prototype system is developed on open source web-based applications – i.e. PHP and MySQL – which allow access to and the sharing of oral history materials through the Internet. It facilitates the storage, organisation, retrieval and dissemination of oral history documents to ensure their availability, accessibility and usability. An initial ontology has also been developed to enhance retrieval precision and relevance. To improve the ontology, the test and evaluation have been conducted through focus group meetings. The outcomes of the meetings can be used to improve the ontology of the prototype systems.

1.6 Proposed high-level architecture

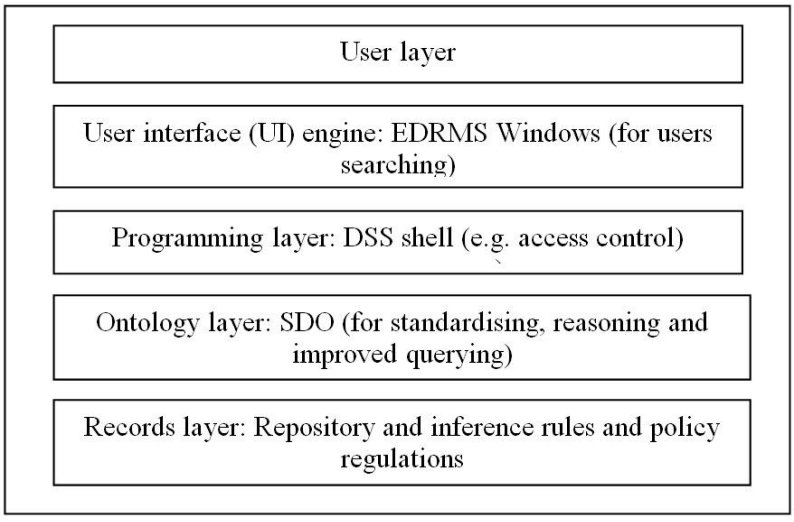

Figure 1.2: Proposed high-level architecture of the ontology-based EDRMS

Figure 1.2 illustrates the proposed solution architecture that is the final outcome of the project. User interface is the layer that enables humans to use the applications.

Next, the programming layer is a method for solving a variety of problems encountered by people involved in software development. It adds useful information to source code in such a way that it does not interfere with either the code or other layers.

The ontology layer enables the core functionalities of information retrieval by adding useful information to the source code of the programming layer, and display this to the user interface engine of the EDRMS. The integration/translation of the new ontology to the DB schema is supported by the programming interface (Perl and MySQL). The EDRMS is re-developed based on the features of the Koha platform (Breeding, 2007), which is an open-source library system that provides tools to manage data. Oral history documents were classified according to their subject matter, such as defence, security, education and so on. The programming interface has been designed to query all the data related to the specific subject and link the data to the ontology browser interface. When the user clicks on the ontology browser (for example, Defence, one of the concepts under the Project field) on the system interface, the programming application links to the subject access field and displays results related to Defence. The architecture is described in detail in chapter five.

1.7 Structure of the thesis

The PhD thesis consists of seven chapters, namely, chapter 1: introduction; chapter two: theoretical background; chapter three: research methodology; chapter four: data collection and analysis; chapter five: technical specifications; chapter six: system evaluation and recommendations and chapter seven: discussion and conclusion. The following contains brief details of the content of each chapter.

Chapter Two: Theoretical background

The chapter presents a theoretical position of the study in the targeted literature area. It describes the state-of-the-art of the ERM literature in information systems. The chapter also presents the research area and relevant sub-areas in the targeted literature by explaining key topic areas such as ERM, records or content management issues, the SW and issues related to the SW and EDRMS.

Chapter Three: Research methodology

The chapter presents the philosophical assumptions underpinning this research, as well as introducing the research strategy and the empirical techniques applied. It examines the interpretive stance in the field of information systems and then describes the research approach followed in case study research.

Chapter Four: Data collection and analysis

The chapter focuses mainly on the aspects of data collection and data analysis. It presents the rationale, process and key findings from field interviews. These semi-structured interviews are undertaken with users and IS practitioners with a view to understanding the benefits and issues of current solutions (e.g. EDRMS).

Chapter Five: Systems specifications

The chapter details the system specifications of the proposed approach. After an introductory discussion, the chapter gives an explanation of the current state of the system, discusses the ontology development procedure, describes the proposed ontology-based system and explains the ontology integration within the application.

Chapter Six: System evaluation and recommendations

The chapter focuses on system evaluation and recommendations. It discusses the SW and ontology, data collection for ontology evaluation and recommendations.

Chapter Seven: Discussion and conclusion

The chapter consists of a discussion of the study and conclusion. It discusses the theoretical contribution, describes the practical contribution of the study and proposes further research as well as outlining limitations of the study.

1.8 Chapter summary

This chapter has provided an overview of the entire research study including a detailed account of the problem statement and research gap which justified the need to embark on the research effort. The motivation for the study was outlined, the research gap identified and the aims, objectives and major contributions specified. The research design was then summarised, the architecture of the proposed ontology-based EDRMS was briefly overviewed and the chapter concluded with an outline of the thesis structure.

Chapter 2

Theoretical background

2.1 Chapter introduction

The aim of the study is to present background literature that may contribute to new knowledge creation within the ERM systems area of the field of the IS development research. The target area of the study will be associated with KM, DSS, and record and CMS fields. The chapter combines these areas to develop relevant discussion in order to outline a theoretical position of the study in the targeted literature area. This will landscape the target research to fit with the development of relatively new technological provisions for record management.

The chapter consists of five sections. The first describes the state-of-the-art of the literature in IS development to clarify the position of the proposed study. The second section highlights main aspects of the study which underlies the area of ERM. In this section, the chapter describes relevant sub-areas such as content and records management, oral history management and their associated user issues. The third section highlights the SW technologies aspect in improving the user-orientated features in records management approaches. The section includes literature on various semantic technologies such as ontologies and potential benefits of such technologies within the target scope of the study. The following Figure 2.1 represents a flow map of the chapter.

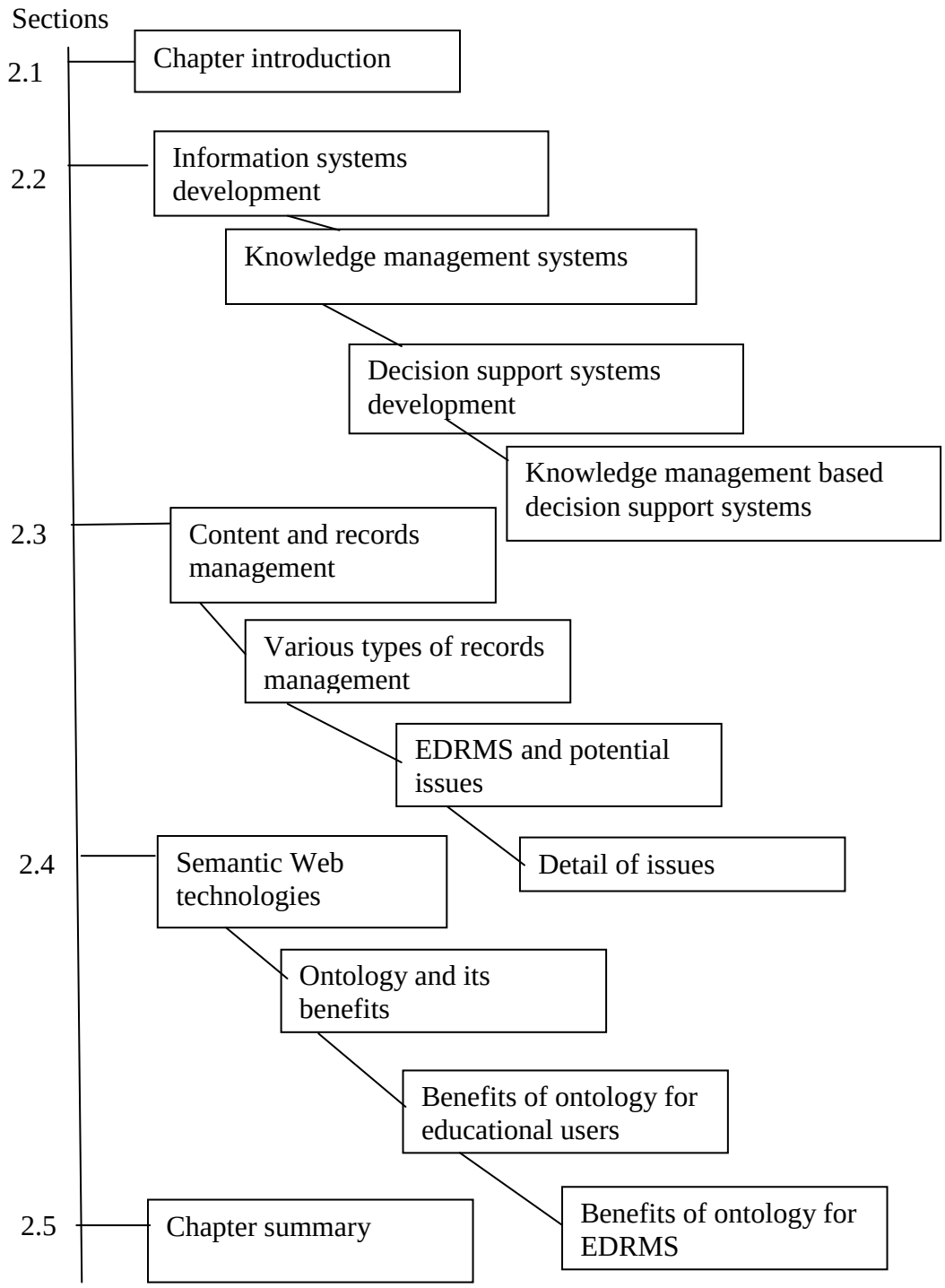

Figure 2.1: Content map of the chapter

2.2 Information Systems (IS) development

IS has been considered as a contemporary discipline that includes computer hardware, software, network, process, people and organisations and all other components within the boundaries of the system that processes, collects, creates and distributes data and information. There are many formal definitions of an information system. Cecez-Kecmanovic (2002) described an information system as a system that *'involves people, machines, and/or methods organised to collect, process, transmit and disseminate data and information'*. Rob and Coronel (2002, p.320) defined an information system to be *'a system that provides for data collection, storage and retrieval, facilitates the transformation of data into information and the management of both data and information. An information system comprises hardware, software (e.g. DB management systems-DBMS and service applications), the DB(s), people and procedures'*.

In a broad sense, the disciplinary areas are concerned not only with the matter of the information and communication technology (ICT) improvement that an organisation adopts, but also with the way in which people interact with the technology in order to support business processes and their requirements. Specific information systems include management information systems (MIS), knowledge management systems (KMS), DSS and other application-specific systems such as e-health, e-commerce and e-government. The following sections discuss some specific IS that are most relevant to this study.

2.2.1 Knowledge Management Systems (KMS)

KMS can refer to any of the tools and techniques that support KM practices for stakeholders in organisations. In its narrower sense the concept of KMS refers to information technology systems that enhance KM processes by meeting stakeholders'

particular requirements. Saito, Umemoto and Ikeda (2007, p. 109-110) categorised KMS into those systems that *'facilitate knowledge discovery, dissemination, collaboration and capturing in repositories'.* Under this category, it can be argued that KMS incorporates features of document management systems, content management systems, learning management systems, groupware, expert systems, semantic networks, enterprise portals, simulation tools and artificial intelligence. A system that manages documents and records electronically such as EDRMS can be considered as a type of KMS.

KM focuses on systematic and active management of data, information and knowledge residing in organisations for their users' decision-making. The IS technologies that make KM workable throughout an organisation are referred to as KMS (Park and Kim, 2006; Zhang and Zhao, 2006). A KMS includes the processes of capturing, extracting, processing and storing knowledge. From the existing KM literature, it is evident that the semantic-based approach improves the searching and browsing ability of the system (Vandic, Dam and Frasincar 2012; Domingue, Dzbor, and Motta, 2004; Bonino, Corno, Farinetti and Bosca, 2004).

Sriti, Eynard, Boutinaud, Matta and Zacklad (2006) discussed a knowledge reuse approach based on the SW technologies enabling information to be processed through an extensible structure in collaborative product development. It is important to discuss SW technologies to support knowledge modelling and sharing through the product lifecycle. Joo and Lee (2009) analysed the limitations of KMS and proposed an approach applying the SW approaches to improve KM practices. The study suggested several ways that the application of the SW to overcome limitations such as searching and navigating in KMS may be used. Uren et al. (2006) examined semantic

annotation for KM. The result shows that while other approaches exist, semantic annotation tools could be able to address some of the KM issues differently.

2.2.2 Decision Support Systems (DSS) development

DSS is a subset of IS research that focuses on supporting and improving managerial decision-making through providing suitable information and analytical data according to the requirements of decision makers (Daniel, 2008). Furthermore, DSS involves organizing, developing and deploying IT-based systems in which the vital components consist of a data or knowledge base (Daniel, 2008). Arnott and Pervan (2008) classified eight sub-areas of the DSS field. These are:

- PDSS : This type of system is normally developed for business managers or decision-makers for relevant activities in supporting a GSS. the class of DSS uses a combination of communication and DSS technologies to enable the operational and strategic working of groups;
- NSS : A DSS system which focuses on group work in cooperation with opposing parties in order to improve relevant decision-making;
- IDSS : This type of system involves the application of artificial intelligence techniques to decision support;
- KMDSS : This type of system supports decision-making by supporting knowledge storage, retrieval, transfer and support through assisting individual and organisational memory and inter-group knowledge access.
- DW : This type of system provides large-scale data infrastructure for decision support;
- ERAS : This type of system includes executive information systems (EIS), business intelligence (BI) and, more recently, corporate performance management systems (CPMS).

According to Arnott and Pervan's (2008) classification, an EDRMS can be classified as a KMDSS as it *'support(s) decision making by aiding knowledge storage, retrieval, transfer and application by supporting individual and organizational memory and inter-group knowledge access',* (p. 658), which is the targeted research area. A limited number of studies identify issues of such DSS that in the past have aimed specifically at maximising the benefits of users' options, particularly in the education domain for academic and student communities.

2.2.3 Knowledge Management-Based DSS (KMDSS)

KM software provides a structure to execute and integrate one or more expert systems with the operation of DSS components. A DSS that includes a KM component is called a KMDSS (Arnott and Pervan, 2008). There are many studies which investigate the issues of KMDSS. Wen, Chen and Pao (2008) proposed a mobile KMDSS for measuring and managing an electronic business. The mobile KMDSS enables fast and effective decision-making based on automatic or semi-automatic reasoning and various vital financial measure queries.

Wen, Wang and Wang (2005) proposed a DSS based on an integrated knowledge base for acquisitions and mergers. The system provides information concerning merger processes, major problems likely to occur in merger situations, and practical or procedural regulations. Furthermore Wen's et al. (2005) approach also provides rational suggestions in compliance of the appropriate regulations. In addition, it can suggest to the user how to deal with an uncertain growth rate and current evaluations. Zopounidis, Doumpos and Matsatsinis (1997) developed a KMDSS for financial management that integrates the technologies of DSS and that was used to tackle past and current frequently occurring problems. Moreover, there are quite a few studies that discuss DSS and KM techniques (Li, 2000; Bharati and Chaudury, 2004;

Eriksson, 1996; Liao, 2001; Masod and Soo, 2002; Matsatsinis, Doumpos and Zopounidis, 1997; Mohanty and Deshmukh, 1997).

From the above discussion it is important to highlight the EDRMS, a type of KM based decision support approach that is intended to enhance the searchability and navigability of the system as well as to improve the decision support ability of users.

2.3 Content and record management systems

From a search of the literature, it was found that most terms related to content management referred to ECM and CMS. Under this classification, an EDRMS, can be defined as a KMS, specifically: *'an automated system which supports the creation, use and maintenance of paper or electronic documents and records for the purposes of an organisation's workflow and processes. An EDRMS includes record-keeping functionality and also manages documents of informational rather than evidential value. The EDRMS includes the whole of documents, records, methods, procedures, tools, [meta] data, (index terms), knowledge, means and persons with which an organisation operates and fulfils its requirements to preserve evidence of its activities, maintain its memory, and preserve its knowledge'* (Johnston and Bowen, 2005, p.133).

The National Archives of Australia (NAA, 2011) defines an EDRMS thus: *'An EDRMS is a software application that manages a range of digital information, including word-processed documents, spreadsheets, emails, images and scanned documents. An EDRMS can combine both document management and records management functionality'*.

According to the International Records Management Trust (IRMT, 2009) an EDRMS is: '*An electronic system or process – managed with the aid of computers*

and software – implemented in order to manage both electronic documents and electronic records within an organisation. Electronic document and records management systems combine the functions of document and records management'.

The National Archives of Australia (NAA, 2011) stated that: *'An EDRMS is a software application that manages a range of digital information, including word-processed documents, spreadsheets, emails, images and scanned documents'.* Compared to the other definition the NAA's aspect supports the EDRMS problem space that can be capable of combining both document and records management functionality in a problem context.

However, a limited number of studies identify features of such a system that in the past aimed especially at maximising the benefits to users across the university academic and student community. For example, issues such as searchability, navigability and data management are common in terms of the practical use of EDRMS, especially in the context of education institutes.

As a class of EDRMS, the Oral History Management Systems (OHMS) has been developed to allow access to and sharing of oral history materials through the Internet. This system facilitates the storage, organisation, retrieval and dissemination of oral history documents to ensure their availability, accessibility and usability (Muhd Ashfee Kamaruddin, Ahmad Zam Hariro Samsudin, Adnan Jamaludin, Sohaimi Zakaria, Aliza Ismail, Mohd Nazir Ahmad, Zulkefli Mohd Yusop, Mohd Najib Mohamad and Terrance Igai Langat, 2009). It has been developed on open-source Web-based applications such as the Koha Library Management System (Breeding, 2007). However, OHMS evolution has followed what might be described as an "existing" approach to record management IS development. Various studies have been conducted on OHMS over the past decades. Apart from focusing on developing

its decision support functionalities, many of these studies highlight the requirement for understanding, conceptualising, and designing a DB system (Gallacher and Treleven, 1988); improving bibliographic control and access to oral history interviews (Bruemmer, 1991); metadata models (Hunter and James, 2000); the creation, indexing and provision of access (Gustman et al., 2002); and, more recently, the provision of online access to oral history (Daniels, 2009).

Gallacher and Treleven (1988) analysed the nature of oral history collections, survey methodology and system design, including computer system requirements and DB design criteria, to develop an online DB, printed directory and subject guide to oral history collections. Their success in developing simultaneously both a model directory/subject guide and collections DB suggest the possibility of other state, regional or national oral history groups initiating projects to collect, classify and disseminate up-to-date information on oral history collections.

On the other hand, Bruemmer (1991) recommended four items to improve bibliographic control and access to oral history interviews such as: the establishment of machine readable catalogue (MARC) Archives and Manuscripts Control (AMC) records, the need to make interviews available for inter-library loan, enhancing the availability of oral history information, and improving the consistency of oral history records through the creation of guidelines to allow access to oral history collections by the community.

Furthermore, Hunter and James (2000) examined the ABC[1] event-aware metadata model, developed within the Harmony project, by applying it to a complex multimedia oral history archive. This project has shown that the fundamental concept of ABC, which is the explicit recognition of events (and their properties) in resource

[1]According to Hunter and James (2000) , ABC is the name of the model proposed in Harmony project to provide a clear understanding of the individual resources, events, contributions and relationships which constitute useful collection of digital multimedia content.

lifecycles, is essential to the generation of interoperable metadata descriptions, particularly in the context of multimedia collections. Gustman et al. (2002) identified a set of critical research issues that must be addressed to provide full and detailed access to collections. This study identified challenges, strategies to meet the challenges, and opportunities offered by the Visual History Foundation (VHF) collection which, enriched by the work of the project, provides a large amount of training data for automatic speech recognition and further text processing tasks in many languages.

In addition, Daniels (2009) examined the decisions that must be made in the course of making analogue audio available online. Legal, ethical and technical decisions are examined and evaluated in the context of one repository's experience. Issues such as copyright, privacy and defamation are examined, as are technical issues around analogue audio capture and access. Different options for presenting oral histories to the public are evaluated in light of ease of production and access. The paper found that it is possible to provide easy-to-use online access to oral histories even in the absence of a large budget and programming staff to create cutting-edge tools.

However, there appears to be a significant development area to date that will enhance the benefits of decision-makers using OHMS. It is thus important to focus on addressing these issues by identifying the issues of OHMS as a class of EDRMS and the anticipated potential technologies that could enhance services to end users.

2.3.1 Various types of records management

Various types of records management systems have been introduced that provide applications to users and organisations in the past. They have been described by

different terms in the literature such as CMS, ECM, ERM and digital asset management system as described below:

2.3.1.1 Content management systems (CMS)

Shaikh and Fegade (2012, p. 379) stated that a CMS *'...supports the creation, management, distribution, publishing, and discovery of corporate information'.* They further indicate that such systems cover the complete lifecycle of content, from its creation to its archiving. In addition, a CMS offers the capability to handle the organization of the site, the graphical user interface as well as the aspect of user navigation.

2.3.1.2 Enterprise content management (ECM)

According to Blair (2004), ECM was coined by AIIM International (Association for Information and Image Management (AIIM) International, 2014[2]) and is now widely used by vendors and users. Smith and McKeen (2003: p.647) defined ECM as *'the strategies, tools, processes and skills an organization needs to manage all its information assets regardless of type over their lifecycle'.*

The ECM Association (AIIM International, 2014) defines ECM as *'the strategies, methods and tools used to capture, manage, store, preserve, and deliver content and documents related to organizational processes. ECM tools and strategies allow the management of an organization's unstructured information, wherever that information exists'.*

According to Woolley and Fletcher (2007), ECM includes the following core components: document management, web content management, records management, document imaging, document-centric collaboration and workflow. ECM is also defined as *'the technology that provides the means to create/capture, manage/secure,*

[2] URL: http://www.aiim.org/what-is-ecm-enterprise-content-management, Accessed on 25 Aug 2014

store/retain/destroy, publish/distribute, search, personalize and present/view/print any digital content' (Munkvold, Paivarinta, Hodne and Stangeland, 2006, p. 71).

Based on the foregoing definitions, it was found that most of the researchers view ECM as the evolution of document management, records management, workflow (business process) management and web CMS that started in the 1980s. Therefore, it can be concluded that EDRMS can be classified under ECM and covers both elements of document management and record management.

2.3.1.3 Enterprise records management (ERM)

Over the history of IS application development, technologies of ERM are still inadequate to meet the growing demand of industry's record preservation and its further management for decision-makers (Katuu, 2012; Alalwan and Weistroffer, 2012). Beyond the provisions for simply preserving records and documents in a record repository, the system should provide useful features to meet users' regular problem-solving demands within their different business conditions.

Sprehe (2005) highlighted three case studies that demonstrate the positive benefits of ERM in terms of ECM. Katuu (2012) revealed that limited studies represented institutional experiences and their use related to implementing electronic document and records management in South Africa. Alalwan and Weistroffer (2012) reviewed the literature of ECM through a structured research approach in order to point out gaps where further research is most needed in terms of records management. This study provides a framework that also reinforces the necessity to develop practical solutions to meet the growing demands of users.

2.3.1.4 Digital asset management systems

According to Extensis (2011), a digital asset management system is a system which manages and distributes *'digital assets such as images, documents, creative file, audio*

and video clips effectively. In addition, the system allows organisations to catalogue, store and retrieve collections of valuable digital assets. There are many benefits of digital asset management such as: centralisation of digital assets, protective storage of rare or valuable content, find-ability of digital assets, reduction of organisational costs, and the dynamic distribution of assets to internal and external teams'.

There are many examples of the implementation of digital assets management (Meserve, 2003; Smith, 2000; Leland, 1999) at higher education organisations that range from scientific data such as digital images of samples, digitisation of theses, possible digitisation of rare archival collections including photos and other formats, to name but a few. The system developed in this project can be considered as a type of EDRMS.

2.3.2 EDRMS and potential issues

Maguire (2005) discussed the experience of implementing an EDRMS and identified the lessons learned from the process. Wilkins, Swatman and Holt (2009) also discussed the experience of implementing an EDRMS and found that it is quite challenging to bring the people and process together in the life cycle of records, especially when it involves a long-term commitment. On the other hand, Johnston and Bowen (2005) identified the benefits of implementing an EDRMS. These benefits may be a guide for the organisation that plans to implement an EDRMS. In addition, Williams (2005) described the implementation of an EDRMS in the United States (US) National Weights and Measures Laboratory and identified whether the benefits were achieved. It was found that the project succeeded and achieved the expected benefits. Furthermore, Garrido (2008) explored whether the records manager had taken into consideration users' needs and preferences in creating the folder structure of EDRMS. This study found that users' objectives are similar to those of records

management. It implies that prioritising user needs is the best way to achieve records management objectives.

Limited studies have been conducted on oral history systems within the aspect of user access provisioning. Some studies focused on the requirement for understanding, conceptualising and designing a DB system (Gallacher and Treleven, 1988); improving bibliographic control and access to oral history interviews (Bruemmer, 1991); metadata model (Hunter and James, 2000); the creation, indexing and provision of access (Gustman et al., 2002); and more recently on the provision of online access to oral history (Daniels, 2009). They, however, appear to be limited in their analysis of examining the benefits and problems of developing and using an OHMS.

2.4 Semantic Web Technologies

The main goal of SW technologies is to develop languages for expressing information in a machine-processable way (Dumbil, 2001). According to Berners-Lee, Hendler, and Lassila, (2001, p. 29), '*The Semantic Web is not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation. The first steps in weaving the Semantic Web into the structure of the existing Web are already under way. In the near future, these developments will usher in significant new functionality as machines become much better able to process and "understand" the data that they merely display at present'*.

SW technologies have been a well-accepted tool for enhancing web application usages. One example of SW applications in the education domain is identified by Cardoso (2007), who demonstrates the applicability and the benefits of using SW

technologies by developing a real-world application. The application is called a Semantic Course Management System (S-CMS), which is based entirely on SW that uses the latest technologies in this field such as Web Ontology Language (OWL), *RDF Query Language* (RQL), *RDF Data Query Language* (RDQL) and Semantic Web Rule Language Combining OWL and RuleML (SWRL). This system focused on distance education opportunities. S-CMS offers services such as class project management, registration tools for students, examinations, management of enrolment, test administration, tools for assessment and online discussion boards (Meinel, Sack and Schillings, 2002). It is noted that the more expressive mark-up languages like SWRL allow developers to write application-specific declarative knowledge, and can improve the ontology and annotation richness of information on the SW.

Gliozzo et al. (2007) have developed SW technologies to enhance legacy systems. Their study introduces a framework to add a SW layer to legacy organisational information. Their findings show that a SW layer can enhance a legacy system by providing an intelligent and collaborative front end. Drawing from the aforementioned ontology definitions towards vocabulary and meanings enhancement, in our study it is anticipated that SW based concepts may have the potential to improve the searchability of an OHMS through the utilisation of ontology-based features.

2.4.1 Ontology and its benefits

While philosophical ontology is primarily concerned with the 'establishment of truth' by finding answers to questions such as 'what exists?', in the field of Artificial Intelligence, computer scientists and researchers utilise the term 'ontology' to mean the science of specification of existing concepts. According to the well-known definition laid down by Tom Gruber, ontology is defined as *'a specification of*

conceptualization, wherein "conceptualization" refers to couching of knowledge of a particular domain (or general) in terms of entities (things, relations and constraints), and "specification" implies representation of conceptualization in concrete form' (Gruber, 1993, pp. 1). The field of information science has accepted the notion of 'ontology' as a formal theory involving definitions and a supporting framework of axioms themselves providing implicit definitions of the terms involved (Smith, 2003).

In the context of information systems, an ontology is distinguished as *'a software artefact or formal language designed with a specific set of uses and computational environments in mind'* (Viinikkala, 2004). Furthering this notion, Zuniga (2001) noted that an information systems ontology is *'a formal language designed to represent a particular domain of knowledge, which depicts the structure of domain objects in question and accounts for the intended meaning of a formal vocabulary or protocols'.* The present study adopts the notion of ontology as a *'representation of knowledge about a particular domain, which would be utilised for generating rich semantic metadata structures, to be acted upon as "search points" for providing value added information services in OHMS'.* The literature shows that there is no common ontology addressing such sensitivity of the domain knowledge for managing records and Oral History projects in education institutes.

2.4.2 Significance of SW

The advantages of using the SW have been demonstrated in many domains: life sciences (Kashyap, 2009; Kashyap, Cheung, Doherty, Samwald, Marshall, Luciano, Stephens, Herman and Hookway., 2007); health care (Hyvonen, Vijanen and Suominen (2007); Patel, 2007; Marie, Falkman, Lindahl and Torgersson, 2006); energy (Norheim and Fjellheim, 2006; Ramakrishna, 2008); education (Cardoso, 2007; Gliozzo et al., 2007). The literature suggests that SW and ontologies can offer

many significant benefits to any enterprise system. The SW approach also addresses various issues in information service development. The following section provides a detailed explanation of benefits of SW and ontologies related to KM issues, DB issues, searching issues and navigability issues.

2.4.2.1 KM Issues

In relation to KM issues, Uren et al. (2006) examined semantic annotation for KM. The study found that some time is needed to prove the ability of semantic annotation tools to address all the KM needs. Joo and Lee (2009) analysed the limitations of KMS and proposed an approach applying the SW to KM. The study suggested the application of SW to overcome limitations of KMS. In addition, Sriti et al. (2006) proposed an IT platform based on SW technologies to support knowledge modelling and sharing through the product lifecycle. Furthermore, there are few studies that find that SW can improve KM, provide knowledge representation and semantic annotation (Euzenat, 2002; Sriti et al., 2006; Uren et al., 2006; Joo and Lee, 2009; Miah, 2010; Varlan, 2010; Toledo, Ale, Chiotti, and Galli, 2011).

2.4.2.2 DB Issues

Iqbal, Ott and Seneviratne (2010) mentioned the importance of removing data redundancy from distributed SW data. Their study addresses the data redundancy removal problem such that excessive bandwidth usage due to in-network duplicate data transfer can be minimised.

Choi and Han (2013) developed a new method that removes data redundancy in a training set of sequences based on their features. The method constructs a larger and more informative training set than the standard redundancy removal method based on sequence similarity, and the constructed data set is guaranteed to be redundancy-free. The study computed the interaction propensity (IP) of nucleotide triplets by applying

a new definition of IP to an extensive dataset of protein-RNA complexes and developed a support vector machine (SVM) model to predict protein binding sites in RNA sequences.

Alpar and Winkelstrater (2014) discussed an application of data mining to an accounting transactions DB in order to discover patterns. The discovered patterns are represented in the form of association rules. Then, deviations from discovered patterns can be marked as potential data quality violations that need to be examined by humans. Data quality breaches can be expensive, but manual examination of many transactions is also expensive. Therefore, the goal is to find a balance between marking too many and too few transactions as being potentially erroneous. The study applies appropriate procedures to evaluate the classification accuracy of developed association rules and supports the decision on the number of deviations to be manually examined based on economic principles. In order to support the decision on the number of deviations to be manually examined based on economic principles, the study evaluates the classification accuracy of developed association rules using an appropriate procedure.

2.4.2.3 Searching Issues

Upstill, Craswell and Hawking (2002) studied the interaction between search engines and websites by conducting a case study of online bookstores and general-purpose search engines. In this study, they compared the relative effectiveness of the search engine and then compared the relative searchability of the bookstore website. The study found that two of the search engines performed better than the others. Furthermore, they nominated the most searchable bookstore website and gave recommendations to others on how to improve their search engine and website. In an education institute context, Cardoso (2007) developed Course Management System

using SW technologies to demonstrate the applicability and the benefits of using SW technologies in an education institute. It was found that the student enrolment to class projects at the University of Madeira have been successfully managed using this system. Vakkari and Talja (2006) examined how academic status and discipline affect the major search methods used by university academic staff for obtaining electronic articles. They found that keyword searching was clearly the most important access method for searching journal and reference DBs in all disciplines compared to browsing, chaining or obtaining material from colleagues. Furthermore, the patterning of search methods used was influenced by academic status and discipline. In addition, in the natural sciences, engineering and medicine, compared to other disciplines, the most common searching method used was keyword searching.

Vandic et al. (2012) identified searchability issues and noted that a semantic-based approach improved the searching and browsing ability of the system. The study by Vandic et al. proposed the Semantic Tag Clustering Search (STCS) framework for enhancing the end-user experience in interacting with tagging systems.

2.4.2.4 Navigability issues

Domingue et al. (2004) described several advanced functionalities of Magpie, a tool that assists users with interpreting web resources. Moreover, they claimed that the ability to generate different semantic layers for a web resource is vital to support the interpretation of web pages. In addition, the semantic layer allows users to browse their neighbourhood semantically. It was also found that the approach semantically enriched browsing history management.

Issues like navigability were also identified by Castro, Melia, Genero, Poels, and Calero (2007), who described that improving the navigability of Web-based applications is one of the key indicators of success in systems development. The study

suggested a web-engineering-based methodology to improve the navigability of Web-based applications.

Bonson-Ponte, Escobar-Rodriguez and Flores-Munoz (2007) measured the navigation quality of the corporate webpages of the principal European financial entities. Their study focused on the accessibility of online content for the successful execution of their operational activities. In another study, Happel and Seedorf (2006) presented some examples of ontology applications throughout the Software Engineering lifecycle. In addition, they discussed the advantages of ontologies in each case and provided a framework for classifying the usage of ontologies in Software Engineering. According to Happel and Seedorf (2006), SW can improve usability, reliability and scalability.

Semantic technologies aim to provide enhanced meanings to user groups with timely, useful and valid information support based on some pre-coded domain knowledge settings (Cardoso, 2007; Joo and Lee, 2009). Educational users such as academics and students can benefit from such provisions of technologies being implemented in records management systems (Cardoso, 2007; Boyce and Pahl, 2007; Sampson et al., 2004). The underlying condition for successful development of using SW provisions such as an ontology to enhance ability of decision support can be seen as the creation of a reliable instrument for the benefits of information retrieval for better practice of domain KM. The literature shows that there is no common ontology addressing such sensitivity of the domain knowledge for managing records and Oral History projects in educational institutes.

2.4.3 Benefits of ontology for educational users

SW technologies have been a well-accepted tool for enhancing web application usage. Examples can be viewed in education institutes for developing a semantic course

management system (Cardoso, 2007); for developing domain ontologies for course content (Boyce and Pahl, 2007); and in exploring topics related to the new opportunities for e-learning created by the advent of ontologies and the SW (Sampson et al., 2004). This shows that SW technologies can contribute to improve the process of managing course management systems.

Boyce and Pahl (2007) developed domain ontologies for course content. Their study presented a method for domain experts rather than ontology engineers to develop ontologies for use in the delivery of courseware content. Boyce and Pahl (2007) focused in particular on relationship types which contribute adequately to model-rich domains.

In addition, Jacinto and Parente de Oliveira (2008) proposed an architecture for Intelligent Tutoring Systems (ITS) supported by several ontologies. This architecture extends the use of SW concepts, where the representation of each component is made by a specific ontology, making possible a clear separation of concerns about the components of ITS and clarifying communication among components.

Furthermore, Sampson et al. (2004) explore topics related to the new opportunities for e-learning created by the advent of ontologies and SW. The papers published in this special issue cover a wide range of research problems in Semantic e-learning. In this special issue readers not only gain a state-of-the-art literature review but also are able to understand the design and development of real-world applications, prototypes and tools of e-learning in the SW. This implies that provisions of SW technologies being implemented in record management systems can benefit educational users such as academics and students.

2.4.4 Benefits of ontology

2.4.4.1 How SW can improve EDRMS

Based on the literature, it is evident that the SW has much to offer to improve the EDRMS. Under the category of searching, SW can enhance system performance, improve effectiveness, enhance access, improve reasoning, improve precision, provide SW vocabularies for expressing metadata and create uniform semantic meaning (Bonino et al., 2004; Chen, Y. Wang, H. Wang, Mao, Tang, Zhou, Yin and Wu, 2006; Happel and Seedorf, 2006; Bose and Sugumaran, 2007; Cardoso, 2007; Urs and Angrosh, 2007; Joo and Lee, 2009; Rios-Alvarado, Medina-Ramírez and Ricardo, 2009; Toledo et al., 2011; Blomqvist, 2012; Figueiredo, Dos Reis and Rodrigues, 2012; Vandic et al., 2012).

Second, in terms of navigating, SW can improve browsing ability, facilitate linking and support browsing and navigation activities (Domingue et al., 2004; Chen et al., 2006; Bose and Sugumaran, 2007; Castro et al., 2007; Blomqvist, 2012; Figueiredo, Dos Reis and Rodrigues, 2012).

Third, in terms of KM, the SW can improve KM, provide knowledge representation and semantic annotation (Euzenat, 2002; Sriti et al., 2006; Uren et al., 2006; Joo and Lee, 2009; Miah, 2010; Varlan, 2010; Toledo et al., 2011).

Fourth, SW can also contribute to the betterment of DB management in areas such as data integration, data extraction, improving information consistency, improving information processing quality, reducing data redundancy and simplifying interoperability (Lausen et al., 2005; Chen et al., 2006; Happel and Seedorf, 2006; Bose and Sugumaran, 2007; Cardoso, 2007; Joo and Lee, 2009; Iqbal et al., 2010; Blomqvist, 2012).

2.4.4.2 Ontology and EDRMS

The main objective of a domain ontology *is 'to reduce the conceptual and terminological confusion among the members of a virtual community of users (for example, tourist operators, commercial enterprises, medical practitioners) who need to share electronic documents and information of various kinds'* (Navigli and Velardi, 2004, p. 151). This definition has been supported by several recent studies in the context of their domain ontology construction in various domains. Some examples are:

a) Y.J. Chen, Chu, Y.M. Chen and Chao (2013) for personalised knowledge searching;

b) Liu, He and Lim (2012) for Chinese text classifications; and

c) Velardi, Faralli and Navigli (2013) for taxonomy induction.

This indicates that the purpose of this study can be achieved by identifying and properly defining a set of appropriate concepts with a given common vocabulary and their definitions to describe a better application domain for a shared understanding of the domain of interest (Uschold and Gruninger, 1996). At the same time, some studies do not focus on a problem ontology that goes with the problem-specific nature of ontology constructs (Chandra and Tumanyan, 2007). However, the significance of integrating a specific domain ontology into system design has in the past been well accepted within the perspective of DSS development (Miah, Kerr, Gammack, 2006; Miah, 2009; Musen et al., 1996; Ceccaroni et al., 2004). This is for the reason that it enhances information retrieval and improves accessibility of data, meta-data and its further description to support users with complicated decision-making (Ceccaroni et al., 2004; Dzemydiene and Kažemikaitiene, 2005). With regard to academic record and oral history management, ontologies can enhance the perception of academics and

students regarding the subject of the knowledge repository and can enable common vocabularies and uniformities to make informed choices. Moreover, the use of a shared and integrated domain ontology can improve the decision-making activity whereby most of the users' decisions are reliant on the output of an EDRMS as a source of reference.

The need for further research in KM and decision support for record and Oral History management has been well recognised over the past years (Arbon, 2004; Gruber, 1995; Zeitz et al., 2002). Previous studies describe the use of ontologies for better KM, especially for content management (Euzenat, 2002; Uren et al., 2006). Haghighi et al. (2013) introduced the requirements of domain ontology construction for the better use of domain knowledge in informed decision-making in medical emergency management for mass gathering. The domain ontology developed by Haghighi et al. (2013) is functional for the aim of planning and managing domain knowledge in effective medical emergency management. In this study, after careful consideration, it was found that the requirements of Haghighi et al. (2013) are similar to the requirements for managing domain knowledge for effective record and oral history management.

2.5 Summary of the chapter

This chapter presented the theoretical position of the study in the targeted literature area. The study had two main objectives to achieve from the chapter: first was to identify relevant studies on ERM and associated issues of its applications and second was to determine the benefits of SW in order to relate to the issues of ERM. In other words, the chapter described the targeted issues of records management and how SW and ontology-based provisions have been utilised to address them. OHMS has been

described as a type of EDRMS along with other classes such as CMS and digital asset management system. The chapter also highlighted the use of organisational context for ERM applications in order to demonstrate the value of a new solution implementation in the problem domain. The following Table 2.1 summarises key benefits of enterprise systems as indicated by relevant studies.

Table 2.1: Benefits over the issues and relevant studies

Benefits over the issues	***Issues***	***Relevant studies***
Semantic-based approach improved the searching and browsing ability of the system	Searching	Vandic et al., 2012; Domingue et al., 2004; Bonino et al., 2004
SW technologies for improving decision support	Improving DSS	Blomqvist, 2012
Improving navigability of web based application is one of the key indicators of success	Navigability	Castro et al., 2007; Domingue et al., 2004
Information representation and retrieval	Information representation	Rios-Alvarado et al., 2009; Tennis and Calzada-Prado, 2007
Document retrieval issues in organisational memory development	Document retrieval	Toledo et al., 2011
Knowledge representation issues for knowledge society	Knowledge representation	Varlan, 2010
To improve vocabulary of taxonomies through SW	Vocabulary	Burke, 2009
Enhancement of capability of DSS environments	Enhancing DSS	Bose and Sugumaran, 2007
Accessibility issues	Accessibility	Martinez and Isaksen, 2010; Figueiredo et al., 2012

DB issues	DB	Chen et al., 2006
Removing information redundancy	Information redundancy	Iqbal et al., 2010
KM issues (digital libraries)	KM	Sriti et al., 2006; Uren et al., 2006; Urs and Angrosh, 2005; Joo and Lee, 2009

Chapter 3

Research methodology

3.1 Introduction

The aim of this chapter is to present the philosophical assumptions underpinning this research, as well as to introduce the empirical research method that was applied to conduct the study. The philosophical assumptions underlying this research come from the interpretive tradition of qualitative research. This implies a subjective epistemology and the ontological belief that reality is socially constructed suitable to an organisational research context. The target organisation is an education institute that facilitates higher education through various associations of learners and educators for academic records or documents exchanges. The research work was conducted at the site during the period of November 2012 to January 2013 and steady correspondence has been maintained with the various informants to ensure a smooth collection of updated data findings. The main data collection technique used in this research study was the semi-structured interview. The chapter will explain the reasoning behind the selection of the technique.

This chapter is divided into three sections. In the first, the interpretive stance in the field of information systems is examined. The next section is about the research strategy, describing the research approach followed in the case study research. Finally, section three deals with the research design and covers the reasons for selecting organisations, data sources, research analysis sub-units, data collection and analysis, followed by a brief summary of the expectations from the theoretical framework adopted.

3.2 Structure of the research project

There are four different parts of the research procedure in this research project. Figure 3.1 shows the four phases of the research activities in the project.

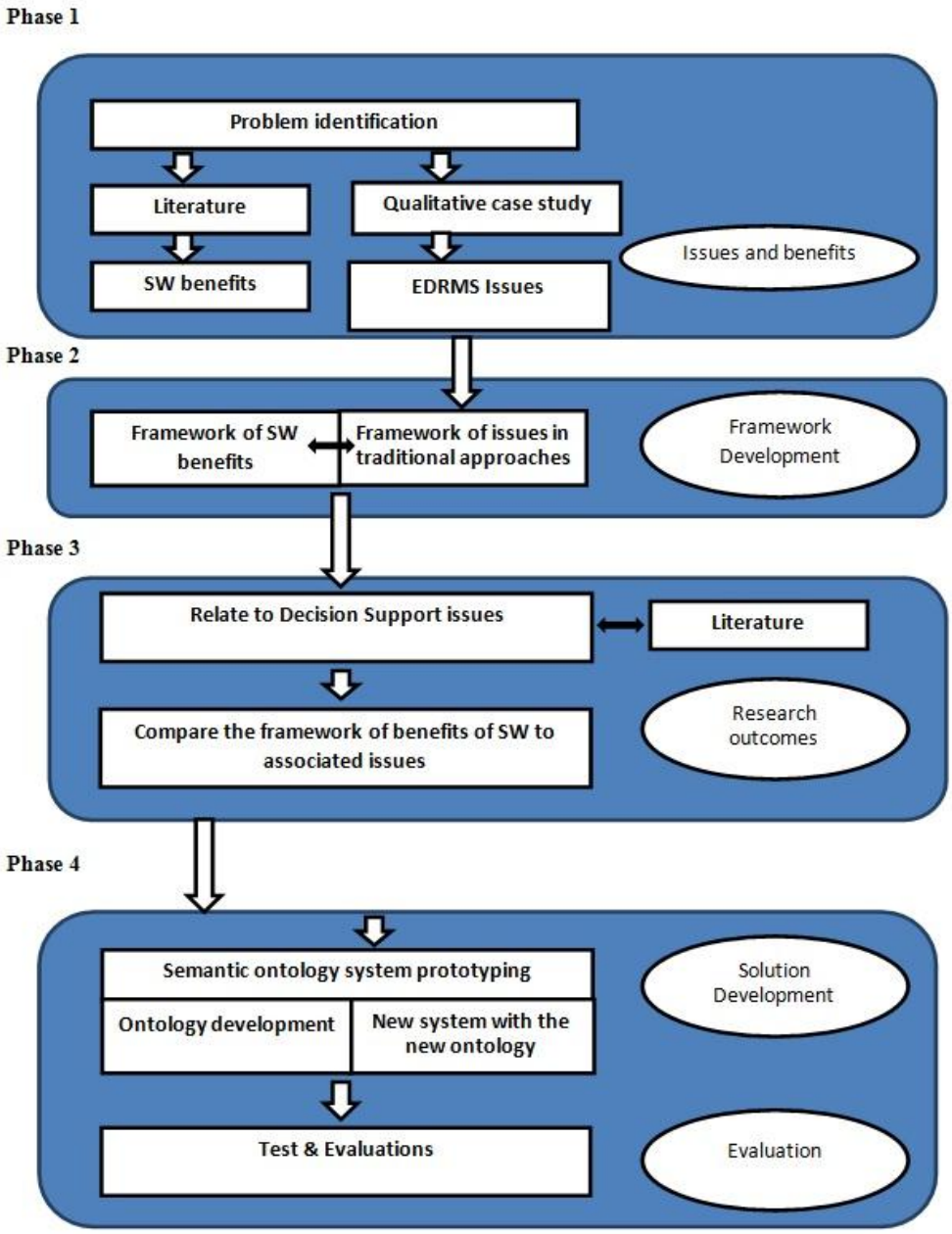

Figure 3.1: The four-phases of the research activities in this project

3.2.1 Phase 1: Problem identification

This phase involves problem identification related to the issues and benefits of existing approaches and SW-based approaches. The semi-structured interview

(Gorman and Clayton, 1997) is adopted as the data collection approach. In terms of selection of the participants, non-probability sampling, i.e. purposive sampling, is deemed to be appropriate in view of the large number of interested groups, and involved about thirty informants (five developers and 25 users). Furthermore, this study received Victoria University (VU) ethics approval in the candidate's ethics application (Ref. HRETH 12/271)[1]. According to NASA (1993), a system developer *'incorporates the technical security specifications into an operational system'*. In this study, 'developers' refers to the persons involved in developing the system (approaches to the current EDRMS). Rob and Coronel (2002, p. 20) stated that *'end users are the people who use the application programs to run the organization daily operations'*. In this study, 'end users' refers to the educators and students of the Faculty of Information Management of the Universiti Teknologi MARA, Malaysia (Mara University of Technology, Malaysia). The number of samples of respondents is reviewed during the research in order to ensure that it is as comprehensive as possible. The developers are included in this study in order to obtain feedback and an overview of current decision support features from a technical perspective. The issues and benefits of SW approaches are explored through the literature survey. In this case, the sources are based on published literature on the potential benefits of SW in supporting features for enhanced decision-making.

[1] A copy of all relevant ethics documentation can be provided upon request to the author of the PhD thesis.

Table 3.1: Interviewees' basic description

Interviewees	**Position**	**Association to existing system/Category**
Interviewee 1	Professor	Developer
Interviewee 2	Senior Lecturer	Developer
Interviewee 3	Professor	Developer
Interviewee 4	Programmer	Developer
Interviewee 5	System Developer	Developer
Interviewee 6	Associate Professor	User
Interviewee 7	Senior Lecturer	User
Interviewee 8	Senior Lecturer	User
Interviewee 9	Lecturer	User
Interviewee 10	Senior Lecturer	User
Interviewee 11	Lecturer	User
Interviewee 12	Lecturer	User
Interviewee 13	Recent graduate	User
Interviewee 14	Recent graduate	User
Interviewee 15	Recent graduate	User
Interviewee 16	Recent graduate	User
Interviewee 17	Recent graduate	User
Interviewee 18	Associate Professor	User

Interviewee 19	Professor	User
Interviewee 20	Senior Lecturer	User
Interviewee 21	Former Graduate	User
Interviewee 22	Senior Lecturer	User
Interviewee 23	Senior Lecturer	User
Interviewee 24	Lecturer	User
Interviewee 25	Lecturer	User
Interviewee 26	Professor	User
Interviewee 27	Senior Lecturer	User
Interviewee 28	Senior Lecturer	User
Interviewee 29	Associate Professor	User
Interviewee 30	Lecturer	User

3.2.2 Phase 2: Conceptual framework development

The second phase consists of framework development activity. In this phase, data collection and analysis are conducted to obtain a clear understanding of the issues and benefits of the existing approach and SW so that a new solution can be developed. Decision-making aspects are highlighted in this study, since the activity is very important in improving learning activities in educational institutes. Enhancing the decision-making ability of educators and students (in this context) will contribute to quick decision-making. This will save time and ensure that learning activities run smoothly. The framework is based on taxonomy descriptions developed according to a systematic and reliable process (e.g. Protégé KM method, Gennari et al. (2003). In

this study, two frameworks were developed for existing and SW approaches. For the existing approaches, a framework is developed from the findings of the interview data. In this case, the study used semi-structured interviews. The interviews were then transcribed into MS Word documents and analysed according to Strauss and Corbin's (1998) coding paradigm. The study will use Strauss and Corbin's (1998) method of analysis as it is relevant to the aim and nature of the expected findings. To facilitate the analysis process, a qualitative data analysis software called ATLAS.ti version 5.0 was used. Then, the taxonomy structure of the framework was developed using Protégé software. For the SW approaches, a framework was developed using a literature survey on the SW. In this case, this study used content analysis as a method for data analysis. Tables 3.1 and 3.2 show the details of taxonomy description of the frameworks.

Table 3.2: Existing approach issues

Existing approach issues
Searching
Effectiveness
Precision
Navigating
Browsing
User interface
User Friendliness
Flexibility of web environment
Language
KM
Data integration
Representation
Abstract
Description of collection
Description of figure
DB Management
Data quality
Data redundancy
Display
Maintenance
System feedback
System performance
User guide
Others
Content
Updating issues
Scope (e.g. more content needed)

Table 3.3: SW approach benefits

SW approach benefits
Searching (Bonino et al. (2004); Chen et al. (2006); Happel and Seedorf (2006); Bose and Sugumaran (2007); Cardoso (2007); Urs and Angrosh (2007); Joo and Lee (2009); Rios-Alvarado et al. (2009); Toledo et al. (2011); Blomqvist (2012); Figueiredo et al. (2012); Vandic et al. (2012) Enhance performance Effectiveness Improve access Improve searching ability Improve reasoning Precision Provide SW vocabularies for expressing metadata Uniform semantic meaning Navigating (Domingue et al. (2004); Chen et al. (2006);Bose and Sugumaran (2007); Castro et al. (2007); Blomqvist (2012); Figueiredo et al. (2012). Improve browsing ability Linking Supporting browsing and navigation Uniform semantic meaning KM (Euzenat (2002); Sriti et al. (2006); Uren et al. (2006); Joo and Lee (2009); Miah (2010); Varlan (2010); Toledo et al. (2011)

Improve KM Knowledge representation Semantic annotation
DB Management (Lausen et al. (2005); Chen et al. (2006); Happel and Seedorf (2006); Bose and Sugumaran (2007); Cardoso (2007); Joo and Lee (2009);Iqbal et al. (2010); Blomqvist (2012) Data integration Data extraction Improve information consistency Improve Information processing quality Reduce data redundancy Simplifies interoperability
Others Content management (Happel and Seedorf (2006). Improve usability Improve reliability Improve scalability

3.2.3 Phase 3: Research outcomes

The third phase focuses on research outcomes. The proposed framework is related to decision support options for the decision-makers, such as educators and students, who use the system to assist them in the process of selecting the subjects to be interviewed in their studies. The idea in this phase is to compare both frameworks to focus on the key uses of SW over existing EDRMS features. Ontologies came into use as a solution in this study in that they offer enhanced vocabulary, taxonomy and better representation of knowledge. It is also suggested that ontologies can improve DB management issues such as data redundancy (Iqbal et al., 2010). Furthermore, the

proposed SW issues and benefits framework was compared with existing approaches to develop the new solution approach. Bolloju et al. (2002) identified impacts of KM for developing decision support in that knowledge should be obtained through various conversions. Using a knowledge discovery technique, this study proposed an approach to integrate decision support and KM processes. Kim et al. (2014) more recently found that the issues of navigation are of paramount importance for decision support development. This study proposed a dynamic category selection mechanism and a reordering scheme for resulted categories. Aminilari and Pakath (2005) discussed the issues of information searching for the benefits of decision makers. Hirouchi and Kosaka (1984) discussed management and planning DBs from the viewpoint of decision support. DBs should be connected to the DSS system architecture to facilitate decision making. Based on this discussion, four issues (searching, navigating, KM and DB management) have been found as heavily related to decision making and support design. Therefore, this PhD study focused on these four issues.

3.2.4 Phase 4: Solution development

The fourth phase of this study involves system development and testing where a proof-of-concept prototype has been developed and evaluated through potential users in an education institute. In this phase, a solution prototype, namely the Protégé II method (Gennari et al. 2003), was used to construct comprehensive ontologies through the guidance of the adopted methodology in this study. The Protégé system (Gennari et al. 2003) provides an application platform for more general purpose knowledge organisation so that the components of the repository can be structured within the problem domain prior to system design. Using the Protégé platform the study demonstrates how ontology components can be turned into system components

in order to achieve agreement in focus group meetings. This activity helped to reduce knowledge acquisition issues by minimising knowledge engineers'[2] roles in constructing the proposed system.

3.3 Research philosophy

The philosophical assumptions underlying this study come from the social constructionist stance, which engages the interpretivist paradigm. This interpretive study uses the qualitative research approach to explore and investigate the essential problems and issues of developing and using EDRMS. Adopting a qualitative case study approach, the researcher made a study of EDRMS's developers and users from the Faculty of Information Management, Universiti Teknologi MARA, Malaysia (MARA University of Technology, Malaysia). In-depth semi-structured interviews were used to understand the phenomenon based on the experience of EDRMS's developers and users.

Jennings (2004) stated that the phrase that is related with the social constructionism, social phenomenology, hermeneutics and relativist methodology is interpretive paradigm. According to Gummeesson (2000), in the interpretive paradigm, the social world is better recognized if the research is conducted and observed from the client's perspective. Prasad (2002) suggested that modern interpretivism is dedicated to the comprehensive idea of social constructionism. 'Interpretive' is a combined phrase for constructionism and the interpretivist methodology as stated by Erickson (1986) and Ferrier (1998). Therefore, in this study, the researcher was reasonably confident that understanding the relevant phenomenon

[2] *Knowledge engineers* interpret and organize information on how to make systems decisions (Aylett & Doniat 2002).

was not misinterpreted, rather it was constantly recreated based on the perception and situation.

The social constructionism method declares that meanings are built through social developments. Martin (2006) declared that this approach is abstract and subjective due to the fact that it inspires disagreement in reporting opinions. Cromby and Nightingale (1999) stated that in the process of understanding a phenomenon, certain methods and principles have been employed. Then it would *'create knowledge which will be taken as the truth'*. Different activities and purpose could create different 'truths'. According to Cromby and Nightingale (1999, p. 6), there *'can be no fact which is really true in every culture and for all time'*.

In this study, due to the limitations of Hirschheim and Klein (1989), which is based on Burrell and Morgan's four paradigms, the approach outlined by Creswell (2003) has been chosen for modelling the research. Mitroff (1983) and Hirschheim and Klein (1989) identified these limitations as overlapping and overstated concepts in their divisions. According to Creswell's (2003) criteria (i.e., understanding, multiple participant meanings, social and historical construction and theory generation), this research is modelled on constructivism, as this is intended to construct a solution platform for information support aids in the work environment.

Since the focus of this study is to gain insight into users and developers of the existing system (EDRMS), and to offer interpretations of the benefits and problems of using and developing an EDRMS, the researcher's philosophical assumptions underlying this research come from the social constructionism orientation. The social constructionism philosophical orientation is a sociological theory of knowledge put forward by Berger and Luckmann (1966), according to whom three elements are involved in analysing the social construction of reality: individuals, society and their

interaction. The social constructionist orientation is employed in this research to uncover and construct on the problems of using an EDRMS. The focus of social constructionism is subjective, looking at how individuals or groups apprehend, understand and make sense of social events and settings (Gephart, 1999). This research seeks to delve in-depth within the context of EDRMS users' and developers' social interactions and experience. Prasad (2002) suggested that contemporary interpretivists decline to be *'confined, policed and disciplined'* by outdated notions of interpretivism's limitations and is therefore committed to the wide philosophy of social constructionism. As highlighted in Bahde (2003), social constructionism challenges complacency in interpreting things taken for granted. In fact, it suggests taking an active role in discussing the preferred ways of exploring realities and possibilities.

Based on the interpretivist view, this study found that the qualitative methodology was applicable, as the aim of this study was to investigate in-depth and elicit the opinions of developers and users. In addition, the study tried to identify the individuals' reasons for choices and relate these to future aspects. On the other hand, this study does not attempt to speculate nor to make general claims. The most important aspect of this study was to define and understand the structures adjoining the social phenomenon, but not to control it.

3.3.1 Interpretive research approach

The interpretivist method is a complementary alternative to positivism and has a focus on comprehending and clarifying human and social reality. Crotty (1998, p. 64) declared that the interpretivist method *'looks for culturally derived and historically situated interpretations of the social life-world'*. According to Taylor (2006), interpretivists argued on the basic that sociological approaches are about exploring,

accepting and translating the implications that society practice to reveal their activities in their social world. Moreover, Taylor (2006) also stressed that the natural sciences approaches are not suitable to the study of humanities.

Interpretive approaches to research in IS *are generally 'aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context'* (Walsham 1993, pp. 4-5). Examples of interpretive research include the work of Orlikowski (1991), Walsham (1993) and Myers (1994). Using the interpretive perspective will enable us to increase our understanding of the critical, social and organisational issues related to the use of EDRMS in organisations.

3.3.2 Research ontology and epistemological positions

Since social science research is about the study of human beings, as opposed to 'objects' as in the natural sciences, the interpretive paradigm with the qualitative research approach is adopted to achieve the research objectives. Developers and users interpreted problems and issues as a process of sense making in the EDRMS social setting. Benton and Craib (2001) claimed that the study of human beings involves a complex setting in social sciences since they are not as similar as 'objects' of chemistry and physics in pure sciences. Interpretivists trust that reality in social sciences needs to be interpreted because it is not realistic to arrive at this through observations. A qualitative approach has been chosen, as this strategy has the potential to produce data from developers and users in their natural setting. In this context, the 'people' – the developers and users – interpret their experience and attach meaning to what is occurring throughout their involvement in developing and using an EDRMS. In qualitative research, data are collected from people within their environment through a more flexible and open-ended method, which in this case is

through semi-structured interviews. Amaratunga et al. (2002) claimed that this technique has the ability to understand individual meanings and adapt to new issues and ideas as they emerge. In addition, this method also has the ability to look at change in the surroundings over time. According to Merriam (1998, p.15), *'qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world'*. Following this context, this study explores and assesses the experiences developers and users have in relation to identifying their problems in using an EDRMS.

3.3.3 Case study strategy

According to previous studies (for example, Abramson, 1992; Bromley, 1986; Merriam, 1998; Stake, 1981 and Yin, 2003), the use of case studies has gained extensive recognition in managing research. Yin (1989) stated that the reason why a single case study method was accepted is due to the aspects of being contemporary and uniqueness. According to Yin (2003), case studies are an appropriate approach: 1) when the investigator has little control over events, 2) when the stress is on the present phenomena in an actual context, and 3) to answer the "how" or "why" questions. Merriam (1998) indicated that the choice whether to use a case study or other research designs will be based on the main aim of the research. According to Bromley (1986, p. 23), a case study is defined as an effort to *'get as close to the subject of interest as they possibly can, partly by means of direct observation in natural settings, partly by their access to subjective factors (thoughts, feelings, and desires)'.* Yin (1994) recommended that, case studies might be planned as single-case or multiple-case. In addition, research which is conducted based on replication (instead of sampling logic) will use multiple designs. Furthermore, Yin (1989), argue

that even though it is hard to choose cases for the case study method, the choice could offer a chance to increase what could be learned as stated by Stake (1995). Nevertheless, a study should always have well-defined boundaries. According to Tellis (1997), there are several concerns that should be considered in implementing a case study method:

- getting permission from the organisation of the subject;
- adequate sources while in the field;
- Have a proper schedule of data collection activities; and
- Preparing for unexpected occasions.

Case study researchers have noted that case studies create much more comprehensive information (Yin, 2003; Benbasat, Goldstein and Mead, 1987)). In addition, they also have the ability to acquire understanding through discovering meanings. According to Yin (2003, p. 2), *'the case study allows an investigator to retain the holistic and meaningful characteristics of real-life events'*. Denscombe (1989) stated that implementing the case study method permits the investigator to study phenomena in a natural setting. However, according to Bryman (1989), generalisation is perceived as one of the main problem of case studies.

In this study, a case study approach has been adopted and supported by the interpretation of Yin (2003) which highlighted that case study research involves an empirical investigation that explores a current phenomenon studied by the researcher within its actual context. The main reason for choosing a case study method in this study is due to the environment of this research; specifically, the context was well-defined and there was no real control over events.

Furthermore, this study was also consistent with the recommendation by Benbasat et al. (1987) that the case study research method is a practical approach for three purposes:

- it is essential to investigate the phenomenon in its normal situation;
- the investigator can enquire on 'how' and 'why' questions in order to understand the nature and complexity of the process that is taking place; and
- the study is conducted in an area where previous studies have been undertaken.

The purpose of this research was to investigate the problems associated with using EDRMS with existing approaches and to compare this against SW approaches. The benefits of SW approaches were explored through the literature review**.** The researcher needs to use a research methodology that allows for close attention to the benefits and problems of existing development approaches compared to SW approaches, while not controlling or influencing the experiences of the people involved. Thus, the application of case study research seemed to be appropriate.

In this investigation, the problems of developing an EDRMS with existing approaches were explored through in-depth field interviews with EDRMS developers and users. In each interview, a probing technique was used to obtain a qualitative and complete understanding of problems of using EDRMS by means of existing approaches. A proposed SW benefits framework was built and compared with existing approaches.

3.4 Research design

The study can be viewed as a solution development research that is designed to outline practical benefits for the target user group of the existing system and also to improve current theoretical approaches of SW-based applications. Pure qualitative

case study, as discussed earlier, resulted in practical benefits and development of a new domain ontology. This allowed an innovative solution development approach to meet the practical demands of users. The pursuit of the study involves four phases, as illustrated earlier in Figure 3.1. In phase 1, problem identification, a literature review is conducted to form a sound foundation to justify the choice of research questions, conceptual framework and method. The second phase involves framework development activity, where data collection and analysis are conducted to gain a clear understanding of the issues and benefits of the existing approaches and SW approaches. The findings constitute a basis for the development of a new solution. The third phase is related to research outcomes. In this phase, the frameworks of SW and existing EDRMS are compared. The focus of the comparison is the key uses of SW over the existing EDRMS features. The final phase is solution development. This phase involves real system development and testing where a proof-of-concept prototype was developed and evaluated through potential users in an education institute. In this phase, a comprehensive ontology is constructed through the guidance of the adopted methodology (Haghighi et al., 2013) which is discussed in Chapters Five and Six.

3.4.1 Data collection

From the literature, it is apparent that there are a number of potential approaches that could be engaged in obtaining data for qualitative research. According to Mahoney (1997), the most common approaches used in qualitative research involve observations, interviews and focus groups. Normally, there are two main questions that need to be answered by the investigator: 'how may the research questions be answered?' and 'which is the best possible method to provide rich data?' Based on the literature review, approriate methods were identified. In the context of the current

study, questionnaires were considered to be too-structured. In addition, although they allow for open-ended question, follow-up issues related to the answers could not be highlighted spontaneously (Miller, 2002). Therefore, they were not employed in this study. The second method that could be used to provide data for qualitative research is through observation. However, it was found that it is not suitable to be used for gathering factual data, especially when obtaining people's experiences, which would normally be more meaningful through oral communication.

Mason (1996) stressed that the philosophy of qualitative study is about how the social world is understood, interpreted, experienced and produced. The method has to allow a certain degree of flexibility in collecting data while ensuring a high level of sensitivity to the data that is captured. Burn (1998) stated that, qualitative interviews give opportunities to the researcher to have various selections when conducting a study. According to Goldstein (2004), in capturing respondents' perceptions, a researcher needs to be competent enough to handle the process involved due to the lack of rules. Hence, the main data collection method adopted in this study was based on semi-structured interviews and focus groups. A procedure for administering interviewing was developed and is shown below in Figure 3.2:

Hence it was proposed that the main data collection method adopted in this study should be based on semi-structured interviews and focus groups. A procedure for administering interviewing was developed and is shown below in Figure 3.2:

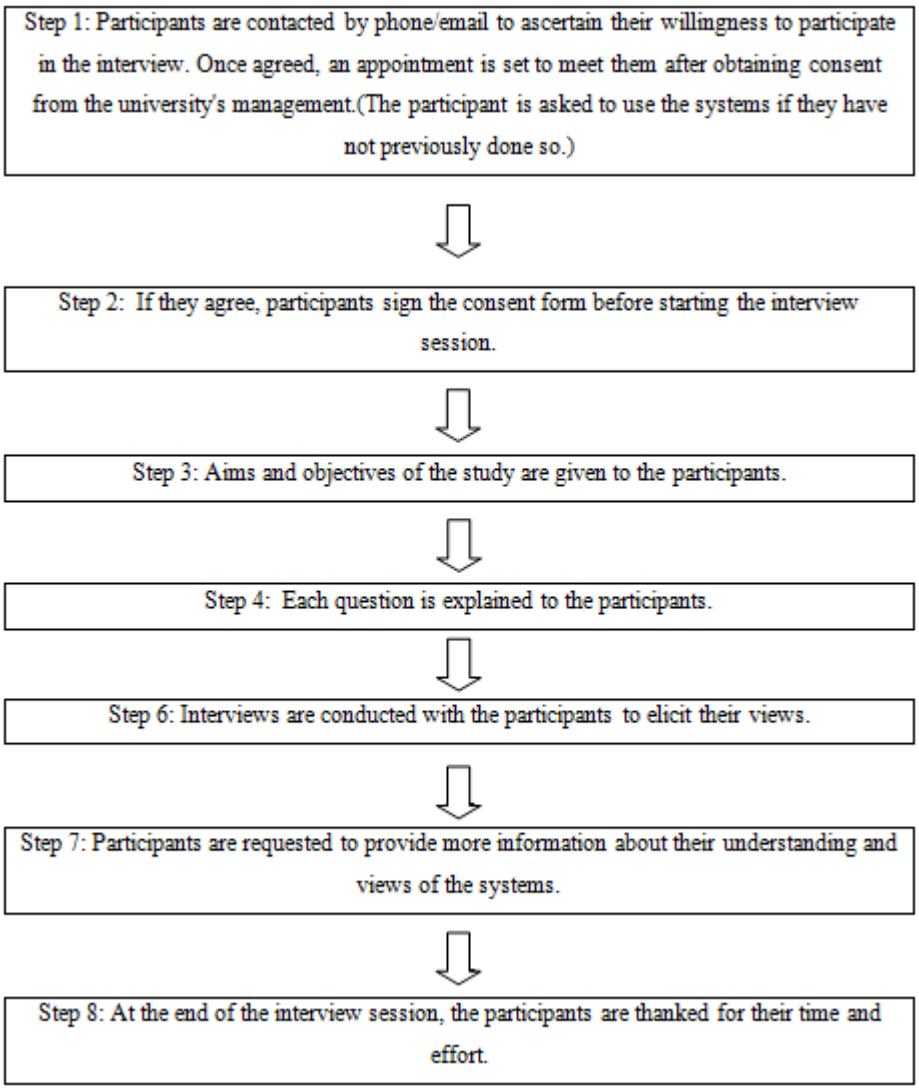

Figure 3.2: Procedure used for administering the interviews

First, participants were contacted by phone/email to ascertain their willingness to participate in the interview and, after receiving consent from the university's management, an appointment was set to meet them. If the participants agreed, the next question was whether they were familiar with or have ever used the system. If not, they were asked to use the system to ensure familiarity with it. Next, participants were requested to sign a consent form before starting the interview session. Then, aims and objectives of the study were given to the participants and questions were explained to them. Next, interviews were conducted with the participants to elicit their views.

During the interviews, an audio recording was made with the interviewee's permission. Where permission for the audio recording was not given, notes were made during the interview and written up immediately afterwards. Participants were requested to provide more information about their understanding and views of the systems. Finally, at the end of the interview session the participants were thanked for their time and effort.

3.4.2 Case analysis

In this study, the analysis of qualitative data from the interviews was guided by the coding paradigm established by Strauss and Corbin (1998). Under this paradigm, coding is referred to as the process of analyzing data and it involves three levels of analyses: (a) open coding, (b) axial coding, and (c) selective coding, with the aim of gathering a complete picture of the information obtained during the data collection process and gradually developing a theory which is based on findings (Strauss & Corbin, 1998). The paradigm was very instrumental in guiding the data analysis process in order to ensure that it was done systematically in order to answer the research questions. To facilitate the analysis process, a software product called ATLAS.ti 5.0 was used. The acronym stands for 'ArchivfuerTechnik, Lebensweltund Alltagssprache' which means 'archive for technology, the life world and everyday language', and the extension 'ti' stands for text interpretation. The detailed explanation of the process is presented in the next section.

3.4.2.1 Coding/Conceptualising

Coding is the process of exploring raw qualitative data. According to Strauss and Corbin (1998, p.3), coding is defined as the analytical process through which "data are fractured, conceptualised, and integrated to form theory". The aim is to identify, create and connect the concepts. There are 3 types of coding:

a. Open coding

This level of analysis involves the process of opening up the text and exposing thoughts, ideas and meanings contained in the data. The purpose is to uncover, name and develop concepts. Next, data are broken down into discrete parts, closely examined and compared for similarities and differences. Similar or related concepts are grouped under more abstract concepts which are called 'categories'. The major purposes of open coding are to conceptualise and label the data findings.

b. Axial coding

This process involves the activities of relating categories to their subcategories. The purpose is to reassemble data that were fractured during open coding. According to Strauss & Corbin (1998), axial coding is a foundation of their approach. On the other hand, Charmaz (2006) considered axial coding as highly organized and non-compulsory.

c. Selective coding

This process involves integrating and refining theory. The first step in integration is deciding on a central/core category. The central category represents the main theme of the research. It is also in the form of a few words that seem to explain what 'this research is all about'. As mentioned above, this study adopted only the open coding and axial coding.

3.4.2.2 A process of analysing the interview documents using Atlas.ti software

First of all, interview documents (primary documents) were assigned to the Atlas.ti software. Then, the next step was to identify areas in an interview document that were of further interest and assign key words (codes). Next, the data segments based on the codes which were assigned were compared. Then, Primary Documents, codes, and

memos were organized using “Families”. Finally, semantic terminological networks were built from the codes which were created.

3.4.3 Focus groups

According to Bryman (2001, p. 338), the focus group offers the opportunity to study *‘the ways in which individuals collectively make sense of a phenomenon and construct meanings around the context of the phenomenon’*. In addition, Bryman (2001) highlighted that focus groups allow a more realistic account of how people think of a phenomenon as they allow ideas and views to be challenged interactively compared to one-to-one interviews. In this study, since there was an opportunity for a face-to-face meeting with a group consisting of experts who have a sound knowledge of oral history and records management, the focus group technique was useful in assisting with data collection and ontology validation. The advantage of choosing this method was that it allows the researcher to avoid the need for a long and complex questionnaire dealing with more than 200 ontology concepts.

The focus group was set up to validate and refine the ontology-based system and involved participants engaged in managing and supervising the oral history projects knowledge domain. The selection of the participants in the focus group was based on their professional experience in the area of oral history projects management nationally and internationally. In addition, the aim of the focus group was to obtain advice from the participants and use this knowledge to validate the ontology draft. During the process, the ontology draft was improved and refined until satisfaction was achieved.

To conduct the evaluation, this study had a protocol whereby the facilitator first presented an overview of an ontology-based system to the participants by showing them the main concepts of the proposed ontology and their sub-classes. Each ontology

concept, its sub-classes, and the relationships between them were discussed. All the suggested changes, such as deletion of some concepts, modification of relationships and addition of new concepts were recorded. In the next sub-section the project is discussed through feedback from the various domain experts who helped refine the ontology as part of the evaluation process.

3.5 Chapter summary

In this chapter, the theoretical and philosophical assumptions underlying the research methodology in the IS field were reviewed. In addition, there was a discussion of the research design of this study. Table 3.4 presents a summary of this chapter by highlighting the major decisions taken in order to conduct the research work.

Table 3.4: Summary of the research design

Level of decision	**Choice of reasons**
Epistemological and ontological assumptions	*Interpretive* It is the intention of the researcher to deeply explore and gradually acquire the views and perspectives of developers and users, while also seeking to understand why individuals make the choices that they make and associate one thing with the next. Using the interpretive perspective will increase the understanding of the critical, social and organisational issues related to usage of EDRMS in organisations.
Research strategy	*Single case studies* The researcher needs to use a research methodology that would allow for close attention to the benefits and problems of existing development approaches compared to SW approaches, while not controlling or influencing the experiences of the people involved.

	According to Yin (2003) case study research deals with an empirical Inquiry that investigates a contemporary phenomenon that is explored by the researcher within its real-life context.
Research techniques	*Semi-structured interviews* Used to understand the phenomenon based on the experience of EDRMS developers and users .
Case organisations	*Faculty of Information Management, Universiti Teknologi MARA, Malaysia.* Involving a Malaysian public University that is actively involved in oral history based records management activities in Malaysia. The University conducted the oral history records management activities through the use of the latest technological applications and has set up an Oral History Laboratory to store and manage its Oral History collections.
Subject	*Problems and issues in using EDRMS* The subject of this study involved educators and students of Faculty of Information Management, Universiti Teknologi MARA, Malaysia

Chapter 4

Data collection and analysis

4.1 Introduction

The prototype based solution is outlined using case study findings. The discussion on data collection and analysis is therefore of necessity in this study to answer the stated research questions in Chapter One and supported by the literature review presented in Chapter Two. This study intended to gather information from the users of EDRMS in the selected case organisation especially on the issues and benefits related to the usage of EDRMS. The interview questions were developed based on the research questions that could serve as an interview guide (Appendix A1 and A2) in order to obtain answers to the research questions. The study used two states of interviews to find issues of EDRMS (Findings A) and benefits of initial ontology (Findings B) which have emerged from the case study findings.

As part of the essential aspects within the research, the chapter presents the rationale, process and key findings from field interviews. These semi-structured interviews were undertaken with users and information systems practitioners with a view to understanding the benefits and issues of EDRMS.

4.2 Data collection

4.2.1 Rationale

Before developing a framework of benefits and issues of EDRMS, it is important to determine the existing state-of-the-art in the target literature to obtain an overview of

the field. This is to avoid waste of effort and to ensure that any contribution will be cumulative in the sense that it builds on existing knowledge established during the literature review. Further for such a proposed framework to be acceptable to users and practitioners it is necessary to understand their expectations such as which assumptions are valid, which elements are present, what prior skills or knowledge are required, who is intended to use the approach and how the results are to be communicated.

4.2.2 Justification of the choice of data collection method

Many methods have been employed to elicit data for qualitative research. The most common methods employed in qualitative research include observations, interviews and focus groups (Mahoney, 1997; Gill, Stewart, Treasure and Chadwick, 2008). Generally the researcher needs to answer which is the best possible method that could provide better and supportive findings to make decisions. In the course of reviewing the literature several methods were identified and utilised. In the context of the present research questionnaires were not considered as they are normally too structured and although they allow open-ended questions, follow-up issues related to the answers of the questions could not be highlighted spontaneously (Miller, 2002). Observation, on the other hand is another method that could be used to provide data for qualitative research, however in this study the collection of factual data is deemed not appropriate, especially when eliciting the experiences of participants which would normally be more meaningful through verbal expression.

Mason (1996) explained that qualitative research focuses on how the social world is understood, interpreted, experienced and produced. While ensuring effective sensitivity on the data that will be captured, the research method also has to allow a certain degree of flexibility in collecting the target findings. Qualitative interviews

allow the researcher numerous choices on how to conduct the interviews (Burn, 1998). According to Goldstein (2004), with a lack of rules the researcher will have to be personally competent to cope with greater responsibility in the process of capturing respondents perceptions. Therefore, the main data collection method adopted in this study is based on the semi-structured interview technique.

4.2.3 Demographics

The final sample consisted of thirty participants who are developers and users of the EDRMS in the Faculty of Information Management, Universiti Teknologi MARA, Malaysia (Mara University of Technology, Malaysia). In terms of selection of participants who had at least three years' experience, the non-probability sampling method, i.e. purposive sampling was adopted from the categories described in the upcoming Chapter Five (Section 5.1). Purposive sampling was chosen in view of the large number of interested groups and involved about thirty informants (five from group one and twenty-five from group two). The numbers in each category of samples was reviewed during the research in order to ensure that subjects interviewed were as representative as possible. The selection of interviewees was based on their experience and knowledge in the field in order to ensure the credibility of the information obtained.

4.3 Data collection method

In this section, the method for collecting and organising the qualitative findings from the interviews is discussed in further detail. It covers the general approach including a description of the process and settings, and the materials, covering the specific questions and prompts used in the interviews. The objective was to identify the benefits and issues of EDRMS.

Subjects were engaged and guided through a semi-structured interview at the Faculty of Information Management, University Teknologi MARA using some pre-written questions. During the interview an audio recording was made with the permission of interviewees. Where such permission was not given, notes were made during the interview and written up immediately afterwards.

Interview subjects were engaged using non-probability sampling, i.e. purposive sampling. Subjects were approached via phone/email to ascertain their willingness to participate in the interview and after gaining consent from the university administration (Case organisation) an appointment was made to meet them. Ethical consent for the study was obtained in accordance with University procedures. All interviews took place at the Faculty of information Management, University Teknologi MARA, either in management offices or designated meeting rooms.

The interviews took place between 9am and 5pm on working weekdays, with the majority occurring before lunch (between 9am and 1pm). An open-ended interview schedule was prepared to capture primary data from individual interviewees. The questions in the schedule which are related to the research questions, provided for some variations to allow for particular knowledge, experience of interviewees and responses gained from previous interviews. Interviews were conducted at the management office of participants or designated meeting rooms where possible. Length of the interviews was about 60 to 90 minutes.

These observations are important because they indicate that the subjects were willing participants speaking on familiar topics in a tone and manner which was comfortable. The subjects were not rushed or interrupted, thus allowing them to control the duration of the interview. Such an arrangement enabled participants to

speak reasonably freely, the presence of recording equipment and note-taking did not distract them from answering the interview questions.

4.3.1 Materials

We described a series of questions related to problems of using the EDRMS at the current stage. The set of questions was distributed to users of the EDRMS. To capture information related to technical details a different set of questions was used when interviewing the developers of the EDRMS. The third set of questions was used during the focus group session designed for ontology evaluation. The questions can be seen at Appendix A1, A2 and A3.

4.4 Data analysis method

This section describes the analytical method applied in the interviews. The interview guide consisted of three sets of question as outlined above. The interviews were conducted from November 2012 to January 2013. Most of the respondents consented to the interviews being recorded on a digital recorder. On average, an interview session took about 60 to 90 minutes and the interviews were then transcribed into MS Word documents, analysed using Strauss and Corbin's (1998) model. To facilitate the analysis process, a qualitative data analysis software called ATLAS.ti version 5.0 was used as discussed in Chapter Three.

4.4.1 Coding/conceptualising

Initially, through the open coding procedure, more than 300 codes were identified. This was done through microanalysis of the interview transcripts where line-by-line analysis was carried out to identify concepts in the data. Subsequently, the concepts were further developed with their properties and dimensions, ultimately forming

categories through the axial coding procedure. This process has been guided by the coding paradigm (Strauss and Corbin, 1998) as it was defined in Chapter Three.

4.4.2 Labelling codes

Once a concept is recognized a label is given to it using keywords that describe the phenomenon in the data. Through the software text passages were read and the area/part that are of further interest were highlighted/selected and then key words (codes) were assigned. This process is called the Textual-Level working phase.

4.4.3 Categories and sub-categories development

Gradually the concepts with their properties and dimensions were fully developed into categories. Taking examples from Strauss and Corbin (1998), what is the higher order concept for birds, kites and planes? Based on this question, we found that the main properties of them are being able to fly. Therefore a more abstract explanatory term such as 'flight' could become a category. Furthermore subcategories help to specify categories further by denoting information such as when, where, why and how a phenomenon is likely to occur. For instance for the category of 'Drug using' the subcategory might be 'Types of drugs'.

4.5. Issues of the existing EDRMS (Findings A)

The concepts with their properties and dimensions of issues in the existing EDRMS were fully developed into categories. At this point four main categories were developed under the issues of EDRMS namely Searching, Navigating, KM and DB management. A range of associated issues was also found that are classified as other categories. Each category is explained in the following sub-sections. Previously in Chapter Three, Table 3.1, identified the issues with existing approaches (existing

system) and the following sub-section will present practical issues identified among the findings.

4.5.1 Practical findings

4.5.1.1 Searching issues

One of the issues of EDRMS highlighted by the users was categorised under Searching. In this category users reported that they found EDRMS needed to be improved in terms of its effectiveness and precision. Below are quotations from the interviewees.

Effectiveness

Users believed that the existing system provided limited searching options.

> *The most disappointed thing is, I already use this system, and there are some information that i cannot find. This maybe because of this system still in the development process and not complete yet. For example, just now, I am looking about engineering and Malay tradition but there is no result. That makes me feel disappointed about this system because I cannot find the things I wanted. (Interviewee 08, para 51)*

> *This system is quite complex and difficult to use because it only depends on one type of searching method. (Interviewee 06, para 11)*

Precision

Users found that the system provided limited parameters and as a result the search output was not precisely presented.

> *Secondly, the parameter prepared in the EDRMS system for the user to find the information is limited. They are just using a few parameters in order to find the information. (Interviewee 01, para 7).*

This system is easy for those who know the topic content in this system, such as the lecturer. This is because they taught the students who already carried out the oral history project. However, for those who are first time user will feel this system is not effective. This is because, the searching cannot fulfil their request. (Interviewee 3, para 27).

4.5.1.2 Navigating

Another issue of EDRMS is categorised under Navigating. In this category users reported that they found some issues related to EDRMS in terms of browsing, user interface and user friendliness. Under user friendliness, a subclass is Language. Below are quotations from the interviewees.

Browsing

Users found that it was very difficult to navigate through the system in order to search for the target information.

The navigation in the EDRMS system quite difficult for the user to find the information. This is because of the less interactive of the system in order to help the user to find the information needed. (Interviewee 01, para 29.)

User interface

Users found that the interface of the system needed to be improved as they were too simple, not interesting, and unorganized.

Firstly, the interface of the system is too basic. (Interviewee 01, para 38.)

The interface is too plain (Interviewee 18, para 60)

The interface need to be improved. (Interviewee 22, para 200)

I hope the main page of this system will be improved. Make it more interesting and organized, so that get to attract attention. But, now the page is not in order. (Interviewee 25, para 97)

User friendliness

Language

Users found that the system was not bilingual, not consistent in terms of the language used and not standardised.

> *The most disappointing thing is, this system still don't have bilingual. This is because, for the first trying I am looking words in English. But there is no result. Then, I understand, this system still in the process. So, I understand about the problem. (Interviewee 06 para 47)*
>
> *Grammatical error, language wise. What are you going to use? Malay language, English language. If it is in English, it must be checked - properly. In order to translate, it is a very tedious to translate the whole thing. You need money. So, if you get some funding, it's okay. To get good translator is another thing. At this point, if you want to do it quickly, you have to identify what are you going to post in the public domain in English. The title, abstract. Please care about the language, English language. (Interviewee 13, para 127)*
>
> *The layout and the searching criteria is okay. But, the arrangement is most important. For me, the user will look for the available data when they use. But, if the standardization of language is less corncern, they will say that this system still in the try and error level. People will not see the stability. (Interviewee 24, para 63)*

4.5.1.3 Knowledge management

Another issue of EDRMS is categorised under KM. In this category, users reported that they found some issues related to EDRMS such as data integration and representation. Under representation there are three subclasses that is abstract,

description of collections and description of figures. Below are quotations from the interviewees.

Data integration

Developers found that they faced data integration problems. In addition, users suggested that this system be required to provide extensive information.

> *So, after we use this XML and PHP, we will still have the problems which is redundancy and integration of data.(Developer 1, para 14)*
>
> *Like this, I see in the national library, they have their oral history like Sheikh Daud Al-Fatani. In EDRMS none. If we can enter in, i'm sure the Manuscript Center will subscribe. The main Manuscript Center is in the Southest Asia. The Malay Manuscript Center is in the national level. Thus, the National Library will be the Southest Asia's reference. The information is already available. We will key in this thing because Institute of Language and UM already become one, integrated about this manuscript. If can by the God wills, with this existing system, if we include it will be more capable to give provide extensive information—especially to the religious and history figures. (Interviewee 15, para 132)*

Representation – description of subjects

Users found that a proper description of search subjects needed to be created.

> *For example, like us – when we are talking about the figure, we can include a few about their background. Thus, people will know who really he is. From the long transcript, we already done a short description. (Interviewee 12, para 148)*

Description of collection

Users suggested it was necessary to provide a description of collections as more than a representation of definitions.

From my opinion, the thing that we can add is just the description. The descriptive of the collection. (Interviewee 14, para 67)

4.5.1.4 DB management

The third issue of EDRMS is categorised under DB management. In this category users reported that they found some issues related to EDRMS such as data quality, data redundancy, display, maintenance, system feedback, system performance and the user guide. Below are quotations from the interviewees.

Data quality

Developers found that data quality was very important to improve searching precision. In addition users were very concerned about the ability of the system to provide multiple views of documents. Furthermore users stressed the importance of data quality.

We can add more from their skills side, enter data or material classification so it will give huge effect to the information searching retrieval for the precise of searching system. (Developer 4, para 125)

As I know, this system still in the completing process. Maybe I can only view or find the transcript or info about something. For examples, about science, communist army figure, but still cannot view yet. May be, I can view it in the future and maybe there are others format, maybe PDF or any format relate where the old computer doesn't have PDF which they only have Microsoft Word. But still, they can view in a form of Microsoft Word. (Interviewee 11, para 46)

I think the improvements, may be before the audio included, we make the editing first. At least, the sound we don't want to hear. And we digitize the transcript, maybe there is error, or maybe the location is not right. That thing can be

corrected and make it quite dark so it will become more clearer. (Interviewee 20, para 38)

Like the author, we have to make the outline. We want to use Tan Sri, Mr, their name, or the title. All the details. (Interviewee 22, para 200)

Data redundancy

Users stressed the importance of eliminating data redundancy in order to avoid work repetition.

Okay, if I say just now, the data is redundant. So, next time, if can when the data is uploaded to EDRMS, it can detect the data. If there is duplication of data, there will be the notification, so that, there is no need repeated work. It will waste time and all. (Interviewee 09, para 78)

Display

Users found that the user interfaces needed to be improved to make it more appealing to users.

Or, if we find about a figure, we can provide the related research or with a few pictures. (Interviewee 10, para 133)

I hope the main page of this system will be recovered. Make it more interesting and organized, so that get to attract attention. But, now the page is not in order. (Interviewee 25, para 97)

From the improvements aspect, I think we can utilize image. This is because the image can capture people's focus, if only the text it will look very dull. So, we use the image that will look very interesting and easy for the user to browse. I think that by adding the image and improving the DB, interface will improve the existing system. (Interviewee 21, para 49)

Maintenance

Users found that it was important to have backup measures for the system. Users also found that skills were an important aspect in developing and maintaining the system. In addition, they appreciated that the rapid development of technology contributes to technology obsolescence.

> *In the future, we plan to have the outside storage, so that if something disaster happened we will have the outside backup. That is our future plan. (Developer 1, para 113)*
>
> *The main problem is not about the system, but it is about us because the skills is very limited. So, if we carry to utilize the system in total, we must have the team or skills to develop because it using multi language. If we only know only one, we have to find other people. And there are not many people know, because the open sources problem at an early stage. For example in the year 2008, there were not many people knew, especially, the older generation of system people, they were less in skills. (Interviewee 2, para 92)*
>
> *I think this system problem is their version, which is keep changing. So we already set our setting to the old version thus when out it become new version. So, it need to change back to the new system. So, this is the problem. So, hopefully next time, this thing will not happened again. That means, if the new version out, we can enter. There's no need to waste the time more because if we do the old system, the new system will come. We need to change to the new system. Waste time, waste money and all. This is the problems of any technology which is obsolescence. (Interviewee 3, para 59)*

System feedback

Users found that it was important to have a feedback mechanism in the system so that the system could be improved based on the user feedback.

> *For the direct improvement, i think we can put a comment or suggestion box.(Interviewee 10, para 133)*
>
> *Maybe from the aspect – this system can help the user to find or get more information by putting a suggestion box from the information obtain. Maybe can provide a suitable comment box in the system for the user reference. (Interviewee 19, para 106)*

System performance

Users found that system performance needed to be upgraded specially in terms of user access.

> *Okay, indeed the improvement is needed; upgrade it from the current version. For example, maybe we should improve from the user access aspect. (Developer 5, para 242)*

User guides

Users found that the system should have had better usage information and a user guide to assist them in using the system effectively.

> *The thing that made me disappointed is the brief information about this system. This system should have the concise information and objective of the formation also how to use this system. (Interviewee 7, para 95)*

4.5.1.5 Other issues

Other than the four main issues related to EDRMS, users also highlighted another issue that is categorised under Content. Under this issue, there are two subclasses, that

is Updating issues and Scope (for example, more content is needed). Below are quotations from the interviewees.

Content

Updating issues

Users found that it was important to improve data quality, create duplication alert notification and update the document viewer.

> *We can add more from the their skills side, enter data or material classification so it will give effect to the information searching retrival for the precise of searching system. (Developer 4, para 125)*
>
> *Okay, as I said just now, the data is redundant. So, in the future, if possible, when the data is uploaded to EDRMS , it can detect the data. If there is duplication of data, there will be a notification, so that, there is no need repeated work. It will waste time and all. (Interviewee 09, para 78)*
>
> *As I know, this system still under the development phase. Maybe I can only view or find the transcript or info about something. For examples, about science, communist army figure, but still cannot view yet. Maybe, I can view it in the future and maybe there are others format, maybe PDF or any format relate where the old computer doesn't have PDF which they only have Microsoft Word. But still, they can view in a form of Microsoft Word. (Interviewee 11, para 46)*

Scope (e.g. more content needed)

Users found that the system needed to add more oral history documents, widen the scope of the subject and provide multimedia information to the user.

The first thing is, the improvement that can be done is to add more information about oral history. So that, there will be more user of this system. (Interviewee 8, para 54)

I think this system is still in the developing phase, migrating process from the old to the new version. So, sometimes there will be changes from the taxonomy, presentation and the use of the system for the user. Next thing is, maybe this system is still new from the OH contexts and the expectation is quite high. Maybe the user aspect to get some or certain information but it is still unavailable. Maybe there is no content or any else. But, that is maybe from the volume or the information number aspect that people can access from the system. (Interviewee 5, para 86)

Maybe, the interest in Malaysia – from the religious aspect. So, maybe there are not many people fills about the religious. So, if can we want all walk of life can access the information. When we insert all the information, I think all ages, education levels will get to know this thing. So I think people will ready to subscribe this system. (Interviewee 15, para 128)

Interview many figures so that we can be reference hub. (Interviewee 17, para 67)

I think the information is still very few, not up to the expectation. Not up to my expectation. Still three percent, but I must be considered also because this is pilot system. But after this I want to see more information added. (Interviewee 21, para 49)

The increasing of data, I think what we – rather than the text, maybe – we may include something else. For examples, picture dan anything include with the figure, event. So that the system can attract attention and people confidence. It

is not when they satisfied when get the right information but they want to dig more. I think that is important. (Interviewee 23, para 120)

4.6 Benefits of EDRMS (Findings B)

After developing an initial ontology from the existing system the study drew on findings from interview questionnaires based on participants' experiences. Findings were then classified into categories. At this point, four main categories were developed (under the wider category of benefits and issues related to the EDRMS) namely Searching, Navigating, KM and DB management. Associated benefits were also found that were classified under other categories. Each of these categories is discussed in the following sub-sections.

4.6.1 Practical benefits

After employing the new ontology-based system, the participants expressed their views on the following benefits:

4.6.1.1 Searching

One of the benefits of EDRMS is categorised under Searching. In this category users reported they found the EDRMS improved searching effectiveness, improved searching precision, facilitated access to the Oral History collection, facilitated searching of information and the storage and retrieval of information. Below are the descriptions of each sub-category followed by quotations from the interviewees.

Facilitate searching of information by using ontology

Users found that the ontology based system contributed to easy access to information and searching. Information could be located effectively and efficiently, plus retrieval processes could be done quickly to save the users' time.

"when I use the system (Ontology system), the document that I search, I can find it easily without having a problem in term of keyword, text or something like I want to find". (Interviewee 04, para 17)

"This system is already effective, efficient and useful for searching any information of historical aspect. (Interviewee 04, para 26)

"Very quickly, we can search user or history that already recorded before this. It is never found before" (Interviewee 06, para 2).

"Besides that, it is easy to use this system because we only use keyword to search" (Interviewee 09, para 10)

"The first speciality that I can see is, it has a classification. Where it is classified according to the subject. If we want to find agriculture, we can find it. Also if we want to find author name or leader we can also get it. So, it is easier for us to search" (Interviewee 12, para 20).

"So, it is easy for those who interested in research" (Interviewee 15, para 16)

"This system is very good at helping to find the information" (Interviewee 16, para 12)

"There are many benefits can be used, because this system is more to the using of the web site. So, we can do the work anywhere and anytime. There are no problems as long as there is internet connection" (Interviewee 18, para 4)

"The user will get to know about the great leader, politician, and everything that I think very useful for student reference. It is especially for school students if they make the local study. So, I think this system is very benefit for them. It is because they can access both the audio and transcript" (Interviewee 20, para 4)

"What I can see, this system is a great help to find the information" (Interviewee 23, para 14)

EDRMS benefit is it can save user time in order to find the information needed. Thus, this system can be used everywhere even without going to the library to find the material. (Interviewee 25, para 14)

Facilitate access to Oral History collection

Users found that the ontology-based system assisted them to access the oral history collection easily and quickly. The users also found that it could save time.

"The oral history documents that kept manually in the lab and be used localy, is easy to access universally" (Interviewee 02, para 12)

"It is easy, fastest and accurate by only typing the keyword" (Interviewee 03, para 4)

"The next benefit is from the side of accessibility. This system can be accessed from all over places and the material placed at one place" (Interviewee 05, para 12)

"For me, rather than the Oral History Lab we now have more advantages for the reference. The students did not need to ask the key's lab from the lecturer. So, now they can access anywhere" (Interviewee 11, para 6)

"There are many benefits. For example, for access purpose. It is not only for the faculty [but also] for the researchers, readers, external researchers from other - -. The public can get access [to the collection]. It is very easy storage and acces" (Interviewee 13, para 24)

"There are many benefits can be used, because this system is more to the using of the web site. So, we can do the work anywhere and anytime. There are no problems as long as there is internet connection" (Interviewee 18, para 4)

"It is easier from the side of access for the material. Without any physical or manual effort, we will get the material. We just have to go through this system. So, we can access the material anywhere. Overall, we get to identify the target and the material through [EDRMS]" (Interviewee 19, para 18).

"The user will get to know about the great leader, politician, and everything that I think very useful for student reference. It is especially for school students if they make the local study. So, I think this system is very benefit for them. It is because they can access both the audio and transcript" (Interviewee 20, para 4)

"I see, we can make a research about the public figure or leaders in various fields. The information can be used by the researcher. It is easy and shorten time with a single click" (Interviewee 24, para 4)

"OHMS (EDRMS) benefit is it can save user time in order to find the information needed. Thus, this system can be used everywhere even without going to the library to find the material" (Interviewee 25, para 14)

Facilitate storage and retrieval of information

Users found that the system improved storage and retrieval of information and facilitated the searching process.

"It is better for storing, record storage and retrieve" (Interviewee 15, para 16)

"I see, we can make a research about the public figure or leaders in various fields. Those information can be used by the researcher. It is easy, shorten time with a single click" (Interviewee 24, para 4)

Improve searching effectiveness

Users found that the ontology-based system improved the retrieval process whereby they could retrieve information quickly.

> *"It means, the time taken is shorter than the traditional [existing] method. Indirectly, the fastest we get to share the information rather than before" (Interviewee 15, para 21)*

Improve searching precision

Users found that the ontology-based system enhanced the searching precision compared to the previous searching method.

> *"Actually, the most benefit from this system is the precision of the information and we are talking about the precision of ratio. It is more precise if we use this catalogue than using only one. Secondly, sometimes, this catalogue we need to refer to the index and others to come out with the data we want. However, the description is already come out from this system. So, when we talk about the precision of ratio, i think the system can provide it better than manual" (Interviewee 14, para 2)*

4.6.1.2 Navigating

The second benefit of EDRMS is categorised under Navigating. In this category users reported they found that EDRMS facilitated decision-making, was user friendly and improved the flexibility of the working environment. Below are the descriptions of each sub-category followed by quotations from the interviewees.

Facilitate decision making

Users found that the ontology-based system can avoid redundancy of information and provided input to the lecturer which can be used as a basis for decision making.

"Avoid redundancy. Anyone who already interviewed, did not necessary to repeat it" (Interviewee 6, para 8)

"From the lecturer prospective, if we first get to access we get to see others leaders with fewer interview from the student. So, we can suggest it to the student" (Interviewee 6, para 10)

User friendly

Users found that the ontology-based system was user friendly, easy to navigate and easy to search for information.

"Originally, we can said this system is easier where we can search quickly. We just have to type the keyword to get the information needed. In other words, it is user friendly" (Interviewee 3, para 62)

"However, I see this system is very efficient. For example, the efficient of respond time, user friendly, very attractive and the content is relevant and timely also presented in various format. Thus, i get to see the efficiency of the system. It is also have the effectiveness of respond time and also for user friendly aspect. So, i got the benefit" (Interviewee 5, para 101)

"Firstly, it is user friendly. Then, from the taxonomy aspect, i think it can develop more and another collection maybe needs to increase. I think the best is, this EDRMS has method and the query is easier" (Interviewee 19, para 103)

"Okay, this system is really user friendly. The system with the two column with colour and the keywords clarification with the red colour is very good. And, it easy for navigation, with the cart we can select anything and put it in the cart. It feels like trading" (Interviewee 20, para 41)

Improve flexibility of working environment

Users found that the ontology-based system provided the flexibility for them to acces the oral history collection from anywhere at anytime.

> *"There are many benefits can be used, because this system is more to the using of the web site. So, we can do the work anywhere and anytime. There are no problems as long as there is internet connection" (Interviewee 18, para 4)*

4.6.1.3 Knowledge management

Another benefit of EDRMS is categorised under KM. In this category users reported that they found many activities in EDRMS that were related to KM such as capturing knowledge, distribution of information, facilitating knowledge sharing & dissemination, historical information, knowledge capture, knowledge sharing, document management, facilitating Oral History Documents Management and as a source of reference for decision-making. Below are the descriptions of each sub-category followed by quotations from the interviewees.

Capturing knowledge

Users found that the EDRMS facilitated the process of capturing knowledge from the interviewees.

> *"We also get to know what the leaders thinking. It can be the concept from the knowledge aspect in a certain field" (Interviewee 1, para 21)*

Distribution of information

Users found that the EDRMS assisted in disseminating knowledge and experience of interviewees.

> *"It can help the user, especially when we spread all the experiences from people like the leaders in our country and so on" (Interviewee 8, para 5)*

Facilitating knowledge sharing and dissemination

Users found that the EDRMS improved knowledge sharing processes by facilitating users to get and share information.

> *"I can e-mail, share [and] from the dissemination, efficiency and time aspect. It makes it easier" (Interviewee 10, para 16)*

Historical information

Users found that EDRMS facilitated them in accessing historical information in the oral history collection.

> *"They can get the historical value. They get to hear by themselves from the people who experience all the history happened in our country" (Interviewee 9, para 13)*

Knowledge capture

Users found they managed to get the benefits from the system in terms of capturing the knowledge and experience of interviewees.

> *"In my opinion, the user gets the benefit from the sources of alternative aspect. All the materials possibly never get published but our students succeed. It is one of the good way to capture all the knowledge that never been published before" (Interviewee 21, para 4)*

Knowledge sharing

Users found that the EDRMS facilitated knowledge sharing where they could easily access the experience of interviewees and disseminate them.

> *"It is easier for us to share the knowledge because now we can easily access the internet. For example, we get to see the experiences from the ancient. Besides that, we get to share knowledge directly through the internet" (Interviewee 3, para 4)*

"It can help the user, especially when we spread all the experiences from people like them" (Interviewee 8, para 5).

"It means, the time taken is shorter than the traditional [existing] method. Indirectly, the fastest we get to share the information rather than before" (Interviewee 15, para 21)

"In my opinion, the user get the benefit from the sources of alternative aspect. All the materials possibly never get published but our students succeed. It is one of the good way to capture all the knowledge that never been published before" (Interviewee 21, para 4)

"Sharing the information and the knowledge about the leaders we had interview" (Interviewee 22, para 14)

"Secondly, it can be shared together. That's the benefit that I can see from this system" (Interviewee 23, para 14)

Document management

Users found that the EDRMS assisted the organisation in managing information efficiently, which contributed to quick and accurate decisions being made.

"Of course because there are many private sector organizations used Electronic Document Management System to assist them in making decision quickly and accurately. So, I think, EDRMS can assist the organization to make a quick and accurate decision. In addition, EDRMS also can help the organization to manage the knowledge of the organization". (Interviewee 5, para 52)

Facilitating oral history document management

Users found that the EDRMS improved the organisation of the Oral History collection by saving space.

"For the lecturer, it easier for them to arrange all the student's transcripts. It is because, every semester, there will be more than 30 students and maybe around 20 manuscript produced. Thus, they can allocate a room to place it. So that, the Oral History room will not be too packed with the student along with Oral History Documents and also the equipments" (Interviewee 11, para 4)

Source of reference for decision making

Users found that the EDRMS could be a source of reference where students can access and view transcripts as a guide in conducting their research activities and assist them in making decision, especially in choosing the subjects to be interviewed.

"The other thing is how can we utilize the information and knowledge for the next research. That is from the public view. The benefits are for our students. Firstly, it is important to those who take OH. Thus, they have the information how to make the transcript, interview and this will be the advance for their studies. Generally, I hope we can give the interesting concept about the Oral History. It can be the evidence. So, through sharing they can make others interested" (Interviewee 22, para 14)

"Directly, the benefits of the system is to our students especially for those who take this subject. They can refer directly to the actual Oral History documents as a guide in their research activities. (Interviewee 22, para 14).

"I see, we can make a research about the public figure or leaders in various fields. The information can be used by the researcher. It is easy and shorten time in a single click" (Interviewee 24, para 4)

4.6.1.4 DB management issues

Other benefits of EDRMS are categorised under DB management. In this category, users reported that they found EDRMS could help to improve data quality by

avoiding redundancy. Below are the descriptions of each sub-category followed by quotations from the interviewees.

Avoiding redundancy

Users found that the EDRMS assisted them in choosing the interviewees by providing accurate information about the interviewees. This avoided repetition in the form of interviewing the same person on the same topic.

> *"avoid redundancy. Anyone who already interviewed, did not necessary to repeat it" (Interviewee 06, para 8)*
>
> *From the lecturer prospective, if we first get to access we get to see others leaders with fewer interview from the student. So, we can suggest it to the student. (Interviewee 06, para 10)*

4.6.1.5 Others

Preservation of information

Another benefit of EDRMS is Preservation of Information for Future Generations. For example, having electronic copies of oral history documents would avoid frequent handling of the original, paper-based documents, hence helping to prolong their preservation. Below are quotations from the interviewees.

> *We will get to do their background research. This is for now and next generation. The information will not disappeared. (Interviewee 01, para 17)*
>
> *All of the information recorded will be preserved. National heritage. (Interviewee 06, para 4)*
>
> *"Preserve the history according to the events" (Interviewee 17, para 6)*

4.7 Issues of Current EDRMS vs Benefits of Ontology-based approach

Based on the interviews, EDRMS problems have been identified according to four main categories: Searching, Navigating, KM and DB management. At the same time a literature survey on SW benefits has been conducted based on the same categories. As a result, it was found that SW approaches offer identified benefits to improve the EDRMS (represented in Table 4. 1). This enables a comparison in order to trace which key benefits could be employed to resolve issues with existing systems. The subsequent chapter will discuss the application of the comparative analysis towards outlining specifications of a domain ontology development.

Table 4.1: Existing approach's problem vs new ontology-based approach's benefits

EDRMS Issues (practical) Findings A	***Ontology approach benefits (Findings B)***
Searching Effectiveness Precision	Searching Availability Enhanced access Enhanced storage and retrieval Enhanced searching Enhanced precision
Navigating Browsing User interface User friendliness Flexibility of web environment Language	Navigating Enhanced decision support User friendliness Multilinguality and flexibility

KM	KM
Data integration	Capturing knowledge
Representation	Distribution of information
Description of collection	Knowledge sharing
Description of figures	Historical information
	Knowledge dissemination
DB Management	DB Management
Data quality	Redundancy avoidance
Data redundancy	
Display	
Maintenance	
System feedback	
System performance	
User guide	
Others	Others
Content	Preservation of information
Updating issues	
Scope (e.g more content needed)	

4.8 Chapter summary

The main aim of this chapter was to report the findings (findings A which described the issues within the current systems and findings B which described the benefits from an initial ontology-based system) that were captured through interviews. A summary of the findings has been presented above in Table 4.1. The findings have been categorised under the four main topics of Searching, Navigating, KM and DB management. Based on the findings, it can be concluded that there is a significant need to improve the system in order to assist the users to maximise usage, particularly on issues such as making quick and accurate decisions in academic activities. Based

on the literature survey it was found that SW approaches offered many benefits and advantages to solve current problem of existing functionality of EDRMS as shown in Table 4.1.

Chapter 5

System specifications

5.1 Chapter introduction

The system specification is also known as ‘functional specification’. It is usually written in a highly abstract manner (Royce, 1987). Specification theories should support various options for refinement that allows finding an appropriate specification in design, for structural composition that permits developing specifications of different components and for logical conjunction of the set of requirements (Bauer, Larsen, Legay, and Nyman, 2014). In a PhD study a system specification helps define technical components that are inter-related within a system in order to operate or perform at its expected capacity. It is important as a guide to the developers or researchers to achieve the expected representation of outcome.

This chapter presents system specification details of the proposed ontology-based EDRMS approach. The system specification details begin with describing the current state of the systems with its associated disadvantages. The second section explains the methodology of the semantic ontology as the main component of the proposed approach. The third section discusses compliance with the records management standard that has been implemented in the proposed ontology-based system. The fourth section highlights ontology integration within the application. Finally the fifth section summarises the chapter.

5.2 Ontology development procedure

The definition of ontology has been discussed in Chapter Two (see section 2.4.1). Generally the majority of the current methodologies for ontology-based solution development are based on domain-independent principles. These methodologies do not meet the local requirements of the complex process of knowledge acquisition and representation. According to Blázquez, Fernandez, Garcia-Pinar and Gomez-Perez (1998) and Miah (2010), the maturity of many previously developed methodologies is still in question as they are still in developing mode. Most ontology principles have similarities and provide step-wise sequential phases to conduct activities of problem or domain ontology development. For example, Uschold and Gruninger (1996) proposed a methodology that sets out a number of steps such as purpose identification, building ontology, evaluation and documentation. This procedure is quite similar to the existing system development lifecycle approach. Neither approach is involved with any knowledge acquisition and conceptualisation activities that may be applied in the ontology development process.

Maedche and Staab (2002) and Staab, Studer, Schnurr and Sure (2001) described a methodology for an ontology-based KMS. The method follows five major steps: a feasibility study, ontology commencement, refinement, evaluation and maintenance. On the other hand Haghighi et al. (2013) have proposed a useful approach for domain ontology construction. It offers three main steps that identify the scope and objectives, knowledge acquisition and design and implementation of domain ontology-based intelligent DSS. This method is similar to the approach used by Mizoguchi and Bourdeau (2000) in terms of the scope and purpose identification for ontology development assumed to have been completed previously. According to the literature, it was found that these methodologies commonly start from the step of identifying the

goals/purpose of the ontology and the need for domain knowledge acquisition. In this study, the three-step approach using Haghighi et al. (2013) was adopted to support our semantic ontology development. This approach offers a rigorous and inclusive ontology and evaluation method involving domain experts, which is vital in our study context. Figure 5.1 shows the improved approach using the four steps – that is, predevelopment phase, conceptual framework design, ontology construction and validation and evaluation. The following sub-sections describe the development and evaluation methodology of the ontology-based approach from the perspective of our study.

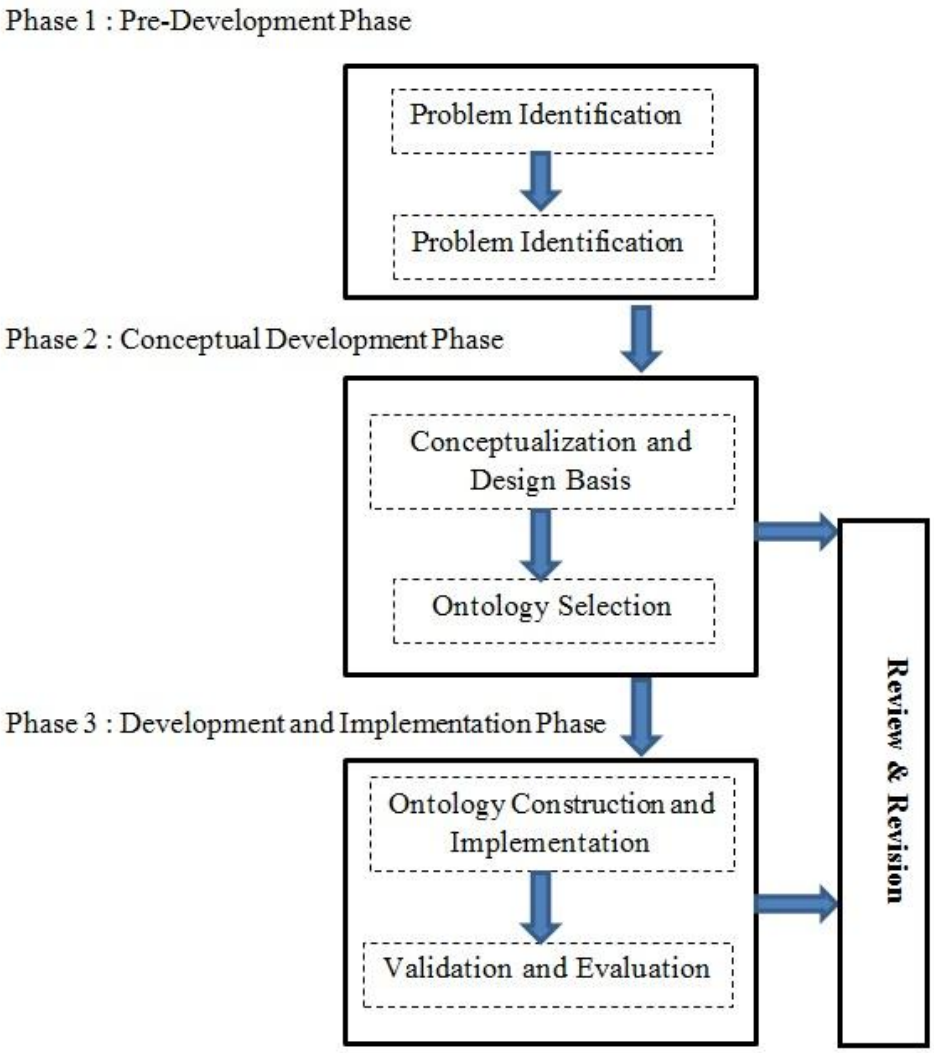

Figure 5.1: Overall methodology for ontology development and evaluation

5.2.1 Pre-development phase

This phase investigates how the problem may be identified with regard to the issues and benefits of existing approaches and SW-based approaches. In this study, a data collection approach was conducted using a semi-structured interview by Gorman and Clayton (1997). In addition, non-probability sampling (purposive sampling) was chosen during the process of selecting participants. This is considered to be an appropriate choice in view of the large number of interested groups and involved 30 informants (five developers and 25 users). The definitions of target users are given previously in Chapter Three (see section 3.2.1). In order to ensure that the process of data collection was as comprehensive as possible the number of samples was reviewed during the research process. Moreover in order to obtain feedback and an overview of the current decision support features from a technical perspective, the developers were included in this study. Furthermore the issues and benefits of SW approaches are explored through a literature survey. For this purpose the sources are based on published literature of the potential benefits of SW in supporting features for enhanced decision making.

5.2.2 Conceptual framework design

Based on the above-mentioned procedures the study develops a framework of SW and existing EDRMS to indicate the benefits and issues so they can easily be linked. The framework is based on the taxonomy descriptions to show categories and sub-categories of the entitled benefits and issues. Taxonomy descriptions as a part of ontology are useful for easily comparing options in classifications in relation to decision-making features. It can be seen through the SW-based approach that ontology development for enhanced vocabulary and meaning enables decision-makers to quickly find the relevant information about their targeted subjects. Table 4.1 in Chapter Four includes details of the framework based on the findings as discussed. Table 4.1 also shows relevant

ontology features that promise to enhance searching and navigating abilities for quick decision-making, compared to the current features of existing EDRMS.

At the same time in terms of DB management and KM, ontologies as one of the SW technologies provides options of data integration, data extraction, improved records consistency, reduced data redundancy, improved knowledge representation and semantic annotation. Some features of ontologies are identified for further service improvement such as enhancement of data or record security, however these are beyond the scope of this study.

5.2.3 Ontology construction and evaluation

Three major theories were used to construct the semantic ontology based system: Joo and Lee (2009) for integrating the developed ontology as the main component of the system, Protégé (Gennari et al., 2003) for structuring the ontology and Haghighi et al.'s (2013) theory that originally adapted the step-by-step process of ontology development procedure explained in an earlier section.

The study of Joo and Lee (2009) proposed a structural integration of the semantic web to overcome the inconvenience of managing knowledge through effective provisions. In this integrated semantic web approach, the software agent represents the meaning of the terms through the application of ontologies. Joo and Lee (2009) found that a semantic web-driven system can support effective provisions to manage knowledge components in order to overcome its search and integration limitations. The Protégé system (Gennari et al., 2003) provides an application platform for more general purpose knowledge organisation so users can structure components within the problem domain prior to system design. That is how Protégé helps to reduce the knowledge acquisition bottleneck by minimising the role of knowledge engineers in constructing

knowledge-based systems. The following section (5.5) explains the details of the new ontology using Protégé 4.0.3.

5.3 Current state of the systems

The advantages of using SW have been demonstrated in many domains: life sciences (Kashyap, 2009; Kashyap et al., 2007); health care (Hyvonen et al., 2007); Patel, 2007; Marie et al., 2006); energy (Norheim and Fjellheim, 2006; Ramakrishna, 2008); education (Cardoso, 2007; Gliozzo et al., 2007) and so on. Semantic technique ontologies enable provisions of records management especially to filter, categorise and rank information resources (Rensselaer Polytechnic Institute, 2011). The creation of the solution technology using ontologies can be considered as an innovative development by recognising its improvement for information retrieval. Figure 5.2 shows the current state of the ontology in the EDRMS application.

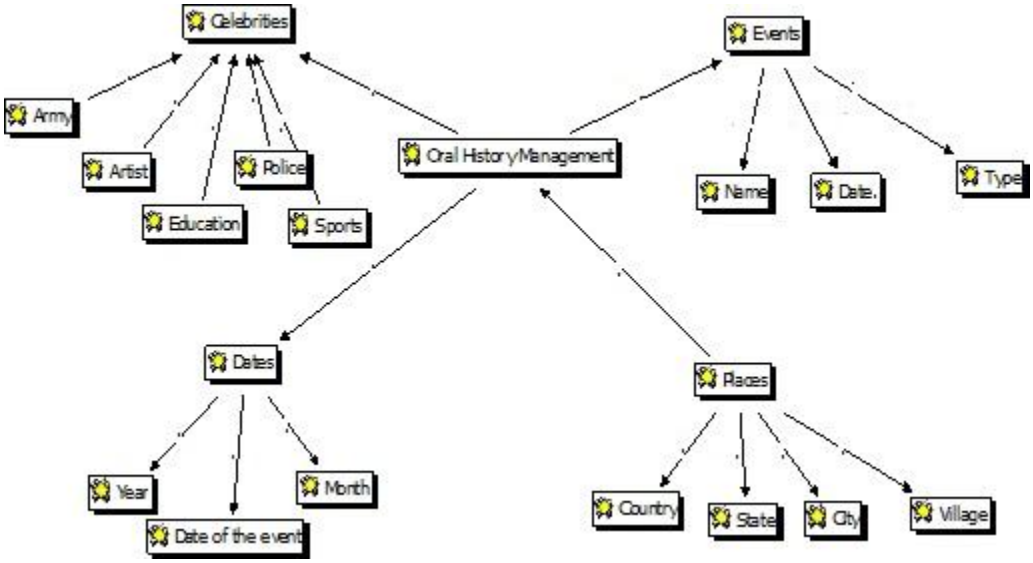

Figure 5.2: Current state of ontology in the EDRMS application

At an earlier stage the ontology was developed as part of the initial documentations to commence discussions with domain experts. In the initial stages the oral history management activities were not well documented, so we have only five types of concept under ‘Celebrities’. Moreover, the development of this taxonomy involved only a few developers, users and experts over a short period of time. As a result the actual situation of oral history projects as a whole has not been reflected to enable sufficient improvement.

Gradually the concepts with their properties and dimensions were fully developed into categories. At the outset the central category was ‘Oral History Management’, under which four subcategories were developed, namely: Celebrities, Events, Dates and Places. Each category is explained in the ensuing sub-sections. However, during the focus group meeting participants found that ‘Oral History Management’ does not represent the appropriate concept of the ontology. After some discussion participants agreed that ‘Oral History Management’ should be replaced by ‘Oral History Project’ to improve clarity.

In the earlier phase it was required that the interviewer should be a celebrity in any field. Based on the content analysis of the oral history documents, all the celebrities were classified under five categories: Army, Police, Education, Artist and Sports. However during the focus group meeting one participant pointed out that the new requirement for selecting participants had been changed by the university which stated that the most important criterion is the contribution of the interviewee. There would not be a problem if students want to interview a person who is not a celebrity but has made significant contributions to a specific field. Based on this argument ‘Celebrities’ was changed to ‘Interviewees’ to ensure that the term accurately communicated the intended meaning.

Moreover events, places and dates were considered as different concepts. One of the participants suggested that the terms ‘Place’ and ‘Date’ be made a sub-class of events, since they refer to the date and place of events. The majority of participants agreed that it was unnecessary to have ‘Date and Place’ that referred to the same events as separate entities. Therefore ‘Date and Place’ became a sub-class of events.

5.4 Proposed new ontology

In this study the Protégé 4.0.3 which supports OWL (Noy, Fergerson and Musen, 2000) has been used in the implementation of the proposed ontology approach. OWL is a common ontology language designed to represent rich and complex knowledge about things, groups of things, and relations between things within a problem domain. In this study the concept of Oral History documents management projects is the core of the ontology. There are four main key concepts in the final structure of ontology: Project Plan, Interviewee Profiles, Events, and Project Fields (as shown in Figure 5.3). The second level of the ontology includes 31 sub-classes which are broken down into over 200 further sub-classes. Altogether the total number of classes at all levels is 245. The concepts in this ontology were generated based on content analysis of the oral history documents. In addition the encoding of the elements includes definitions for most of the domain concepts. Moreover for better understanding and to enable querying and reasoning about the concepts, each of the properties, instances and relations are defined accurately. As part of the ontology description Tables 5.1 and 5.2 include more details such as the definition of terms used and relationships related to the proposed ontology approach. This definition is essential to assist the stakeholders in the process of learning and understanding the ontology. Furthermore it helps the ontology developers to understand the intended meaning of terms. According to Uren et al. (2006), term

definitions demonstrates that the ontology developers have understood the concept the stakeholder had in mind. The relationships involved in this ontology are: ‘includes’, ‘involves’, ‘is property of’, ‘is part of’ and ‘is associated with’.

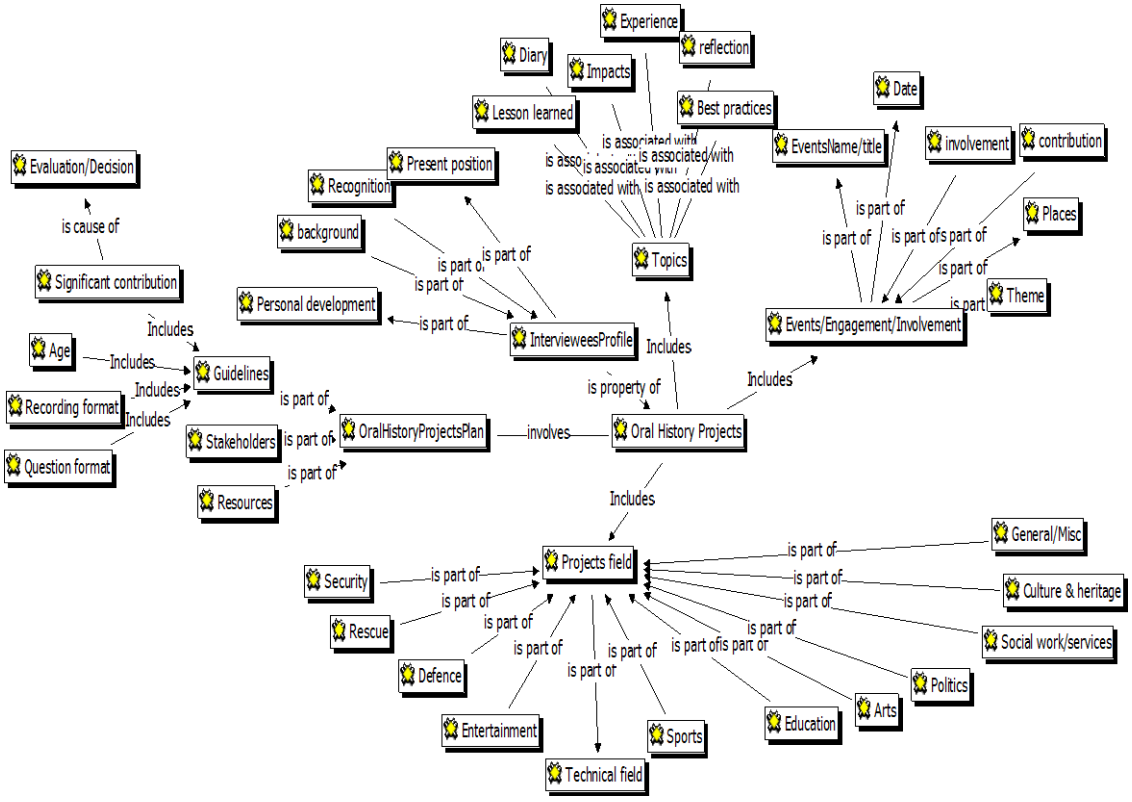

Figure 5.3: The final domain ontology

It is essential to visualise ontologies clearly for understanding and enabling others to understand. There are many tools to visualise the ontologies such as ATLAS.ti, Protégé and Nvivo. In this study we used ATLAS.ti due to its ease of use and its ability to visualise and represent our ontology effectively. ATLAS.ti enables the attachment of files of the Oral History documents used in defining the concepts. This provision is useful for ontology long-term management and documentation. Figure 5.3 illustrates the use of ATLAS.ti for codification and visualisation and shows the improvements of the

main classes of the ontology and some of their sub-classes through iterations from the initial draft of the ontology presented in Figure 5.2. The study conducted seven iterations through focus group meetings employing five domain experts (e.g. professors in software design and development, developers of oral history management and potential users of the EDRMS) to make improvements leading to a final ontology (Figure 5.3). The next section discusses the new ontology.

5.5 Proposed ontology of the system

Table 5.1: An example of glossary of terms

Terms	***Description***
Age	Refers to the age of interviewee (at least 40 years old).
Arts	Refers to the field of an interviewee who is involved with the arts.
Background	Background of the interviewees.
Best practices	Best practices related to the focus story.
Contribution	Something which is significant to the nation/country/societies.
Culture and heritage	Refers to the field of an interviewee who is involved in culture and heritage.
Date	Date of an event.
Defence	Refers to the field of an interviewee who is involved in defence such as the armed forces.
Diary	Diary of the interviewees related to the focus story.

Education	Refers to the field of an interviewee who is involved in education.
Entertainment	Refers to the field of an interviewee who is involved in entertainment.
Evaluation/Decision	The first evaluation to accept the proposal will be based on the interviewee's contribution.
Events Name/title	Name/title of an event.
Events/Engagement/Involvement	Events related to the involvement of the interviewee.
Experience	Experience of the interviewees related to the focus story.
General/Misc	Refers to the field of an interviewee who is involved in any other field which is not listed.
Guidelines	Procedure of conducting oral history projects.
Impacts	Topics related to the focus story.
Interviewees Profile	Profile of the interviewees.
Involvement	How interviewee is involved in the event.
Lesson learned	Lesson learned related to the focus story.
Oral History Projects	Academic research project conducted by undergraduate students as part of the academic assessment.
Oral History Projects Plan	Refers to the planning phase in conducting oral history projects.
Personal development	Personal development of the interviewees.
Places	Venue of an event.
Politics	Refers to the field of an interviewee who is involved in

	politics.
Present position	Present position of the interviewees.
Projects field	Field of the interviewee involved in oral history projects.
Question format	Refers to the format of the questions of oral history projects, which should be followed by the students.
Recognition	Recognition achieved by the interviewees.
Recording format	Refers to the format of recording used in conducting oral history projects (e.g. mp3).
Reflection	Reflection related to the focus story.
Rescue	Refers to the field of an interviewee who is involved in rescue services.
Resources	Refers to resources used by the students in conducting oral history projects.
Security	Refers to the field of an interviewee who is involved with security such as police, RELA, etc.
Significant contribution	The main/most important criterion in selecting/choosing the interviewee.
Social work/services	Refers to the field of an interviewee who is involved in non-government organisation.
Sports	Refers to the field of an interviewee who is involved in sports.
Stakeholders	Refers to students, supervisor/lecturer and the interviewee.
Technical field	Refers to the field of an interviewee who is involved in

	technical activities, such as an engineer.
Theme	The theme of the events.
Topics	Topics related to the focus story.

Table 5.2: An example of glossary of relationships

Relationship	***Formulas/ rules***
Includes	Specifies the attributes related to oral history projects.
Involves	Specifies the importance of planning as part of the process in conducting oral history projects.
Is property of	Specifies the importance of interviewees in oral history projects.
Is part of	Specifies the attributes of the concept.
Is associated with	Specifies the theme associated with the topics.
Is cause of	Specifies the importance of interviewee's contribution as a basis of proposal evaluation.

The identification and definition of the terms and relationships involved in the development of ontology networks should be an agreed result within the domain ontology field. The term/concept definition is very important to ensure the clarity, conciseness and correctness of the ontology being developed. According to Guarino (1998): *'...an ontology is a logical theory accounting for the intended meaning of a formal vocabulary, i.e. its ontological commitment to a particular conceptualization of the world. The intended models of a logical language using such a vocabulary are constrained by its ontological commitment an ontology indirectly reflects this*

commitment (and the underlying conceptualization) by approximating these intended models'. (p. 7).

5.6 Compliance with records management standards

The study analyses three standards for records management: ISO 15489 records management, Moreq, electronic records management and archives management policy (International Organization for Standardization-ISO, 2001 and European Commission, 2011). In this study due to the requirements of the domain, features from the three standards are adapted to ensure compliance in the proposed ontology development.

The ISO 15489 records management standards developed by the ISO in 2001 may be considered as the most relevant 'best practice' standards for records management. It consists of two parts: Part 1 'general', provides a high-level framework for records keeping and Part 2 'guidelines', provides detailed guidelines for framework implementation. In this study this standard has been adapted to achieve compliance.

Moreq is the abbreviation for model requirement for management of electronic records. It is a European records-keeping standards which has been developed to provide guidelines and as a requirement of managing electronic records. One important requirement is the existence of an unalterable audit trail that is capable of automatically capturing and storing information about any action taken relating to any records, the user undertaking the action as well as the date and time of the action.

The guidelines on Electronic Records Management were produced by the Arkib Negara Malaysia to help public offices to manage electronic records. More specific guidelines addressing the management of electronic records in specific environments are also available. These are as follows: Managing Electronic Records in the Unstructured Environment, Managing Electronic Records in the Structured

Environment, and Managing Electronic Records in the Web Environment. All are available from the Arkib Negara Malaysia. These guidelines should also be used in conjunction with Electronic Records and the Akta Arkib Negara 2003 (available from the Arkib Negara Malaysia).

5.6.1 Designing a records systems

In designing the EDRMS the study followed the eight steps that are outlined by the ISO 15489-2: 2001 clause 3: conduct preliminary investigation, analyse business activities, identify requirements for records, identify strategies to satisfy requirements, design records system, assess existing systems, conduct post-implementation review and implement records systems. The study has completed each step to make sure that this system complies with the standard.

5.6.2 Documenting records systems

All the documentation of the system has been provided by the system developers.

- Training records practitioners and other personnel

Training for records practitioners and other personnel has been conducted.

- Converting records to new records systems, formats and controls

All records (in pdf and mp3 formats) have been converted to the records system format and controls.

- Setting standards and measuring compliance and performance against them

  Standards have been outlined and measured to ensure system compliance.

- Determining retention periods and making decisions about records that have continuing value, in keeping with the regulatory environment.

A permanent retention period has been proposed for oral history documents to ensure this complies with the regulatory environment.

5.7 Discussion of findings against each criterion for the new ontology

The concepts with their properties and dimensions were fully developed over time into categories. Currently the central category is Oral History Project under which five sub-categories were developed namely Oral History Project Plan, Interviewees Profile, Topics, Events and Project Fields. Each category is explained in the following sub-sections. Planning is very important for the smooth running of Oral History Projects. There are three sub-categories that make up the Oral History Project Plan: 1) guidelines, 2) stakeholder and 3) resources. Furthermore interviewees play a very important role in Oral History Projects, since they constitute the main subjects of the projects. There are four sub-categories that make up the interviewees Profile: 1) personal development, 2) background, 3) recognition and 4) present position.

'Topics' is another important feature identified in the earlier stage of Oral History Projects, since it relates to the contribution of the interviewees. There are six sub-categories that make up Topics: 1) lesson learned, 2) diary, 3) impacts, 4) experience, 5) reflection and 6) best practice.

'Events' is very important in OHP, since most OHPs are related to important events. There are six sub-categories that make up Events: 1) event name, 2) date, 3) involvement, 4) contribution, 5) places and 6) theme.

The final subcategory is Project Fields which categorises the Oral History Projects into their relevant subject area. To date OHP involves participants from many fields such as security, rescue, defence, entertainment, technical fields, sports, education, arts, politics, social works, culture, heritage and general.

5.7.1 Ontology-based system

As mentioned earlier, Joo and Lee's (2009) model as shown in Figure 5.4 below was adapted to construct the proposed semantic ontology-based approach for records management. Through this integrated semantic web approach the software agent represents the meaning of the terms through the application of the ontology. The study by Joo and Lee (2009) found that a semantic web-driven system can support effective provisions to manage knowledge components to overcome search and integration limitations.

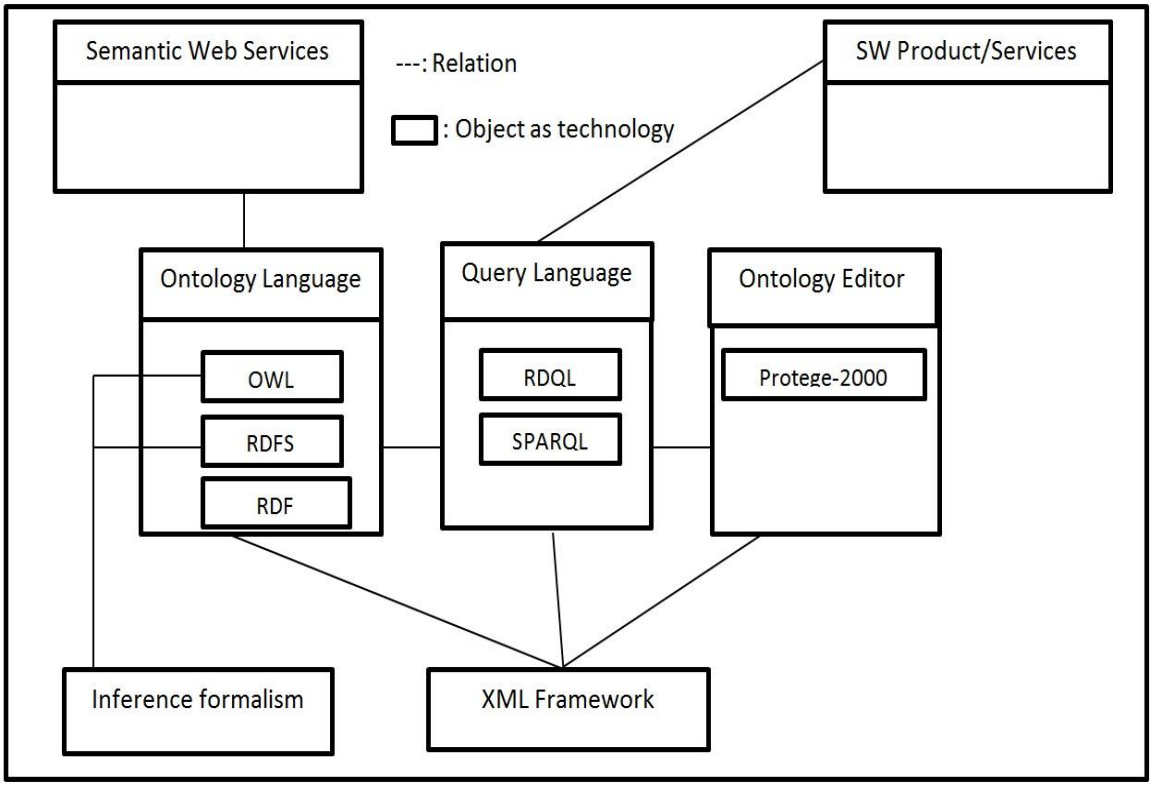

Figure 5.4: Proposed application diagram, improved from Joo and Lee's (2009) model

This model was applicable due to its generic nature and easily fits into our current problem context as well as meeting user demands. The method utilised was useful for generating rich semantic metadata structures to act upon as a 'search point' that was

promising for providing value-added decision-making (Joo and Lee, 2009). Figure 5.4 shows the specifications of the proposed solution. In this diagram SW services are produced for enhancing the vocabulary of records by the ontology language through the application of OWL. Furthermore the ontology language also assists in producing an inference formalism that filters a search result which contributes to extracting relevant search outputs. In order to have adequate links to various data in the record repository the SW service provides query languages such as RDQL and SPARQL (Joo and Lee, 2009). Moreover the ontology editor holds features of the query language and the ontology language to produce semantic outcomes. To develop the semantics of various oral history documents such as recorded interviews relevant to interviewee and their abstracts stored in the records repository, the solution model uses Protégé as its ontology editor.

5.8 Proposed system prototype

In this study a prototype of the system which integrates the semantic domain ontology was developed in which several taxonomies were included for better searching results. It is relevant to note here that previously only four taxonomies were employed. The taxonomies were gathered from the refined semantic ontology above. To show the practical feasibility of applying our developed semantic domain ontology as a core decision support component to deal with complexity and inconsistency in the current ERDMS system a proof-of-concept prototype was developed. The generic architecture (see Figure 5.6) of the ontology-based EDRMS is shown to demonstrate its features and usage value, such as to verify its ability in terms of decision support provisions.

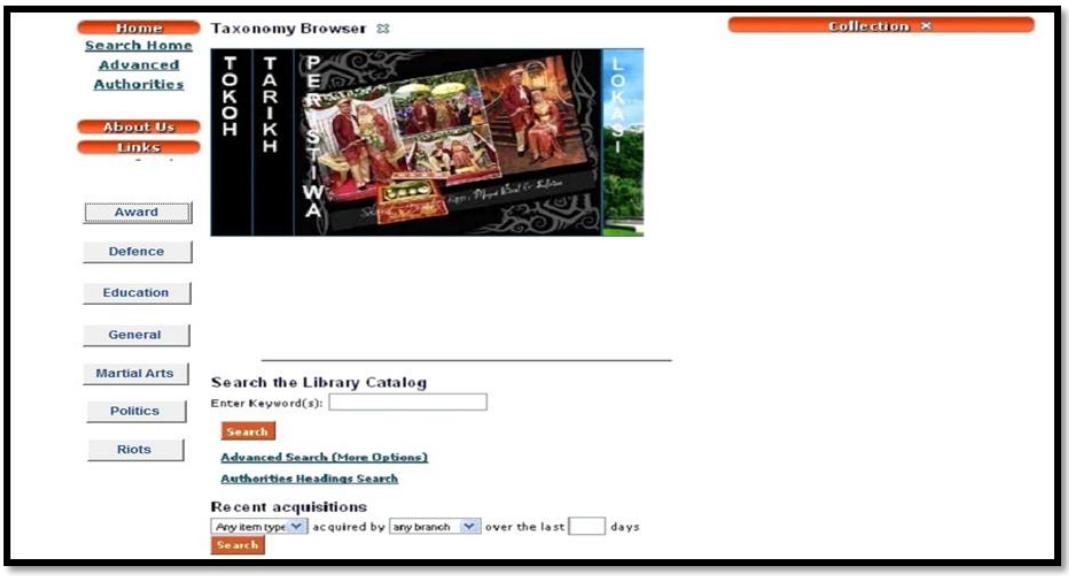

Figure 5.5: Improved EDRMS integrated new ontology for testing with the target users

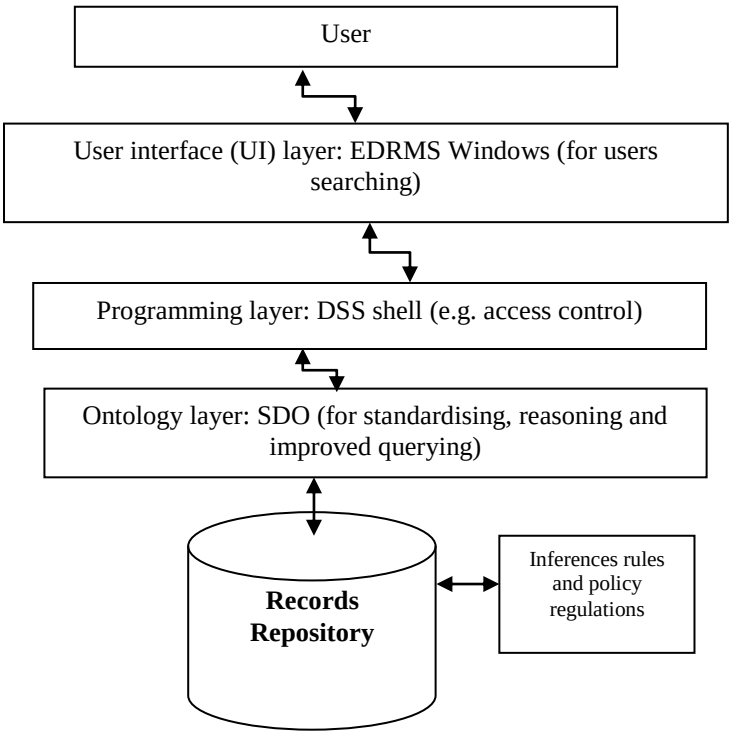

Figure 5.6: A comprehensive architecture for ontology-based EDRMS

As mentioned earlier in relation to the contribution of ontologies, as a feature of SW, the study adopted an ontology-based integration model that could be useful in our

solution. In the semantic web layer ontology was utilised for generating rich semantic metadata structures to act upon as a 'search point' for providing value-added information services in EDRMS. In this study an ontology was used to describe the knowledge domain that deals with queries. Ontology navigation provides semantic-level reasoning in order to retrieve meaningful resources with respect to a given information request (Bonino et al., 2004). Besides ontologies enable complex and precise queries to be formulated and executed to a much greater extent than is possible with existing keyword-based approaches (Abrahams, 2006; Asiaee et al., 2011). In addition ontologies can improve usability, reliability and scalability (Happel and Seedorf, 2006). Furthermore ontologies can accommodate the demands of context sensitivity, especially for content management (Euzenat, 2002; Uren et al. 2006).

The integration of the new ontology to the DB schema is supported by programming interfaces (Perl and MySQL). Based on the final Domain Ontology of the Oral History Project (figure 5.3), the translation/integration has been developed and modeled in the DB using an m:n intersecting relationship (Figure 5.7).

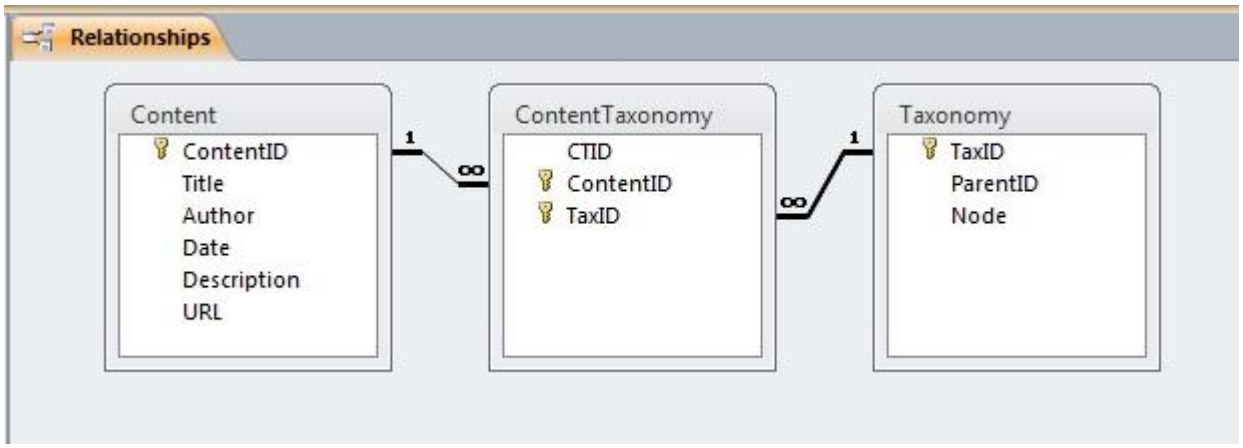

Figure 5.7: Relationship of the entities in the developed ontology

Then, ontology nodes are identified through the oral history documents. Each ontology node has a unique ID (in this case TaxID). If it is related to other nodes, the

superior ID will be assigned to its parent ID. Every component of an ontology has a unique ID – TaxID. If it is related to another taxonomy (superior), the superior ID is assigned as its ParentID and so the relationship continues. On adding a new oral history record it will refer to the existing ontology at 1st, 2nd, 3rd and 4th level. But if the ontology does not exist a new ontology term will be introduced (usually on the 3rd level onwards). On searching each level a records will be assigned one or more ontology nodes (existing and new) according to the following figures (Figures 5.8, 5.9 and 5.10). See Appendix C: Programming code for integrating the developed ontology into the system DB schema.

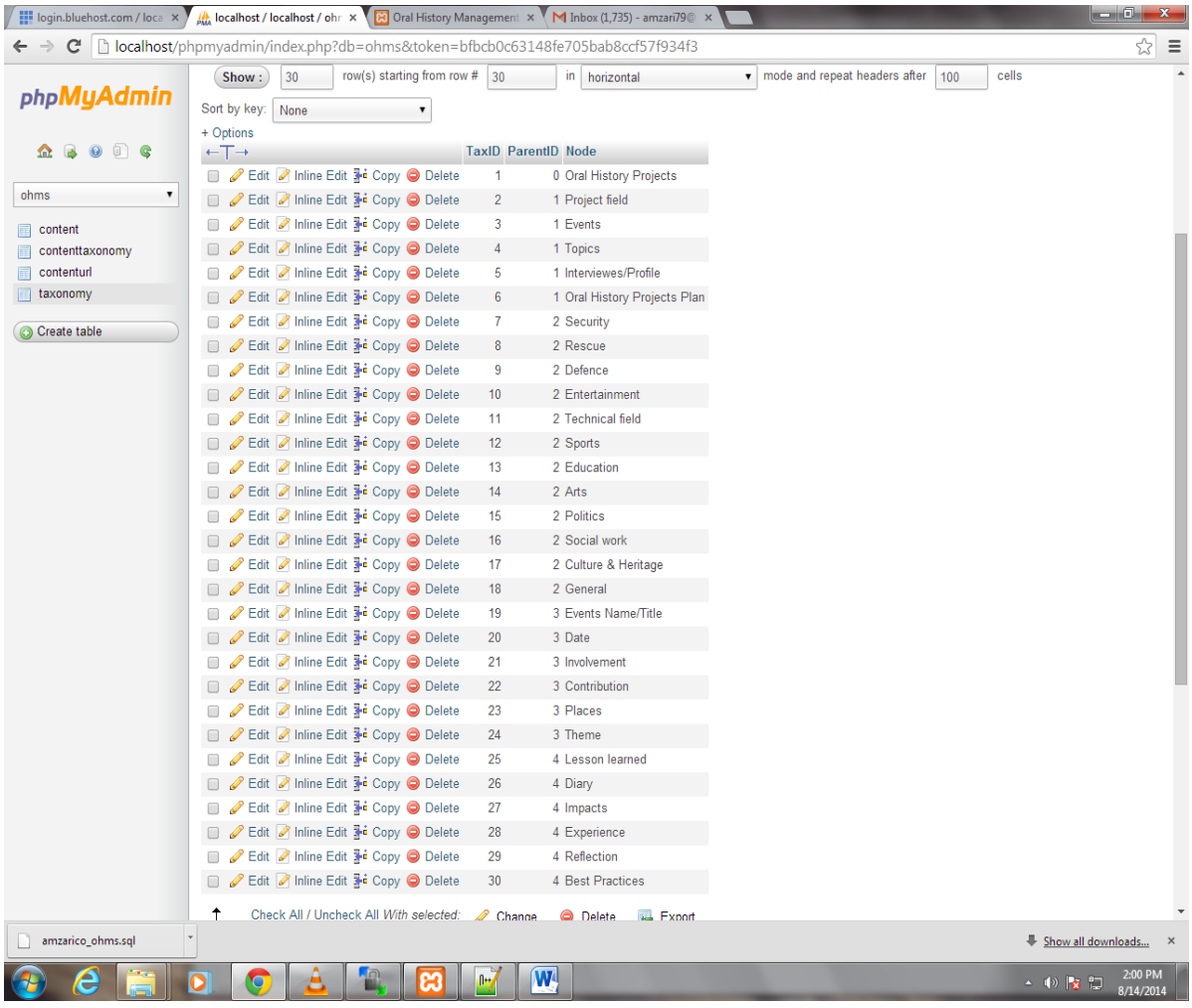

Figure 5.8: The mapping of an ontology node to the DB

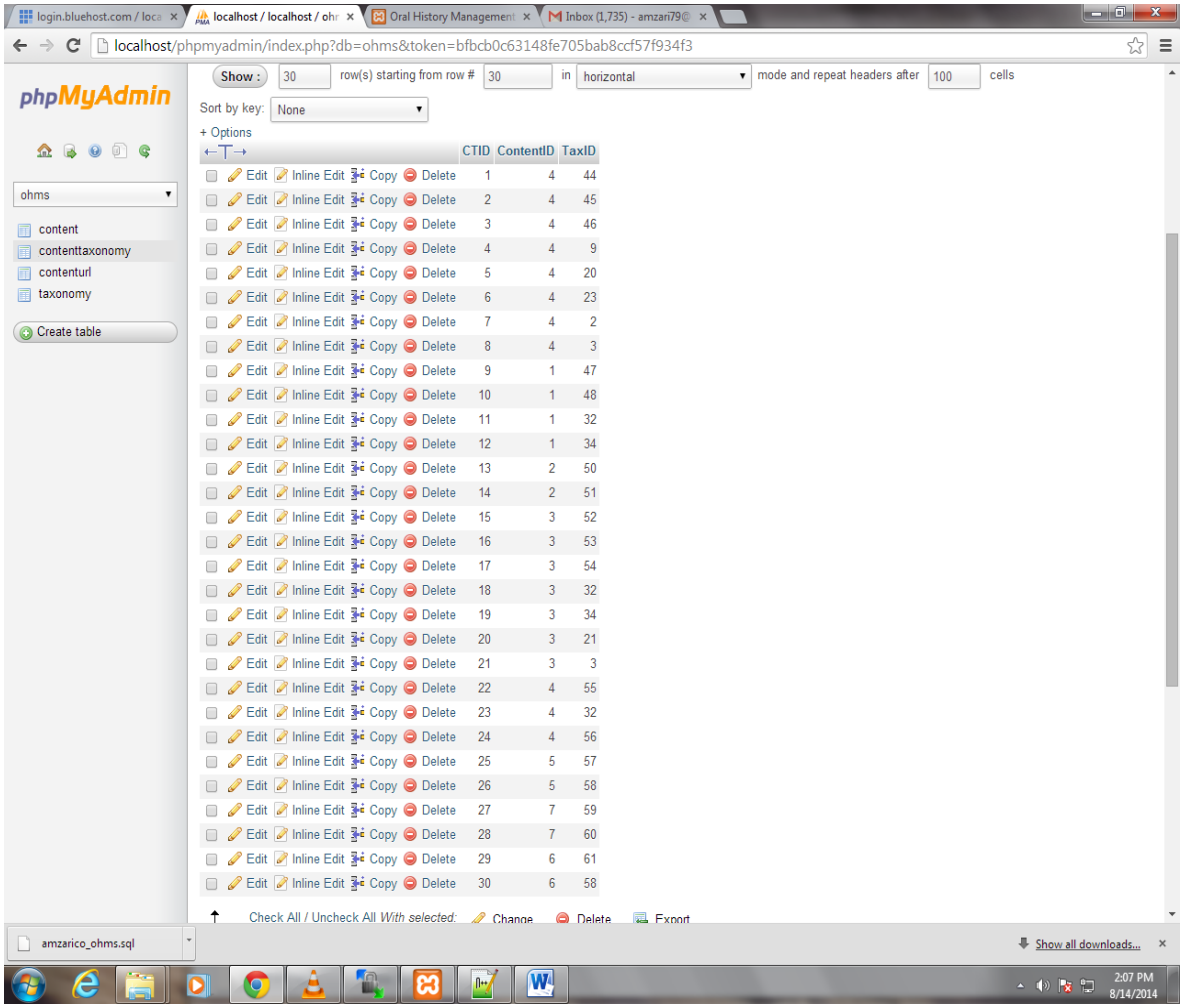

Figure 5.9 : Assigning ontology nodes to the DB.

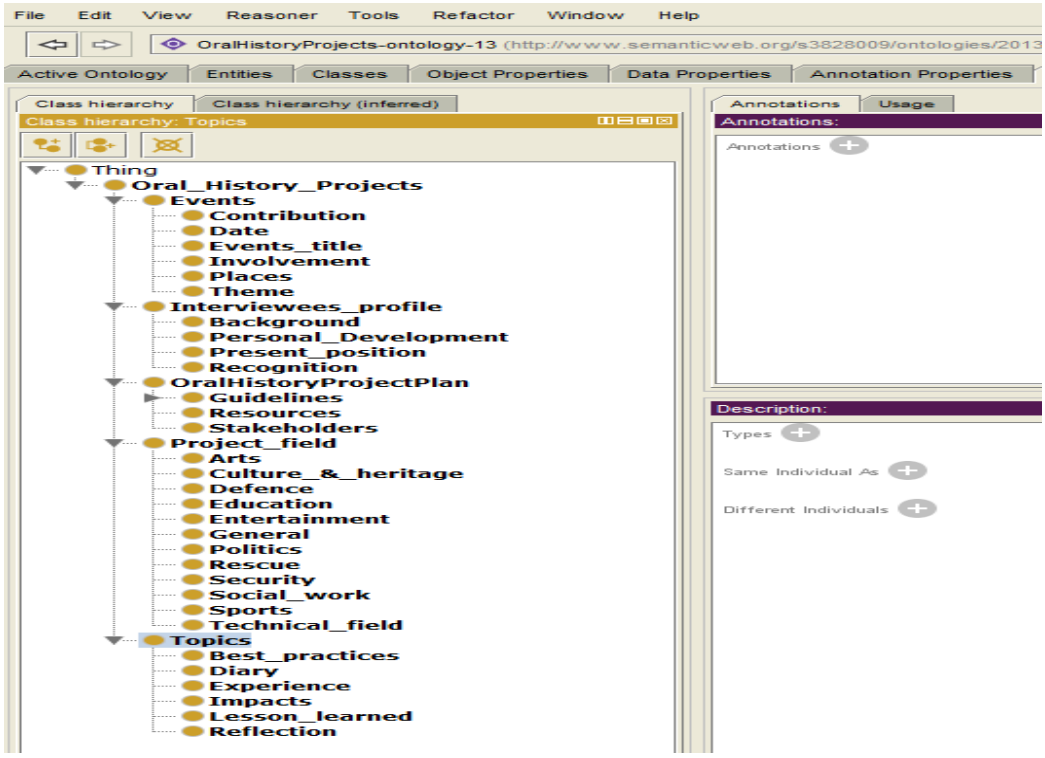

Figure 5.10: An example of properties and instances used in the proposed approach

5.9 Properties and instances used in the proposed approach

There are five properties under the Oral History Projects Domain: Events, Interviewee profiles, Oral History Project Plan, Project fields and topics. Under Events there are six instances: contribution, date, event title, involvement, places and theme. Interviewee profiles has four instances: personal development, background, present position and recognition. Oral History Project Plan has three instances: Guidelines, Resources and Stakeholders. The Project Field contains 12 instances: Arts, Culture & Heritage, Defence, Education, Entertainment, General, Politics, Rescue, Security, Social work, Sports and Technical field. The last property is Topics, which has five instances: Best Practices, Diary, Experience, Impacts, Lesson learned and Reflection.

5.10 Chapter summary

The chapter presented system specification details for the enhanced ontology-based EDRMS system. The second part of the chapter explained the ontology development procedure. In this part this study originally adapted the step-by-step process of Haghighi et al. (2013) to provide suitable guidelines for our IS development exercise. The technical details, as well as the initial ontology definitions have been presented in the chapter. The chapter has also highlighted technical details of ontology integration within applications. Finally the fifth part summarises the chapter.

Chapter 6

Systems evaluation and recommendations

6.1 Chapter introduction

Ontology-based systems have been increasingly in demand for various KMS purposes. Systems using ontologies as a key component of designing the solution are required to determine whether the use of the ontology produces benefits in the target problem domain as defined in Chapter Four and Five. Chapter Four defined requirements of SW based approaches and specifications of a semantic ontology based approach that was presented in Chapter Five. At this point it now becomes important to conduct an evaluation of the developed prototype in order to demonstrate the proof of the concept. To ensure this there are various formal evaluation approaches used to evaluate both the appropriateness of ontology design and the system itself within the context of problem domain. The study employs this evaluation in order to assess the fitness of the developed ontology and the use of the developed application for education users.

The chapter presents a discussion on the evaluation of the ontology and the ontology-based system that is proposed as a new solution. The system specification details begin by describing the semantic domain ontology evaluation. The second section explains the data collection for ontology evaluation. The third section discusses recommendations and finally the fourth section summarises the chapter.

6.2 Evaluation of ontology

For ontology evaluation Haghighi et al. (2013) described evaluation approaches as involving the use of formal and explicit criteria that match ontology construction objectives within the system. According to Yu, Thom and Tam (2005), it is vital to evaluate ontologies as the basis for designing new systems due to the increasing availability of ontology-based solutions. In addition the evaluation process is also conducted to determine whether the ontology is suitable for representing certain domains and applications within it (Yu et al., 2005). Generally ontology evaluation involves the use of formal evaluation criteria and methodologies. Therefore it is essential to select and apply a suitable evaluation approach which is appropriate to the given ontology and its application domain.

6.2.1 Evaluation approaches

There are various approaches for evaluating an ontology-based system as proposed by researchers. For instance Haghighi et al. (2013) mentioned various classes of approaches such as gold standard evaluation, application-based evaluation, data-driven approach, task-based evaluation and criteria-based evaluation. According to Maedche and Staab (2002), the gold standard evaluation compares the ontology to high-level and gold standards, which can be an ontology itself. In some scenarios, access to such standards for ontology or its provision may not be possible. On the other hand data-driven evaluation (Brewster, Alani, Dasmahapatra and Wilks, 2004) compares the ontology with a source of data such as a corpus. However, since the corpus does not suit the nature of the problem space in this study, such an evaluation approach is considered not suitable for assessing accuracy.

The third ontology evaluation approach is an application-based evaluation, which uses the ontology in an application and then evaluates the results. This approach is

very beneficial for evaluating the abilities of the developed ontology to meet objectives. However this approach does not validate the quality of the content and design of the ontology (Haghighi et al., 2013). The fourth ontology evaluation approach is task-based evaluation, which assesses the ontology according to its competency in achieving target tasks by measuring its performance within the context of the application. This approach is similar to the application-based evaluation proposed by Brank, Grobelnik and Mladenic (2005). According to Yu et al. (2005), this approach could be conducted for each task separately. This is due to the fact that evaluation results differ for different applications and tasks may not be comparable. Finally the fifth ontology evaluation approach is criteria-based evaluation. According to Gruninger and Lee (2002), this approach uses a set of proposed criteria for evaluating the ontology. After reviewing the evaluation methodology (shown in Table 6.1), this study found that criteria-based evaluation is well constructed based on the careful consideration of other approaches, and can be applied in this research context.

Therefore this study followed the approach adapted and proposed from Haghighi et al. (2013). The only difference is that this study asks the user to use the ontology for a time prior to evaluating it in order to gain a deeper understanding. Nevertheless similar steps were followed to ensure a rigorous use of the approach.

6.2.2 Adapted refinement of ontology evaluation

During the process of ontology evaluation using the Haghighi et al. (2013) methodology, this study goes through each element individually through seven sessions of focus group meetings and according to records classification criteria. Five domain experts used the developed ontology and evaluated it in particular for clarity, conciseness, completeness, consistency, correctness, expendability/extendibility, minimal ontological commitment and coverage (Haghighi et al., 2013). The iterations

were conducted through the focus group meetings until a satisfactory outcome was obtained. The details of the focus group findings are presented in the following subsection.

Table 6.1: Matrix used to decide on the suitable evaluation methods would be suitable for the present study

Useful Evaluation Criteria (√ = presence, x= absence)	**Ontology evaluation approach 1 (Haghighi et al. 2013)**	**Ontology evaluation approach 2 (Yu et al. 2005)**	**Ontology evaluation approach 3 (Gruber 1995)**	**Ontology evaluation approach 4 (Bright, Furuya, Kuperman, Cimino & Bakken, 2012)**	**Ontology evaluation approach 5 (Stvilia 2007)**
Clarity	√	√	√	x	x
Consistency/Coherence	√	√	√	x	√
Conciseness	√	√	√	x	√
Expendability/extendability	√	√	x	x	
Correctness	√	√	x	√	√
Minimal ontological commitment	√	√	√	x	
Completeness	√	√	x	x	√

Coverage	√	√	x	x	x
Minimal encoding bias	x	√	√	x	x
Usefulness	x	x	x	√	x
Authority	x	x	x	x	√
Semantic consistency	x	x	x	x	√
Structural consistency	x	x	x	x	√
Accuracy/validity	x	x	x	x	√
Currency	x	x	x	x	√
Naturalness	x	x	x	x	√
Verifiability	x	x	x	x	√
Volatility	x	x	x	x	√

6.3 Ontology evaluation details

There are diversed techniques for data collection in a group setting, such as the Delphi method and focus groups. According to Holsapple and Joshi (2002), the Delphi approach is an effective collaborative technique for designing an ontology. Delphi is a systematic and iterative process to assist a group of experts through the use of a questionnaire. Typically the responses are collected anonymously without the need for a face-to-face meeting. On the other hand a focus group technique is similar to a group interview and is coordinated by a facilitator who has strong personal skills. This technique can be used to collect rich qualitative data when access to the group can be arranged (Sim, 1998). In this study since there was an opportunity for a face-to-face

meeting with a group who are expert and have sound knowledge in oral history and records management, the focus group technique was selected to assist with our data collection and ontology validation. The advantage of choosing this method is that it allowed us to avoid the need for a long and complex questionnaire involving more than 200 ontology concepts.

The focus group selected to validate and refine the ontology-based system involved participants who are involved in managing and supervising oral history projects. The selection of the participants in the focus group was based on their professional experience in the area of oral history projects management nationally and internationally. In addition their research and publications in the domain of knowledge for records management was also considered. The aim of the focus group was to obtain information from the participants and use this advice to validate the ontology draft. During the process the ontology draft was improved and refined until satisfaction was achieved. In conducting the evaluation, this study used a protocol whereby the facilitator first presented an overview of ontology-based systems to the participants by showing them the main concepts of the proposed ontology and its subclasses. Each and every ontology concept, its subclasses and the relationships between them were discussed. All the suggested changes such as deletion of some concepts, modification of relationships and addition of new concepts were recorded. In the next subsection feedback was obtained from various domain experts that helped refine the ontology as part of the evaluation.

Clarity: According to Gruber (1995), there are three requirements for clarity as follows: i) the explanation of ontology terms should be defined formally without subjectivity; ii) natural language should be used in documenting an ontology; and iii) the terms must express ‘the intended meaning’ with regard to the requirements of

social situations and computation rather than their context. In this study, since these terms were obtained mainly from the domain-related documents, formal definitions are available for most of the terms. For example the term 'Oral History Projects' is defined as *'academic research project conducted by undergraduate students as part of the academic assessment'* (Ahmad, 2001). In this study all the terms have been documented using everyday language in a Malaysian university context. In the initial ontology-based system 'Oral History Management' was defined as a key concept that included several subclasses such as Celebrities, Events, Dates and Places. During our focus group with domain experts, one of the participants pointed out that this did not communicate the intended meaning and this argument was supported by other focus group members. After some discussion the focus group agreed to replace 'Oral History Management' with 'Oral History Projects' to improve clarity.

Consistency/coherence: According to Arbon (2004) and Gruninger and Fox (1995), the ontology '*should sanction inferences that are not consistent with the definitions*' of the important terms. The elements of an ontology should avoid contradictions or ambiguity and have a logical consistency. For example initially 'Celebrities' was broken into five subclasses: Defence, Entertainment, Education, Security and Sports. However, the inferences were considered inconsistent with and contradictory to the defined concepts because, based on the content analysis, not all of the participants are celebrities. Based on the feedback the concept of 'Celebrities' was removed and replaced with 'Interviewees' to represent it more generally. The subclass 'Professional' was included under the 'Project Field', but in the final focus group meeting it was decided that this topic conveyed some ambiguity, since there could be different types of professionals involved in Oral History Projects. These concepts are considered to be too general to be included in this field. Since the

ontology-based system targets the specific field of the projects, this term was removed to avoid ambiguity and to maintain consistency. In an earlier stage the subclasses of the Project field covered police, army, sports, education and the arts. One of the participants argued that most of the terms under project field, such as Education, Sports and Arts, could be categorised as subjects. On the other hand the terms 'Army' and 'Police' do not constitute a subject and should be replaced with subject terms. After some discussion it was determined that 'Defence' was a more suitable term to use in place of such instances as 'Army', 'Navy', 'Air force', etc. In addition it was also determined that 'Security' was a more appropriate term to use than 'Police'. After seven iterations the ontology-based system achieved consistency removing or avoiding identified contradictions of terms or concepts.

Conciseness: According to Gómez-Pérez (2001), Yu et al. (2005) and Yu, Thom and Tam (2007), the conciseness criterion requires that an ontology should not include unnecessary concepts or redundancies. In the present study this aspect has been carefully considered during the ontology validation. For instance during the focus group meeting one of the participants found that the term 'Dates' in the initial draft ontology was redundant. This term was a subclass of 'Oral History Management' (also a subclass of 'Events'). However since 'Dates' is referred to under the events category, it was put under the 'Events'. At an earlier stage, Events, Places and Dates were considered as different concepts. One of the participants suggested that the terms 'Place' and 'Date' be placed as a subclass of 'Events', since they refer to the date and place of events. The majority of participants agreed that it was unnecessary to have date and place that referred to the same events as separate entities, and therefore 'Date' and 'Place' became a subclass of 'Events'. After seven

iterations, a number of unnecessary concepts had been removed to improve conciseness.

Expendability/extendibility: The actual meaning of this criterion is the ability of an ontology to extend further or to be applied to a specific application domain. In this study an ontology-based system has been built in such a way that it was prepared for the reuse and extension of different parts of the ontology. According to this criterion, it was found that the ontology could be reused and expanded to archival institutions, public libraries and museums to manage their collections effectively. During the focus group meeting one of the participants highlighted that there are other agencies which conduct Oral History Projects such as the National Archives, the National Museum, public libraries and education institutes in Malaysia. According to the participants, the objectives of an ontology-based system can meet the requirements of any Oral History Projects due to the flexibility of the method used to capture the knowledge/contribution of interviewees. Most of the participants agreed that the ontology-based system could be reused and extended to other agencies that conduct Oral History Projects, especially the National Archive of Malaysia, to aid in effective Oral History Projects management.

Correctness: Yu et al. (2005) noted that an ontology should represent the correct modelling of real-world concepts. In this study the main focus of the evaluation is the correctness of the ontology-based system. During the focus group meeting, domain experts greatly assisted in verifying this criterion through useful and constructive suggestions and feedback. For example, the initial ontology-based system 'events' had subclasses of 'Name', 'Dates', 'Places' and 'Type'. The participants found that these subclasses were not sufficient to represent events. After some discussion this concept was revised significantly according to the feedback of the participants (The

subclasses of Events were revised thus: Events Title, Events Date, Events Venue, Theme, Involvement and Contribution). The main issues under this criterion are whether the ontology-based system can represent the real concept of the Oral History Projects domain. During the focus group meeting one of the participants suggested that interviewees become the central concept of the ontology-based system. According to the participants interviewees play a very important role in Oral History Projects. However the majority of the participants disagreed with this suggestion. After some discussion they determined that 'Oral History Projects' was the most suitable term to represent the actual concept of an ontology-based system.

Minimal ontological commitment: According to Gruber (1995), this criterion refers to permitting more flexibility and freedom in an ontology's specialisation. On the other hand Yu et al. (2005) look at this attribute with regard to supporting multiple views for the same information and flexibility in classifying items. This study evaluated this feature by developing EDRMS user interfaces that serve different purposes of searching activities in the subject domain. The comparison between the initial ontology-based system (see Figure 6.1) and the final ontology-based system (see Figure 6.2) shows that the development of the ontology-based system allowed more flexibility and freedom in the specialisation of the ontology. For example, in the early stage of the ontology-based system, Oral History Management became the central term, with four subclasses (Celebrities, Events, Date and Place). After seven iterations it can be seen how the ontology grew from its earlier stage. The final ontology-based system consists of Oral History Projects as the central concept, followed by five subclasses: Oral History Project Plan, Interviewees Profile, Topics, Events and Project Field. In addition the number of instances and subclasses increased from 20 in the initial ontology-based system to 40 in the final system.

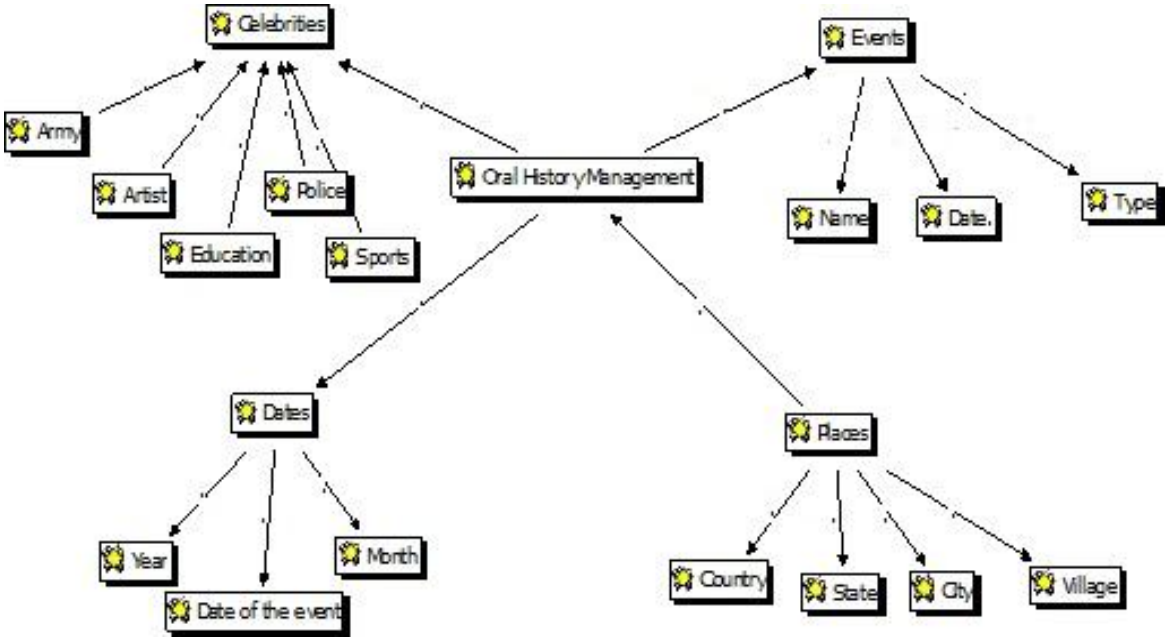

Figure 6.1: Initial state of the ontology in the EDRMS application

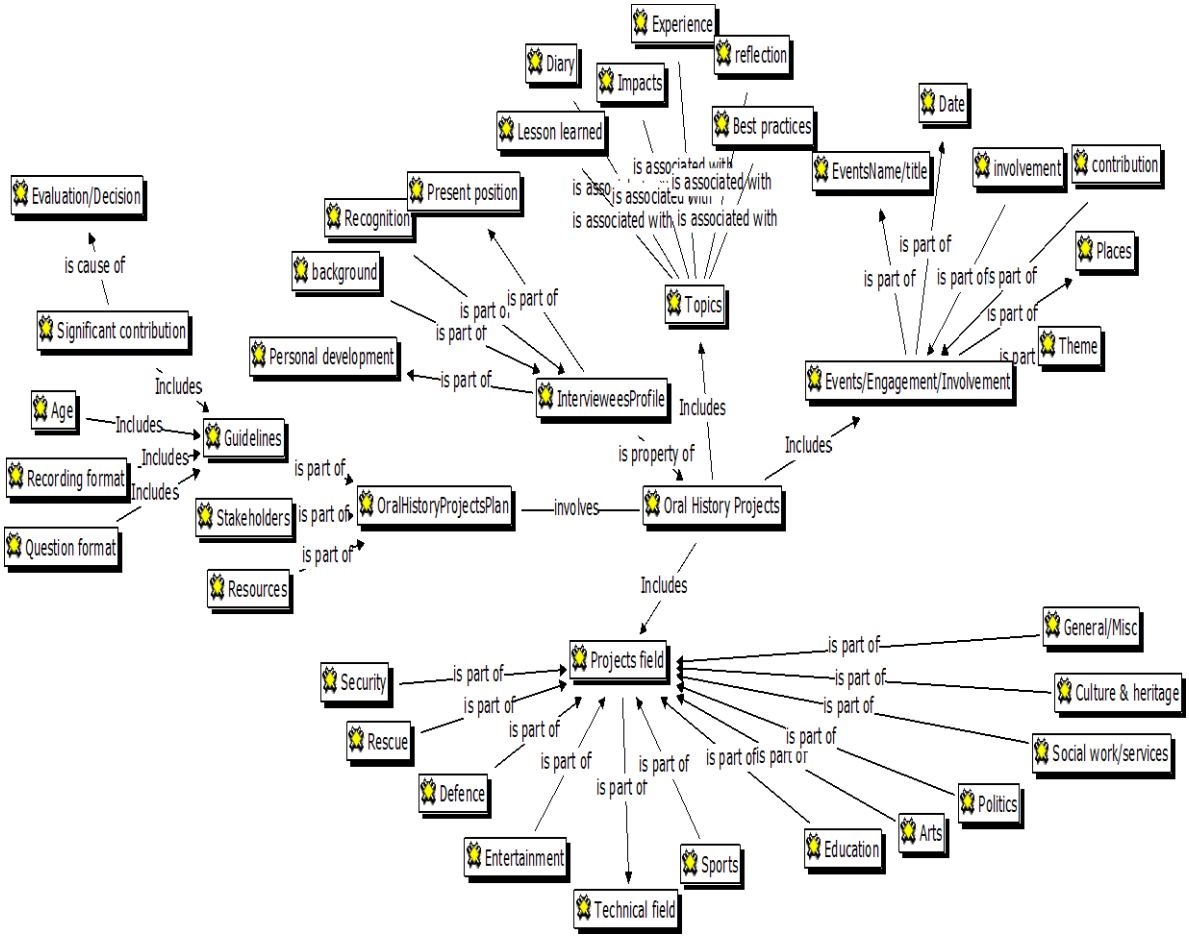

Figure 6.2: The final domain ontology of EDRMS

Completeness: Staab et al. (2001) and Yu et al. (2005) stated that this criterion refers to the completeness of the ontology's individual definitions. According to Gruninger and Lee (2002), this feature can be evaluated by using competency questions that include queries and requirements that the ontology must be able to answer. Due to the size of the ontology-based system only a limited number of examples of the competency questions are presented in this study (Table 6.2).

Table 6.2: An example of the competency questions used to evaluate completeness

Competency questions	***Concept***	***Relationships***
Which candidates/participants should I consider when proposing/conducting Oral History Projects?	IntervieweesProfile	IsPropertyOf
How to conduct Oral History Projects?	Guidelines	IsPartOf
Which criteria should I consider when choosing interviewees?	Significant contribution	Includes
Which field could be considered in selecting interviewees?	Project field	IsPartof
How do I get the interviewees' information?	IntervieweesProfile	IsPartof
Which types of events are involved in the Oral History Projects?	Events	Includes
How do I choose a topic in conducting Oral History Projects?	Topics	Includes

During the focus group meeting most of the participants agreed with all the definitions given. It was also found that an ontology-based system can answer all the queries and requirements outlined. For example, the first competency question is: 'Which candidates/participants should I consider when proposing/conducting Oral History Projects?' The appropriate term to answer this question is 'Interviewee Profile', and the relationship is 'Is Property Of'. The second question is: 'How should Oral History Projects be conducted?' The appropriate term to answer this question is 'Guidelines', and the relationship is 'Is Part Of'. The third question is 'Which criteria should I consider when choosing an interviewee?' The appropriate term to answer this question is 'Significant contribution' and the relationship is 'Includes'. The fourth question is 'Which field could be considered in selecting the interviewees?' The appropriate term to answer this question is 'Project field', and the relationship is 'Is Part Of'. The fifth question is 'How do I get the interviewees' information?' The appropriate term to answer this question is 'Interviewee Profile', and the relationship is 'Is Part Of'. The sixth question is 'Which types of events are involved in the Oral History Projects?' The appropriate term to answer this question is 'Events', and the relationship is 'Includes'. The seventh question is 'How do I choose a topic in conducting Oral History Projects?' The appropriate term to answer this question is 'Topics', and the relationship is 'Includes'. Overall this study found that the ontology can answer all the competency questions outlined. Therefore it can be concluded that the ontology has satisfied the domain experts.

Coverage: Haghighi et al. (2013) addressed this criterion by using leximancer software (Smith and Humphreys, 2006) in their study. However, they found that leximancer had limitations that required significant refinement by the domain expert. In addition it was time-consuming. Based on the recommendations of Haghighi et al.

(2013), this study employed an expert to review, evaluate and refine the coverage. During the focus group meeting, many changes were made to improve the coverage of the ontology. For example the initial ontology had only a small coverage with Oral History Management as a central concept and with four subclasses (Celebrities, Events, Date and Place). After seven iterations the final ontology-based system consists of Oral History Projects as the central concept, followed by five subclasses: Oral History Project Plan, Interviewee Profiles, Topics, Events and Projects. At the end of the session domain experts agreed with the final draft of the ontology.

6.4 Systems evaluation details

As mentioned the study has used an application-based approach for evaluating the proposed ontology-based system. In order to perform usefulness testing, the system was developed in a form of proof-of-concept prototype and therefore an application-based evaluation was useful in this instance. It was found that the prototype system shows real-time and appropriate outcomes that fulfill the complex university criteria for interviewee and field selections. Moreover this study also found that using the developed ontology as an integral part of the proposed new EDRMS provided consistency and effectiveness in all of the testing activities. In addition it facilitated interpretations activities for decision support, and resolved terminology inconsistencies when conducting records entry, modifications of records and integration. Table 6.3 shows the participants' views on the usefulness of the application. Most participants expressed positive comments that demonstrate the application is innovative and promising for effective searching and navigating records and oral history. It can be concluded that the ontology can offer enhanced meaning

support using a common vocabulary that leads to consistency and better decision making.

Table 6.3: Views of some participants on the newly developed application

Participants	**Comments captured during the evaluation sessions**
User 1	*"I found the system has better navigation support that helps to find my preferred answer to find interviewees"*
Developer 2	*"This system offers a variety of options to facilitate the searching activities to the users. I think it will assist the students in the process of determining the interviewees"*
User 7	*"Based on my experience using the system, I found that it is user friendly and easy to use to find the materials needed. This can assist me to make a quick decision related to my study".*
Developer 4	*"Compared to the previous system, I found that the new system is better than the previous one especially in terms of navigability. This system provides many links which facilitate the user to browse and navigate through the system easily. This can assist the supervisor to validate the students' proposal quickly"*
User 2	*"When I use the new system, I can find the information easily and I got a quick answer"*

User 10	*"Ok, from the student view/perspectives, I think he/she can view the system to avoid redundancy/duplication. For those who has been interviewed, will not be interviewed again"*
Developer 3	*"From the taxonomy/ontology perspective, maybe we can come out with general taxonomy to specific. This can facilitate users to their needs. So, it is hope that the system can provide taxonomy/ontology or specific user searching which can guide the users."*
User 7	*"After using this system, I found that it is user friendly, and easy to use because it offer more options of searching method. For me this system is very helpful to assist the students in getting the information quickly"*
Developer 5	*"From the lecturer view/perspectives, if we can access/refer through the system (EDRMS), so we can see which figure is not/less being interviewed by the students, so we can proposed them to the students."*
User 11	*"After using the new system, I found that it is user friendly and easy to user especially in searching information. This can help the user to make a decision quickly."*
User 15	*"Compared to the previous version, this system improves a lot especially in terms of searchability and navigability. This will benefit the users "*

Developer 1	*"The taxonomy provided in the new system guide the users in navigating and searching the system. Actually, it is an added value which can facilitate the users."*
Focus group participants 1	*"I think this system improves a lot after fulfilling all the users' needs"*
Focus group participants 2	*"In my opinion, this system now performs better after addressing all the focus group feedbacks".*
Focus group participants 3	*"I think the system now become more efficient. There are a lot of action taken such as reducing redundancy suggested by the focus group meeting"*
Focus group participants 4	*"The new system exactly implemented according to the improved ontology model, so I think it is much better than before"*

6.5 Recommendations

Based on this study several recommendations are made for the benefit of researchers and practitioners:

- First, data findings from the focus group meetings for both aspects of ontology and system prototype evaluation suggest that the developed ontology is of assistance for target users in searching and navigating key terminologies through the use of the new EDRMS system. It is also evident through the literature that ontology can improve: the searching and navigability ability of

the system (Kashyap, 2009; Kashyap et al., 2007); health care (Hyvonen et al., 2007; Patel, 2007; Marie et al., 2006); energy (Norheim and Fjellheim, 2006; Ramakrishna, 2008); and education (Cardoso, 2007; Gliozzo et al., 2007; Van Harmelen, Horrocks, Hendler and McGuinness, 2000; Fensel et al., 2000; Domingue et al., 2004; Chen et al., 2006; Bose and Sugumaran, 2007; Castro et al., 2007; Blomqvist, 2012; Figueiredo et al., 2012). Therefore, this study recommends that systems development for purposes of records management should use an ontology.

- Second, based on the feedback of the focus group meeting, it was found that the key elements of a records repository are a very important factor to consider during systems development. By doing so it may impact on the performance of the systems developed. It is evident through the literature that the key elements of a records repository are very important to fulfill user needs (Bailey and Konstan, 2006; ISO, 2001). Therefore the study recommends that the development of future systems needs to consider key elements of a records repository to ensure that this fulfills user needs appropriately.
- Third, based on the outcomes of the focus group meeting, it was concluded that the end user is the most important element of systems development because end users are the ones who use and receive benefit from a developed systems. User input is very important that a system is to be improved according to user needs. As stated above it is evident through the literature that the key elements of a records repository are very important to fulfill user needs. For instance Robey and Farrow (1982) highlighted the benefits of user involvement in systems development:

- Improved quality of the systems arising from more accurate user requirements.
- Avoiding costly system features that the user did not want or cannot use.
- Improved levels of acceptance of the system.
- Greater understanding of the system by the user resulting in more effective use.
- Increased participation in decision-making in the organisation.

Therefore it is recommended that systems be evaluated through a high level of user engagement.

- Fourth, the focus group meeting also highlighted the importance of systems integration to ensure that a DB delivers accurate and timely information to the user. It is evident through the literature that systems integration is very important. Abu Bakar (2003) identified the benefits of systems integration as follows:
  - Shorter/reduced steps in business processes
  - Time taken to process an application/record
  - Fewer complaints from members of the public
  - Number of applications/records processed over a period.

  Therefore this study proposes that systems have an efficient integration method in order to interface with a records repository.
- Fifth, the focus group meeting also found that records management standards is very important as a benchmark and guide to ensure that records are managed properly to protect their authenticity and maintain their evidential value. Wilhelm (2009) highlighted the importance of a records management standards:

- Necessary for the development of appropriate software in the 1990s.
- Standards can facilitate software development and also increase user acceptance of standard compliant products.
- Standards are vital for quality control.

Therefore this study recommends that future systems comply with records management standards.

6.6 Chapter summary

The chapter presented a system evaluation and recommendations for the ontology-based EDRMS approach. The system specification details begin with describing the semantic domain ontology evaluation. The second part of the chapter discussed data collection for ontology evaluation. The third part of the chapter presented recommendations. Finally the fourth part summarised the chapter.

The process of ontology evaluation was conducted using the methodology provided by Haghighi et al. (2013). In addition the study used an application-based approach for evaluating the proposed ontology-based system. Furthermore to validate and refine the ontology-based system, focus group techniques have been utilised with participants involved in managing and supervising Oral History Projects (records management development project). It was found that the majority of the respondents were satisfied with the improvements and performance of the new proposed ontology-based application systems.

Chapter 7

Discussion and conclusion

7.1 Chapter introduction

The main goal of this study was to investigate issues of an existing records management application in a case organisation. The issues are related to searching, navigating, KM and DB management. Each issue has been explained in Chapter Four (see sub-section 4.5) previously. The aim was to develop and evaluate a new records management solution in order to address the issues for the target users, particularly for decision-making purposes. The study consists of two aspects: an empirical case study and a solution development study. Through the case study findings the study has collected in-depth details about the issues related to the existing systems that have been explained in Chapters Three and Four. In practice within the case organisation, higher education institutes suffer from a range of issues in managing their academic records and relevant digital content; however the current approaches provided limited options for answers to the need. To address the issues the second aspect of the study has dealt with a proposed solution development through a proof-of-concept prototype demonstration for systems evaluation. The evaluation has been conducted through a number of focus group interviews that are described in Chapter Six. The solution specification has been described in Chapter Five. The development provided a foundation for building an innovative ontology-based records management solution mandated to organisational standards which will be the next step of the study.

This approach addressed several weaknesses identified in previous approaches. As discussed previously relevant applications such as EDRMS are still too incapable, inflexible and static to provide sophisticated support for users in a context-specific manner. For instance Katuu (2012) revealed that a very limited number of ERM implementations presented institutional experiences related to implementing electronic documents and records management. Therefore the specific aim of the research was limited to improving the current capability of EDRMS applications.

This chapter concludes with the summary of the two different aspects of the study (case study and solution development) in the sections below (see sections 7.2 and 7.3). The fourth section (see section 7.4) describes the theoretical contribution of the study. The fifth section (see section 7.5) describes the practical contribution. The sixth section (see section 7.6) explains the limitations of the study and the seventh section (see section 7.7) describes future directions for study. Finally the eighth section (see section 7.8) summarises the concluding chapter.

7.2 Summary of empirical case study

The research questions were:

- *How can a more context-specific and systematic records management approach be developed for meeting end users decision support?*
- *This is followed by two sub-questions:* a) *what are the key issues affecting effective ERM systems development for education end users? b) what technologies may offer context-sensitive improved records management provisions for end users?*

Both theoretical and empirical findings were gathered to address the questions. Interviews were employed to collect participant views on the existing systems. In total 30 informants including five developers and 25 users of the EDRMS were interviewed. The interview guide contained three sets of questions (see Appendix A).

The first set (A1) contained a series of questions for the developers related to the benefits and problems associated with the current systems. The second set (A2) comprised a list of questions for the users related to the benefits and problems associated with using SW ontology features with existing approaches. The collected interview data were analysed through the Strauss and Corbin (1998) method in that open coding was used followed by axial coding. In open coding the study went through the transcripts and assigned a unique code to each relevant subjective (issue) area in order to analyse them individually. After that the study used axial coding in order to perform 'ordering' of the various quotations in each relevant subjective matter. Next, to facilitate the process Atlas.ti software was used to represent initial outcomes of ontology design (see Appendix C). These practical issues were related to users' decision provisions that resulted in inappropriate search indexing and vocabulary inconsistencies that led to mismatches between the user requirements and records contents in the existing systems. The findings were well-justified with the target literature as it was defined in Chapter Two. These findings reinforced the study to explore ontology-based provisions specially to address the associated issues as discussed earlier. As was discussed in Chapter Two, the semantic ontology provides options to address the associated issues.

7.3 Summary of new solution development and evaluation

The IS solution in this study is the ontology-based EDRMS, as an effective ERM application that has been developed and evaluated for meeting the target demand. According to Sprehe (2005), to enhance records management in serving enterprise goals and missions, ERM applications are required to be fully integrated within ECM. Katuu (2012) evaluated the implementation of enterprise content management (ECM) and revealed that there have been a small number of published sources in academic knowledge outlets, related to the implementation of electronic documents and records management. The motivation for this research came from these studies, as they suggested additional research is needed to assess and develop proprietary applications as well as the impact of them for value-adding to an organisation. The research developed a semantic ontology-based EDRMS solution for the benefit of regular users such as educators and students as decision-makers. This solution solves technical issues such as interoperability, consistent vocabulary and friendly domain-specific terminology.

Our focus was on improving the overall aspect of decision support using the core concept of the developed ontology-based system. As mentioned earlier, three major theories were used to construct the semantic ontology-based system: Joo and Lee (2009) for integrating the developed ontology as the main component of the system; Protégé (Gennari et al. 2003) for structuring the ontology and Haghighi et al's. (2013) theory that originally adapted the step-by-step process of ontology development procedure that informed about the proposed four-phased development approach that was used throughout the development activities. The study of Joo and Lee (2009) proposed a structural integration of the semantic web to overcome the inconvenience of managing knowledge through effective provision. In this integrated semantic web

approach a software agent represents the meaning of the terms through the application of an ontology. Joo and Lee (2009) found that a semantic web-driven system can support effective KM components to overcome search and integration limitations. The study adopted the three-step approach using Haghighi et al. (2013) to support domain ontology development. This approach offers a rigorous and inclusive ontology and evaluation method involving domain experts which is vital in our study context (Chapter Six section 6.3 contains evaluation details). The Protégé system (Gennari et al. 2003) provides an application platform for more general purpose knowledge organisation so users can structure components within the problem domain prior to systems design. Protégé helps to reduce the knowledge acquisition bottleneck by minimising knowledge engineers' roles in constructing knowledge-based systems. The following section explains the details of the new ontology using Protégé 4.0.3.

The findings of the comprehensive evaluation of the developed system demonstrated positive reflections on its features and its effectiveness within the organisation. Practically the lessons learnt from building the proposed ontology-based system for this domain could be generally beneficial for information retrieval to eliminate vocabulary inconsistencies in the practice of using an EDRMS.

7.4 Theoretical contribution

The proposed approach advances previous EDRMS solutions by explicitly incorporating three main theories: specifically, KM integration by Joo and Lee (2009) and the Protégé KM platform by Gennari et al. (2003) through the established methodology for ontology construction by Haghighi et al. (2013). This activity promotes a new way of application development through a rigorous process. Simultaneously this research extended ontological development for the first time into

records management application development. As such the anticipated contribution goes to the current body of knowledge of KM and DSS. The study presented a three-phased approach adapting the step-by-step process to conduct the investigation in order to develop a basic ontology-based solution within the targeted domain. The proposed new architecture of domain ontology-based EDRMS satisfies the user requirements through meeting organisational standards. Furthermore evaluation contained positive feedback.

This contribution although validated only in a specific problem domain, can provide a useful insight for application by developers/researchers and practitioners in dealing with complex records management and addressing them through ontology development for better decision support. This study can add to current knowledge of decision support mechanisms and records management systems development.

7.5 Practical contribution

A systematic records management solution was required by the academic users within the target organisation. The current need was pressing due to difficulties encountered within the existing solution. At the same time a new sustainable way was required to meet an ongoing organisational standards for record keeping, sorting, retrieving and representing. The study met this need. In addition:

- This research provides guidelines grounded in the real-life experience of developing EDRMS through the lessons learned during the development of the system.
- In the local context there are quite a number of institutions which develop and maintain records management systems such as for oral history collections, especially public libraries, archival institutions and museums. However none

of these institutions uses an ontology-based retrieval system to manage the access to their collections. Therefore the findings of this study could be applied to those institutions as well.

- Dimoulasa, Kallirisa, Chatzaraa, Tsipasa and Papanikolaoua (2013) called for the requirement to develop a rigorous methodological framework for production, digitisation and presentation of contents to preserve local tradition and folkloric heritage materials. These contents are mainly audio-visual, such as existing music and dances (e.g. video and audio files and their meta data). The developed ontology-based system framework can address this requirement, as the core idea was to promote sensitive preservation and exploitation of contents or records within an organisational environment. As such the contribution of the study, although created and validated in a specific problem domain, can provide a useful insight for application developers/researchers and practitioners in dealing with complex decision situations and addressing them through ontology development for better KM. This activity can improve practices and relevance to the current knowledge in DSS fields.

7.6 Study limitations

The developed ontology can be applied to any similar domains in which digital contents require management through effective techniques and context sensitivity. One of the limitations of the study is that the study focused only on ontology development to improve decision support ability by offering a standard knowledge structure for the use of targeted user groups in a case context. The study also focused on addressing four issues such as searching, navigating, KM issues and DB issues; however, there were issues in the case study findings such as security, integrity and

DB conversions. The proposed system does not address them at all. However the ontology-based system has been constructed in such a way that it provides reusability and sharing capabilities. In addition, it can easily be extended and adapted to other problem domains.

7.7 Future directions for study

State-of-the-art surveys identify a gap in that there is no common ontology describing the domain knowledge for managing digital records in education institutes. The implementation detailed in this thesis demonstrated the potential of using an ontology for resolving issues of vocabulary inconsistencies, decision support among academics and students, coordination in educational records management, plus its ability to be extended further for national archives, museums and public libraries. The lessons learnt from building an ontology-based system for this domain could be beneficial in general for information retrieval and accessibility in the practice of using EDRMS in the education domain. Nevertheless, there are a number of aspects not focused on as a part of this research. These issues merit further investigation and include:

- *Public library archival system:* The developed solution can be used as an initial basis for archival system development in public libraries. It is important to reconstruct the ontology-based repository that could make the solution compatible with any web-based system - including any central knowledge repository that might be available. An interesting area for future research could be to integrate the developed ontology within any organisational archival system for better records management.
- *Web and enterprise-based solutions:* This study developed a new ontology-based solution for education users' records management. Further research

could be undertaken for business enterprises to build customised access options for specific users and problem spaces. For instance a central records repository could be located on any server; end users from different businesses may then access records for their own training and experience-gathering activities.

In summary this research has contributed to the knowledge of records management applications in IS by proposing a new theory for end-user oriented application design. The ontology-based design overcomes a number of identified limitations with previous approaches. At the same time the developed ontology-based system addresses the dynamic requirements of education institutes for enhancing decision-making by educators and students, and its potential extension to other areas such as public libraries or national archives has been anticipated. This work also advances the theory of KM in IS by employing semantic ontology-based records management in which users can benefit by employing advanced features. Feedback from participants in focus group interviews has been positive and it is hoped that the flexible solution developed can support education organisations in the future.

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Appendix A:

Research Question Development

According to Cresswell (2007), qualitative research needs to be conducted when the issues or problems are to be explored. In addition, qualitative research also conducted when there is a need to study a group of population or to measure variables. Blaikie (2003) noted that, in order to address a research problem, research question have to be stated. Therefore, the research questions for this study are as follows:

How can a more context-specific and systematic record management approach be developed for meeting end users decision support? This is followed by two sub-questions: a) *what are the key issues affecting effective ERM system development for education end users? b) what technologies may offer context-sensitive improved record management provisions for end users?*

The next stage of the study involved interviews conducted with the purpose of collecting research data to be used for answering the research questions. In this study, the interviews involved the development of the research instrument i.e. the interview questionnaires. Based on the research question, the interview questionnaires were developed. The following question is dedicated to answer the first sub-research question: *what are the key issues affecting effective ERM system development for education end users?* While the second sub question relies on literature survey.

Appendix A1

Interview Schedule For Developers

The key issues affecting effective ERM system development for education end users

1. What was your involvement in the Oral History Management System (EDRMS) project?
2. Can you explain how the system was developed?
3. Is the required functionality available?
4. Are the procedures properly documented, published and known about?
5. Have users received adequate training and coaching to take advantage of the new facilities?
6. Are staffing levels and skillsets appropriate for the actual workloads?
7. Are staffs displaying appropriate attitudes to get the best out of the system (confidence in its capabilities, belief in its purpose, willingness to make it work, etc)?
8. How busy, usable, useful and adequate are support services such as the systems support function and help desk?
9. Are third parties such as customers and suppliers satisfied with the service?
10. Is the level and nature of identified faults acceptable?
11. Are faults handled at an acceptable speed and with satisfactory results?
12. Is data integrity being maintained within the system and in relation to other integrated or interfaced systems?
13. Are systems controls being applied correctly?
14. Are business, procedural and financial controls being applied correctly?
15. Does the system and its usage meet current legal and regulatory requirements?
16. Is the system able to process transactions at an adequate speed?
17. Does the system have the capacity to deal with the actual peak loadings as encountered and foreseen?
18. Are staffs following operational procedures including backup, recovery, security and disaster recovery?
19. Has the project been properly demobilised, eg documentation filed, team members appraised and reassigned, equipment and facilities returned, final accounting and reporting completed, success and completion communicated?

Benefits

20. What were the final costs of the project?
21. What is the actual operating cost of the new solution?
22. What is the actual benefit being delivered by the new solution?
23. How does that compare to the original project definition?

Further Improvements

24. Could further training or coaching improve the degree of benefit being generated?
25. Are there further functional improvements or changes that would deliver greater benefit?
26. Are specific improvements required in procedures, documentation, support, etc?
27. What learning points are there for future projects?

Appendix A2

Interview Schedule For Users

The key issues affecting effective ERM system development for education end users

1. How long have you been using this system?
2. What are the benefits users can get from this system?
3. How would you describe the benefits of an EDRMS? What steps need to be taken in order to successfully deliver an EDRMS that achieves these benefits?
4. How would you describe the users' use of the current EDRMS?
5. How satisfied are users with the current EDRMS? How would you define the user satisfaction? How is satisfaction measured?
6. How would you assess the importance of users skills for the success (or otherwise) of the current EDRMS?
7. How has the quality of the data affected the current EDRMS project's outcome?
8. How has the quality of the IS staffs (skill and experience) affected the current EDRMS project's outcome?
9. What are the goals for an EDRMS?
10. Do you think the Organization can achieve their goals through an EDRMS?

11. Are there any other factors that you believe would influence delivery of the service?
12. What are the main barriers to the success of the current EDRMS?
13. What do you think about the query representing the current system?
14. What do you believed is good about it?
15. What do you believed is not good / what frustrating you when you use them?
16. What do you think you might able to do with the current system?
17. What do you think you might not able to do with the current system?
18. Are there any other factors EDRMS successes in Malaysia that you want to discuss?

Appendix A3

Focus Group Interview Schedule (adapted from Haghighi et al. (2013)

A Semantic Ontology-Based Records Management Approach for Academic Users' Decision Support

1. In your opinion, would this term be suitable as the key concept for this ontology domain?
2. What do you think of the terms proposed to represent the concepts in the ontology?
3. Please comment on the choice of concepts in terms of their ability to express what needs to be said?
4. Do you think that this ontology has the ability to be extended further or to be applied to a specific application domain for example to another system outside the organization?
5. Do you think that this ontology adequately represents the concept in the oral history collection?

Appendix B:

Details of Qualitative Data Findings

B1: Example qualitative data findings (Interview script by Developers)

What are the key issues affecting effective ERM system development for education end users?

1. **What was your involvement in the EDRMS System project?**

   I was among the team member who was involved in the project from the early stage, i.e. as early as the conception of the project. We felt that as a pioneer in the field of information management in this country, we ought to be a role model for the others to look up upon, hence this project. We started by building the foundation, then enhancing it to include a taxonomy of related terms, and more recently the creation of bibliographic metadata for the contents.

2. **Can you explain how the system was developed?**

   It started with a rather humble footing. The concept was simple, basically according to the SDLC. We ventured through MS Access, then xml php, and gradually we moved to open source KOHA. Basically we progressed based on the acquisition of new knowledge on the subject matter, i.e. when a new technology is introduced, we studied them and try to adopt it to our system.

3. **Is the required functionality available?**

   The system has all the basic functions, from the means to capture information, processing, retrieval, etc. It is suitable for users of all levels of skills to use it to look up for information. This is partly due to the fact that members of the development team represent different subfields of information

   Are the procedures properly documented, published and known about?

   Initially, this system was developed for a specific of community – the staff and students of information management. Each member was basically trained to

use the system and the procedures were produced in both hard and soft copies. Documentation was complete for the system development and usage and is readily accessible in the lab for everyone's reference.

4. **Have users received adequate training and coaching to take advantage of the new facilities?**

   Continuous training was given to in-house users, maintenance staff and end users. Users were trained in batches in the lab which include guided hands-on sessions for them to familiarise with the system. Additionally, up-to-date user manuals are also provided for them to refer.

5. **Are staffing levels and skill sets appropriate for the actual workloads?**

   This project was set forth with a multipronged strategy, especially as a platform to expose students to a real oral history management system. In this case, students take turn to update the contents of the database and this somehow reduces the dependency of full-time staff to work on the system. These students have the required skills for the tasks.

6. **Is staff displaying appropriate attitudes to get the best out of the system (confidence in its capabilities, belief in its purpose, willingness to make it work, etc)?**

   A sense of belonging and the desire to improve the system was high among staff and students as they see that the system is a pride of the faculty, a product which would enhance the visibility of this institution nationally and internationally.

7. **How busy, usable, useful and adequate are support services such as the systems support function and help desk?**

   In the beginning, efforts were concentrated on systems support and a special feature of this system is that support is locally available and the development team works closely with each other. This helps problems to be addressed in good time – through a weekly meeting of the development team.

8. **Are third parties such as customers and suppliers satisfied with the service?**

   The development team receives direct feedback from end users on the systems performance and through this kind of mechanism, problems could be solved in a consultative manner to the satisfaction of the users.

9. **Is the level and nature of identified faults acceptable?**

   A big portion of the comments received from users could be categorised as personal preferences as to how the system should function. On the average, the requests were used to further customised the system for the benefit of the users.

10. **Are faults handled at an acceptable speed and with satisfactory results?**

    Since we have an in-house maintenance team, we would say that we were able to attend to any issue raised by the users in good time, in consultation with them, creating a workable platform to continuously enhance the syetem.

11. **Is data integrity being maintained within the system and in relation to other integrated or interfaced systems?**

    As it is the system does not require data from other sources apart from its own databases of users and information contents. Perhaps, in the future we would look into these issues when the need for fee-based subscriptions, for example, arises.

12. **Are systems controls being applied correctly?**

    The administrator and development team are fully in charge of the controls and that decisions are made collectively by the management team, which represent the interest of the institution.

13. **Are business, procedural and financial controls being applied correctly?**

    The management team oversees the overall development and operations of the system and human resource development of the entire project. As such the academic and research interests of the faculty and university are always upheld.

14. **Do the system and its usage meet current legal and regulatory requirements?**

    Continuous efforts are being taken to ensure legal requirements met, through the periodic advice from the university's legal office and the computer centre.

15. **Is the system able to process transactions at an adequate speed?**

    Speed was one of the aspects given top priority in the planning stage and as such both hardware and design of the system were planned with the need to ensure speed of transactions in mind.

16. **Does the system have the capacity to deal with the actual peak loadings as encountered and foreseen?**

    The present infrastructure that we acquired is capable of handling simultaneous processing, but as technology gets outdated very quickly, we constantly monitor that and would update our requirements as and when we need to do so.

17. **Is staff following operational procedures including backup, recovery, security and disaster recovery?**

    We have developed quite a comprehensive SOP for everyone to follow, but we have not been tested on disaster recovery yet. However, we are prepared. Backups are routinely done according to schedule.

18. **Has the project been properly demobilised, eg documentation filed, team members appraised and reassigned, equipment and facilities returned, final accounting and reporting completed, success and completion communicated?**

    To date we have completed a full cycle of the development and gained a lot of experience from that exercise. We have made tremendous improvements thereon and are still incorporating best practices in our quest to continuously enhance the system. Along the way we had occasions where staff was reassigned, facilities upgraded and sharing of experiences within our fraternity.

Benefits

19. **What were the final costs of the project?**

    Thus far we have spent around RM500,000 and this amount does not account for shared facilities such as existing storage facilities, etc. We consider this a relatively low investment by the institution which would provide good ROI in the long run.

20. **What is the actual operating cost of the new solution?**

    It is about 60% of the total costs which include the acquisitions of resources, processing, expert reviews, training and documentation.

21. **What is the actual benefit being delivered by the new solution?**

    As a training institution, we saw students and staff getting first-hand experience in using and developing such a system. Our students having this

kind of exposure would enhance their employment chances in market-driven job opportunities.

22. **How does that compare to the original project definition?**

    Since the idea of the project started in a research interest group, we saw the potentials of the system, but as it grows to become what it is now, we realised that some of the outcomes are just beyond expectation, especially the sense of pride for being the first local product.

Further Improvements

23. **Could further training or coaching improve the degree of benefit being generated?**

    We are already positioning people to study new requirements and technology to take this system further.

24. **Are there further functional improvements or changes that would deliver greater benefit?**

    At the moment we are considering the application of new methodologies.

25. **Are specific improvements required in procedures, documentation, support, etc?**

    We would consider what we have achieved so far as the outcome of phase 1 or version 1 if you like, and the challenges that we faced indicate that we need to also consider new methodologies, to be competitive and more importantly for integration and interfacing with other systems. It would be imperative to improve the procedures, documentation and support.

26. **What learning points are there for future projects?**

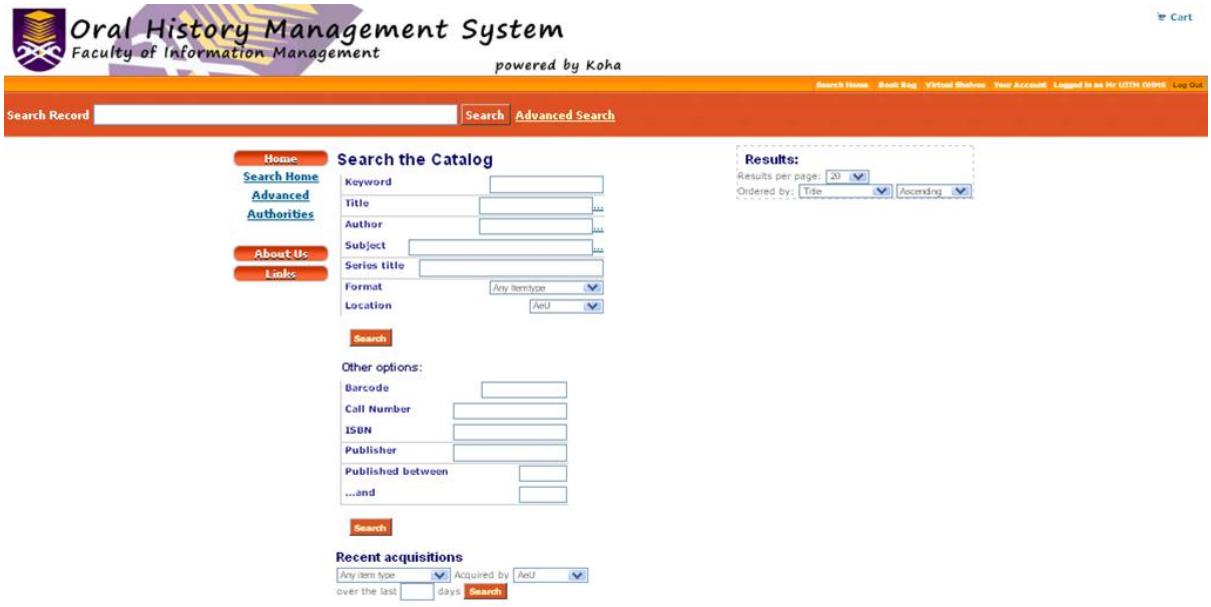
    We have learned a great deal from the experience and some important lessons are like procurement of hardware needs to take into account price hikes, training of staff should be open to many due to staff leaving the institution for other jobs.

Appendix C:

Details of Design Specifications

New solution Ontology-based EDRMS Interface

Figure C1: Main window



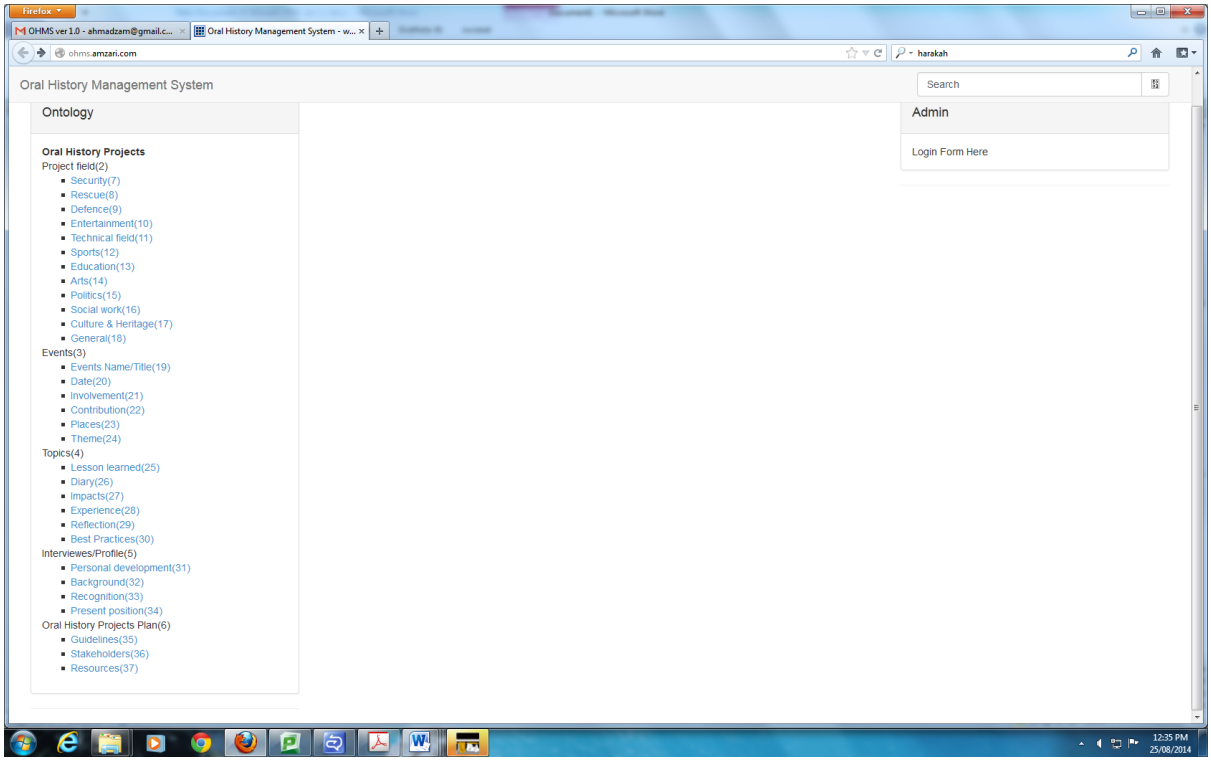


Figure C2: Ontology interface

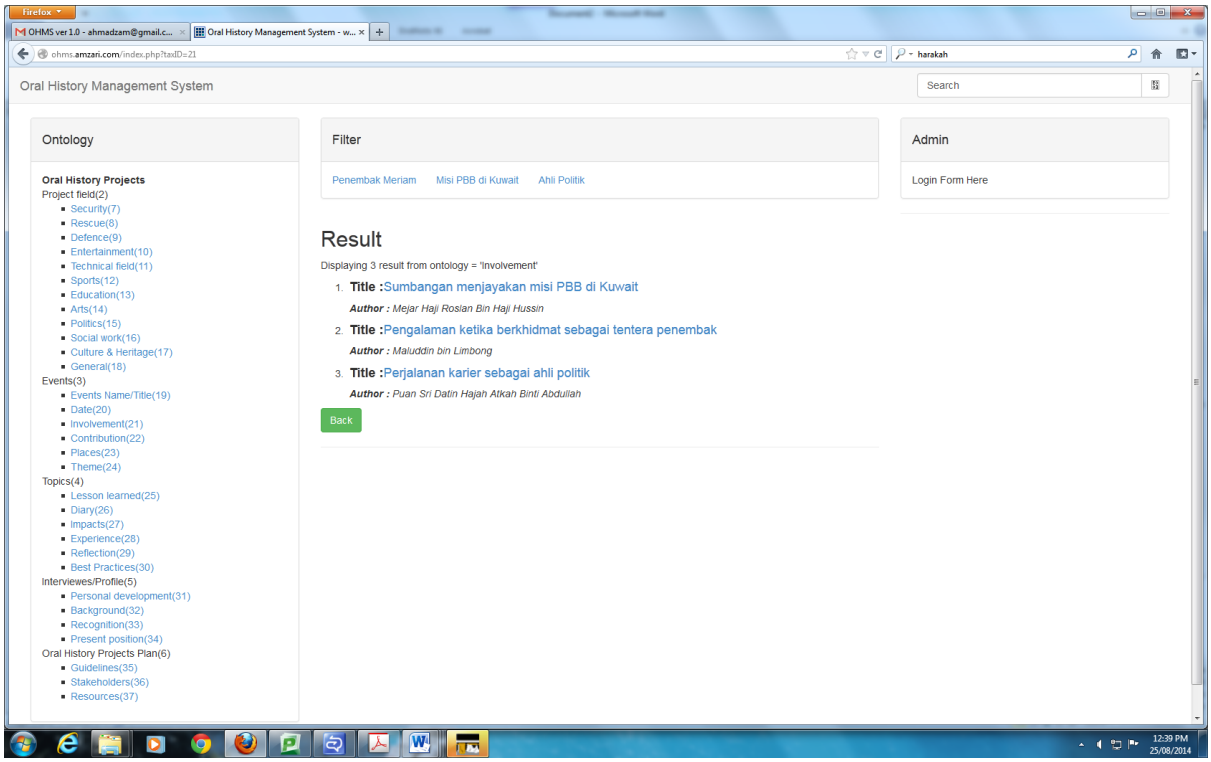


Figure C3: Ontology interface with searching results

Source Code

1. Index.php

```
<?php
include 'header.php';
include 'left.php';


//$sql3 = "SELECT * FROM content";
if(isset($_GET['taxID'])){
	$sqlfilter = "SELECT * FROM taxonomy WHERE ParentID = ".$_GET['taxID'];
	$sqlpre = "SELECT ContentID FROM contenttaxonomy WHERE TaxID =
".$_GET['taxID'];
	$sqlont = "SELECT * FROM taxonomy WHERE TaxID = ".$_GET['taxID'];
}

if(isset($_GET['ContentID'])){
	$sqlcontent = "SELECT * FROM content WHERE ContentID =
".$_GET['ContentID'];
}

if(isset($_GET['srch-term'])){
	$sqlsearch = "SELECT * FROM content WHERE Title LIKE '%".$_GET['srch-
term']."%' OR Author LIKE '%".$_GET['srch-term']."%' OR Description LIKE
'%".$_GET['srch-term']."%'";
}

?>

  <!--center-->
  <div class="col-sm-6">
  <?php
  //Display result from Taxonomy Nodes
  if(isset($_GET['taxID'])){
  $taxID = $_GET['taxID'];
  echo " <div class='panel panel-default'>
         <div class='panel-heading'><h4>Filter</h4></div>
               <div class='panel-body'>";
                      $resultfilter = mysqli_query($con,$sqlfilter);
                      while ($rowfilter = mysqli_fetch_array($resultfilter)){
                             echo "<a
href='index.php?taxID=".$rowfilter['TaxID']."'>".$rowfilter['Node']."</a> 
      ";
                      }
       echo "         </div>
       </div>";


    echo "<div class='row'>
      <div class='col-xs-12'>
        <h2>Result</h2>";
               $resultpre = mysqli_query($con,$sqlpre);
               $numrow = mysqli_num_rows($resultpre);
               $resultont = mysqli_query($con,$sqlont);
               while ($rowont = mysqli_fetch_array($resultont)){
                      echo "<p>Displaying $numrow result from ontology =
'".$rowont['Node']."'</p>";
               }
               echo "<ol>";
               while ($row3 = mysqli_fetch_array($resultpre)){
                      //echo $row3['ContentID']."<br>";
                      $sqldisplay = "SELECT * FROM content WHERE ContentID =
".$row3['ContentID'];
                      $resultdisplay = mysqli_query($con,$sqldisplay);
                      while ($rowdisplay =
mysqli_fetch_array($resultdisplay)){
                             echo "<li><h4><strong>Title :</strong><a
href='index.php?ContentID=".$rowdisplay['ContentID']."'>".$rowdisplay['Title'].
"</a></h4> <em><strong>Author :</strong> ".$rowdisplay['Author']."</em><!--<p
class='lead'><button class='btn btn-success'>View Details</button></p>--
></li>";
                      }
               }
```

```
       echo "</ol>
               <p class='lead'><button class='btn btn-success'
onclick='goBack()'>Back</button></p>
        <!--Hide
               <p class='pull-right'><span class='label label-
default'>keyword</span> <span class='label label-default'>tag</span> <span
class='label label-default'>post</span></p>
        <ul class='list-inline'><li><a href='#'>2 Days Ago</a></li><li><a
href='#'><i class='glyphicon glyphicon-comment'></i> 2 Comments</a></li><li><a
href='#'><i class='glyphicon glyphicon-share'></i> 14 Shares</a></li></ul>
               Hide -->
               <hr>
      </div>
    </div>";
       }

//Display result from Free Text Search Term
  if(isset($_GET['srch-term'])){
  $searchtxt = $_GET['srch-term'];


    echo "<div class='row'>
      <div class='col-xs-12'>
        <h2>Result</h2>";
               $srch_result = mysqli_query($con,$sqlsearch);
               echo $sqlsearch;
               $numrow = mysqli_num_rows($srch_result);
               echo "<p>Displaying $numrow result from Search Term =
'$searchtxt'</p>";
               echo "<ol>";
               while ($row = mysqli_fetch_array($srch_result)){
                       //echo $row3['ContentID']."<br>";
                       //$sqldisplay = "SELECT * FROM content WHERE ContentID =
".$row['ContentID'];
                       //$resultdisplay = mysqli_query($con,$sqldisplay);
                       //while ($rowdisplay =
mysqli_fetch_array($resultdisplay)){
                               echo "<li><h4><strong>Title :</strong><a
href='index.php?ContentID=".$row['ContentID']."'>".$row['Title']."</a></h4>
<em><strong>Author :</strong> ".$row['Author']."</em><!--<p
class='lead'><button class='btn btn-success'>View Details</button></p>--
></li>";
                       //}
               }
       echo "</ol>
               <p class='lead'><button class='btn btn-success'
onclick='goBack()'>Back</button></p>
        <!--Hide
               <p class='pull-right'><span class='label label-
default'>keyword</span> <span class='label label-default'>tag</span> <span
class='label label-default'>post</span></p>
        <ul class='list-inline'><li><a href='#'>2 Days Ago</a></li><li><a
href='#'><i class='glyphicon glyphicon-comment'></i> 2 Comments</a></li><li><a
href='#'><i class='glyphicon glyphicon-share'></i> 14 Shares</a></li></ul>
               Hide -->
               <hr>
      </div>
    </div>";
       }

       //Display Record Details
       if(isset($_GET['ContentID'])){
       if(isset($_GET['taxID'])){
               $taxID=$_GET['taxID'];
       }
       $recordno=$_GET['ContentID'];
       echo "<div class='row'>
      <div class='col-xs-12'>
        <h2>Display Record Number $recordno</h2>";
               $displaycontent = mysqli_query($con,$sqlcontent);
               //$numrow = mysqli_num_rows($resultpre);

               echo "<ul>";
               while ($row4 = mysqli_fetch_array($displaycontent)){
                               echo "<li><p><h4><strong>Title
:</strong>".$row4['Title']."</h4></p></li>
```

```
                                <li><em><strong>Author :</strong>
".$row4['Author']."</em></li>
                                <li><p><em><strong>Description :</strong>
".$row4['Description']."</em></p></li>";
                                $sqlurl = "SELECT * FROM contenturl WHERE
contentID=".$row4['ContentID'];
                                $displayurl = mysqli_query($con,$sqlurl);
                                $displayurl2 = mysqli_query($con,$sqlurl);
                                $numrow = mysqli_num_rows($displayurl);
                                if($numrow > 0){
                                echo "<li>Links:</li>";
                                        echo "<ul>";
                                        while ($row5 =
mysqli_fetch_array($displayurl)){
                                                echo "<li>Link: <a
href='".$row5['URL']."' target='_blank'>".$row5['URL']."</a> Type:
".$row5['type']."</li>";
                                        }
                                        echo "</ul>";
                                echo "<li>Streaming:</li>";
                                        while ($row6 =
mysqli_fetch_array($displayurl2)){
                                                if ($row6['type']=="audio/mpeg"){
                                                        echo "<p><audio controls>
                                                          <source
src='".$row6['URL']."' type='".$row6['type']."'>
                                                            Your browser does not
support the audio tag.
                                                        </audio></p>";
                                                }
                                                if
($row6['type']=="application/pdf"){
                                                        echo "<div><iframe
width='100%' height='450px' src='".$row6['URL']."'></iframe></div>";
                                                }
                                        }
                                }
                                echo "<p class='lead'><button class='btn btn-
success' onclick='goBack()'>Back</button></p>";
                }

        echo "</ul>
                <hr>
      </div>
    </div>";

        }
        ?>

  </div><!--/center-->

<?php
include 'right.php';
include 'footer.php';
?>
```

2. Header.php

```
<?php
include 'db.php';
?>
<!DOCTYPE html>
<html lang="en">
        <head>
                <meta http-equiv="content-type" content="text/html; charset=UTF-
8">
                <meta charset="utf-8">
                <title>Oral History Management System - with Ontology</title>
                <meta name="generator" content="Bootply" />
                <meta name="viewport" content="width=device-width, initial-
scale=1, maximum-scale=1">
                <link href="css/bootstrap.min.css" rel="stylesheet">
                <!--[if lt IE 9]>
```

```
                        <script
src="//html5shim.googlecode.com/svn/trunk/html5.js"></script>
                <![endif]-->
                <link href="css/styles.css" rel="stylesheet">
                <script>
                function goBack() {
                        window.history.go(-1)
                }
                </script>
        </head>
        <body>
<nav class="navbar navbar-default navbar-fixed-top" role="navigation">
        <div class="navbar-header">
         <a class="navbar-brand" rel="home" href="#">Oral History Management
System</a>
                <button type="button" class="navbar-toggle" data-
toggle="collapse" data-target=".navbar-collapse">
                <span class="sr-only">Toggle navigation</span>
                <span class="icon-bar"></span>
                <span class="icon-bar"></span>
                <span class="icon-bar"></span>
                </button>
        </div>
        <div class="collapse navbar-collapse">
        <!--Hide Unused Links
                <ul class="nav navbar-nav">
                        <li><a href="#">Link</a></li>
                        <li><a href="#">Link</a></li>
                        <li><a href="#">Link</a></li>
                        <li class="dropdown">
               <a href="#" class="dropdown-toggle" data-
toggle="dropdown">Dropdown <b class="caret"></b></a>
               <ul class="dropdown-menu">
                 <li><a href="#">Action</a></li>
                 <li><a href="#">Another action</a></li>
                 <li class="divider"></li>
                 <li><a href="#">Separated link</a></li>
                 <li class="divider"></li>
                 <li><a href="#">One more separated link</a></li>
               </ul>
             </li>
                </ul>
        Hide Unused Links-->
                <div class="col-sm-3 col-md-3 pull-right">
           <form class="navbar-form" role="search">
             <div class="input-group">
                  <input type="text" class="form-control" placeholder="Search"
name="srch-term" id="srch-term">
                 <div class="input-group-btn">
                     <button class="btn btn-default" type="submit"><i
class="glyphicon glyphicon-search"></i></button>
                 </div>
             </div>
           </form>
                </div>
        </div>
</nav>
<div class="container-fluid">
```

3. Footer.php

```
<hr>
</div><!--/container-fluid-->
        <!-- script references -->
                <script
src="//ajax.googleapis.com/ajax/libs/jquery/2.0.2/jquery.min.js"></script>
                <script src="js/bootstrap.min.js"></script>
                <script src="js/scripts.js"></script>
        </body>
</html>
<?php
mysqli_close($con);
?>
```

4. Right.php

```
<!--right-->
  <div class="col-sm-3">
        <!--<h2>Right Side Panel</h2>-->
        <div class="panel panel-default">
               <div class="panel-heading"><h4>Admin</h4></div>
               <div class="panel-body">Login Form Here</div>
        </div>
        <hr>
  </div><!--/right-->
```

5. Left.php

```
<?php
$sqlt1 = "SELECT * FROM taxonomy WHERE ParentID=1";
$rsltt1 = mysqli_query($con,$sqlt1);

/*$sqlt2 = "SELECT  b.TaxID as 'PTaxID', b.ParentID AS 'ParentID',b.Node AS
'ParentNode',
a.TaxID AS 'ChildID',a.Node AS 'ChildNode'
FROM taxonomy a, taxonomy b
WHERE a.ParentID = b.TaxID
b.ParentID=1
AND
b.TaxID=4";
$rsltt2 = mysqli_query($con,$sqlt2);*/


?>

  <!--left-->
  <div class="col-sm-3">
        <!--<h2>Left Side Panel</h2>-->
        <div class="panel panel-default">
               <div class="panel-heading"><h4>Ontology</h4></div>
               <div class="panel-body">
                      <ul class='list-unstyled'>
                             <li><strong>Oral History Projects</strong></li>
                             <ul class='list-unstyled'>
                             <?php
                             while ($row=mysqli_fetch_array($rsltt1)){
                                    echo
"<li>".$row['Node']."(".$row['TaxID'].")</li>";
                                    $sqlt2 = "SELECT  b.TaxID as 'PTaxID',
b.ParentID AS 'ParentID',b.Node AS 'ParentNode',
                                                                  a.TaxID AS
'ChildID',a.Node AS 'ChildNode'
                                                                  FROM
                                                                  taxonomy a,
taxonomy b
                                                                  WHERE
                                                                  a.ParentID =
b.TaxID
                                                                  AND
                                                                  b.ParentID=1
                                                                  AND

       b.TaxID=".$row['TaxID'];
                                    $rsltt2 = mysqli_query($con,$sqlt2);
                                    echo "<ul>";
                                    while
($row2=mysqli_fetch_array($rsltt2)){
                                           echo "<li><a
href='index.php?taxID=".$row2['ChildID']."'>".$row2['ChildNode']."(".$row2['Chi
ldID'].")</a></li>";
                                    }
                                    echo "</ul>";
                             }
                             ?>
                             </ul>
                      </ul>
```

```
                    </div>
        </div>
        <hr>
  </div><!--/left-->
```

6. SQL

```
-- phpMyAdmin SQL Dump
-- version 3.5.8.2
-- http://www.phpmyadmin.net
--
-- Host: localhost
-- Generation Time: Aug 13, 2014 at 11:08 PM
-- Server version: 5.5.38-35.2-log
-- PHP Version: 5.4.23

SET SQL_MODE="NO_AUTO_VALUE_ON_ZERO";
SET time_zone = "+00:00";


/*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
/*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
/*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
/*!40101 SET NAMES utf8 */;

--
-- Database: `amzarico_ohms`
--

-- --------------------------------------------------------

--
-- Table structure for table `content`
--

DROP TABLE IF EXISTS `content`;
CREATE TABLE IF NOT EXISTS `content` (
  `ContentID` int(11) NOT NULL AUTO_INCREMENT,
  `Biblionumber` int(5) NOT NULL,
  `Title` varchar(250) NOT NULL,
  `Author` varchar(150) NOT NULL,
  `Description` text NOT NULL,
  `Timestamp` timestamp NOT NULL DEFAULT CURRENT_TIMESTAMP ON UPDATE
CURRENT_TIMESTAMP,
  `Datecreated` date NOT NULL,
  PRIMARY KEY (`ContentID`)
) ENGINE=InnoDB  DEFAULT CHARSET=latin1 AUTO_INCREMENT=293 ;

--
-- Dumping data for table `content`
--

INSERT INTO `content` (`ContentID`, `Biblionumber`, `Title`, `Author`,
`Description`, `Timestamp`, `Datecreated`) VALUES
(1, 295, 'Pengalaman sebagai anggota tentera dan jurutera pesawat pejuang',
'Abu Bakar Bin Saud', 'Transkrip temubual bersaman dengan Mejar (B) Ir Abu
Bakar Bin Saud mengenai pengalaman-pengalaman dan sumbangan beliau di dalam
Tentera dan Jurutera Pesawat Pejuang.', '2014-04-24 23:12:52', '2014-04-25'),
(2, 296, 'Pengalaman ketika berkhidmat sebagai tentera penembak', 'Maluddin bin
Limbong', 'Transkrip temubual bersama dengan Encik Haji Maluddin bin Limbong
mengenai pengalaman beliau ketika berkhidmat sebagai tentera penembak meriam di
dalam unit meriam dari tahun 1952 hingga tahun 1975', '2014-04-24 23:12:52',
'2014-04-25'),
(3, 297, 'Sumbangan menjayakan misi PBB di Kuwait', 'Mejar Haji Roslan Bin Haji
Hussin', 'Transkrip temubual bersama Mejar Haji Roslan Bin Haji Hussin mengenai
pengalaman dan sumbangan beliau berkhidmat untuk menjayakan misi PBB di
Kuwait', '2014-04-24 23:12:52', '2014-04-25'),
(4, 298, 'Mengenai pengalaman dan kejayaan menentang serangan', 'Abdul Jalal
Bin Haji Sulaiman', 'Transkrip wawancara dengan Sarjan Mejar Haji Abdul Jalal
Bin Haji Sulaiman mengenai pengalaman dan kejayaan beliau menentang serangan
PARAKU dan menangkap seorang anggota PARAKU hidup-hidup di Sarawak di Utara
Borneo,pada tahun 1969', '2014-04-24 23:12:52', '2014-04-25'),
(5, 299, 'Pengalaman menjawat jawatan Leftenan Kolonel', 'Mohd Safari bin Abd
Hamid', 'Transkrip ini disediakan mengikut temubual yang telah dijalankan
bersama Lt Kol (B) Mohd Safari bin Abd Hamid yang menpunyai urusan
```

pentadbirannya semasa beliau menjadi tentera.', '2014-04-24 23:12:52', '2014-04-25'),
(6, 300, 'Pengalaman dalam Misi (UNPROFOR) United Nation Protection Force', 'Ab. Halim Bin Awang', 'Temubual Bersama Leftenen Kol. (B) Ab. Halim Bin Awang Mengenai Pengalaman Beliau dalam Misi (UNPROFOR) United Nation Protection Force Sebagai Kontinjen Malaysia MALBAT 1 di Bosnia Herzegovina, 1992 dan Pemerhati PBB dalam Misi (UNTAET) United Nation Transitional Administration at East Timur di Timor Leste, 2003', '2014-04-24 23:12:52', '2014-04-25'),
(7, 301, 'Penglibatan beliau dalam bidang ketenteraan', 'Kolonel Abdul Rahim Bin Sainon', 'Transkrip temubual bersama dengan Kolonel Abdul Rahim Bin Sainon mengenai penglibatan beliau dalam bidang ketenteraan dari tahun 1973 hingga 2008', '2014-04-24 23:12:52', '2014-04-25'),
(8, 302, 'Perjalanan karier sebagai ahli politik', 'Puan Sri Datin Hajah Atkah Binti Abdullah', 'Transkrip temubual bersama Puan Sri Datin Hajah Atkah Binti Abdullah', '2014-04-24 23:12:52', '2014-04-25'),
(9, 303, 'Sejarah dan pengalaman bersama arkib negara', 'Encik Sidek Bin Jamil', 'Transkrip temubual bersama dengan Encik Sidek Bin Jamil, Ketua Pengarah Arkib Negara Malaysia mengenai sejarah hidup dan pengalaman beliau bersama Arkib Negara Malaysia', '2014-04-24 23:12:52', '2014-04-25'),
(10, 304, 'Penglibatan dalam aktiviti kebajikan', 'Nordin Bin Ibrahim', 'Transkrip wawancara bersama dengan Datuk Hj. Nordin B. Ibrahim (P.J.N., K.M.N., A.M.N., P.J.K.) mengenai penglibatan beliau dalam aktiviti kebajikan, politik dan perpaduan', '2014-04-24 23:12:52', '2014-04-25'),
(11, 305, 'Penglibatan dalam seni hiburan tanah air', 'Zulkafli Bin Hj. Md Zain', 'Transkrip temubual bersama Encik Zulkafli Bin Hj Md Zain mengenai pengalaman dan penglibatan beliau dalam dunia seni dan hiburan tanah air', '2014-04-24 23:12:52', '2014-04-25'),
(12, 306, 'Pengalaman anggota tentera didalam unit pancaragam', 'Damanhuri Bin Abdul Rahman', 'Transkrip temubual bersama Encik Damanhuri Bin Abdul Rahman mengenai pengalaman beliau sebagai anggota tentera di dalam unit pancaragam', '2014-04-24 23:12:52', '2014-04-25'),
(13, 307, 'Pengalaman perisik dibahagian Kor Risik Diraja', 'Halim Bin Khomiza', 'Transkrip temubual bersama Tuan Halim Bin Khomiza mengenai pengalaman beliau sebagai bekas perisik di bahgian Kor Risik Diraja', '2014-04-24 23:12:52', '2014-04-25'),
(14, 308, 'Pemerhati Bangsa-bangsa bersatu di Bosnia Herzegovina', 'ASP A.Sahak Bin Haji Rahmat', 'Transkrip temubual bersama Asp A.Sahak Bin Haji Rahmat mengenai pengalaman dan penglibatan beliau sepanjang berkhidmat sebagai pemerhati pertubuhan Bangsa-Bangsa Bersatu (PBB) dl Bosnia Herzegovina.', '2014-04-24 23:12:52', '2014-04-25'),
(15, 309, 'Pengalaman misi pengaman ke Somalia 1994', 'Md Faizal Bin Ahmad', 'Transkrip temubual bersama dengan pegawai waran II MD Faizal Bin Ahmad mengenai pengalaman beliau semasa menjalankan misi pengaman ke Somalia pada tahun 1994', '2014-04-24 23:12:52', '2014-04-25'),
(16, 310, 'Peristiwa pertempuran dengan komunis', 'Kop. (B) Tuan Haji Abdul Rahim Bin Ishak', 'Transkrip wawancara bersama dengan Kop. (B) Tuan Haji Abdul Rahim Bin Ishak mengenai peristiwa pertempuran dengan pengganas komunis di Sungai Siput, Perak pada tahun 1976', '2014-04-24 23:12:52', '2014-04-25'),
(17, 311, 'Wartawan dan pengarang', 'Pn. Maimunah Binti Mohamad Yusof', 'Transkrip temubual bersama dengan Puan Maimunah Binti Mohamad Yusof mengenai biografi beliau sebagai wartawan dan pengarang di Utusan Melayu Berhad', '2014-04-24 23:12:52', '2014-04-25'),
(18, 312, 'Pengalaman semasa operasi menentang komunis', 'Konstabel Ngah Bin Hitam', 'Transkrip temubual bersama dengan Konstabel Ngah Bin Hitam mengenai pengalaman beliau semasa operasi menentang komunis di Ijok, Selangor pada tahun 1949', '2014-04-24 23:12:52', '2014-04-25'),
(19, 313, 'Seniwati tanah air dan sumbangan dalam dunia perfileman negara', 'Pn. Mariam @ Mariani Binti Ismail', 'Transkrip temubual bersama dengan Puan Mariam @ Mariani Binti Ismail mengenai pengalaman beliau sebagai seniwati tanah air dan sumbangannya dalam dunia perfileman negara', '2014-04-24 23:12:52', '2014-04-25'),
(20, 314, 'Serangan di sekitar Perak pada tahun 1948', 'Tuan Haji Suji Bin Abdul Latif', 'Transkrip temubual bersama dengan Konstabel Tuan Haji Suji Bin Abdul Latif mengenai serangan di sekitar Perak pada tahun 1948', '2014-04-24 23:12:52', '2014-04-25'),
(21, 315, 'Pengarah di Jabatan Hal Ehwal Orang Asli', 'Dato Fadzli Bin Mahmud', 'Transkrip temubual bersama dengan Dato'' Fadzli Bin Mahmud sebagai mantan Ketua Pengarah di Jabatan Hal Ehwal Orang Asli', '2014-04-24 23:12:52', '2014-04-25'),
(22, 316, 'Penglibatan dalam bidang seni tanahair', 'En. Omar @ Abdul Majid Bin Puteh', 'Transkrip temubual bersama En. Omar @ Abdul Majid Bin Puteh (Aimi Jarr) Timbalan Presiden Seniman, mengenai penglibatan beliau dalam bidang seni tanah air', '2014-04-24 23:12:52', '2014-04-25'),
(23, 317, 'Konfrontasi Malaysia-Indonesia di Sarawak', 'Mejar (B) Abd. Karim Bin Si Alang', 'Transkrip temubual bersama dengan M(B) Abd. Karim Bin Si Alang

mengenai konfrontasi Malaysia dan Indonesia di Sarawak pada tahun 1963 hingga 1967', '2014-04-24 23:12:52', '2014-04-25'),
(24, 318, 'Peristiwa Serangan Komunis di sekitar Johor', 'Lans Koperal Said Bin Shamsuddin', 'Transkrip temubual bersama dengan Lans Koperal Said Bin Shamsuddin mengenai peristiwa serangan komunis sebanyak tujuh kali di sekitar Johor pada tahun 1951', '2014-04-24 23:12:52', '2014-04-25'),
(25, 319, 'Peristiwa Pertempuran Dengan Pengganas Komunis', 'Tuan Haji Abu Samah Bin Bador', 'Transkrip wawancara bersama dengan Sarjan Mejar (B) Polis Diraja Malaysia Tuan Haji Abu Samah Bin Bador mengenai peristiwa pertempuran dengan pengganas komunis ketika darurat pada tahun 1948 di sekitar Kuala Lipis, Pahang', '2014-04-24 23:12:52', '2014-04-25'),
(26, 320, 'Sumbangan dalam Bidang Pendidikan', 'Prof. Dr. Bukhory Bin Haji Ismail', 'Transkrip wawancara bersama Professor Dr. Bukhory Bin Haji Ismail megenai sumbangan beliau dalam bidang pendidikan di UiTM', '2014-04-24 23:12:52', '2014-04-25'),
(27, 321, 'Peristiwa Serang Hendap Oleh Komunis di Sg Siput, Perak', 'En. Sharif Bin Ahmad', 'Transkrip wawancara dengan En. Sharif Bin Ahmad sebagai pegawai waran satu mengenai pengalaman beliau dalam peristiwa serangan hendap oleh pihak komunis di Lasah, Sungai Siput pada tahun 1952', '2014-04-24 23:12:52', '2014-04-25'),
(28, 322, 'Pengalaman Sebagai Polis Sewaktu Pendudukan Komunis', 'Tuan Haji Janah Bin Hassan', 'Transkrip temubual bersama Tuan Haji Janah Bin Hassan (PPN, PJK) mengenai pengalaman beliau sebagai polis sewaktu pendudukan komunis di Terengganu pada Tahun 1949', '2014-04-24 23:12:52', '2014-04-25'),
(29, 323, 'Pengalaman dalam bidang pendidikan', 'Dato Haji Abdul Majid Bin Omar', 'Transkrip temubual bersama Dato Haji Abdul Majid Bin Omar Tokoh Guru Kebangsaan 2007 mengenai pengalaman beliau dalam bidang pendidikan', '2014-04-24 23:12:52', '2014-04-25'),
(30, 324, 'Peristiwa pertempuran dengan pengganas Komunis', 'En. Muit Bin Ahmad', 'Transkrip temubual dengan staf Sarjan (B) Muit Bin Ahmad mengenai peristiwa pertempuran dengan pengganas komunis di Bentong, Pahang pada tahun 1973', '2014-04-24 23:12:52', '2014-04-25'),
(31, 325, 'Pengalaman Sebagai Ketua Kampung dan Homestay Banghuris', 'Tuan Haji Basir Bin Wagiman', 'Transkrip wawancara bersama Tuan Haji Basir Bin Wagiman mengenai pengalaman beliau sebagai ketua kampung Hulu Chucoh dan ketua Homestay Banghuris', '2014-04-24 23:12:52', '2014-04-25'),
(32, 326, 'Peristiwa Darurat di Bekok, Segamat Johor', 'Haji Othman Bin Jamil', 'Transkrip temubual dengan Special Constable Haji Othman Bin Jamil mengenai peristiwa darurat di Bekok, Segamat, Johor pada tahun 1948', '2014-04-24 23:12:52', '2014-04-25'),
(33, 327, 'Pengalaman sebagai Ketua Pengarah Kesihatan Malaysia', 'Tan Sri Dato Seri Dr. Abdul Majid Bin Ismail', 'Transkrip temubual bersama Yg. Bhg Tan Sri Dato Seri Dr Abdul Majid B Ismail mengenai pengalaman beliau sebagai Ketua Pengarah Kesihatan Malaysia tahun 1971 hingga 1976', '2014-04-24 23:12:52', '2014-04-25'),
(34, 328, 'Pengalaman semasa menjadi pemain Hoki Negara', 'En. Soon Mustafa Bin Karim', 'Transkrip temubual bersama Encik Soon Mustafa Bin Karim mengenai pengalaman beliau semasa menjadi pemain hoki Negara', '2014-04-24 23:12:52', '2014-04-25'),
(35, 329, 'Perubahan pendidikan wanita dahulu dan sekarang', 'Prof Dr. Szarina Abdullah', 'Transkrip temubual bersama Prof Dr Szarina Abdullah mengenai perubahan pendidikan wanita dahulu dan sekarang', '2014-04-24 23:12:52', '2014-04-25'),
(36, 330, 'Peristiwa ditawan oleh pengganas komunis', 'Tuan Haji Kasim Bin Nordin', 'Transkrip wawancara dengan Tuan Haji Kassim Bin Nordin mengenai peristiwa ditawan oleh pengganas komunis di Bukit Siput Ressetlement Area, Johor pada tahun 1950', '2014-04-24 23:12:52', '2014-04-25'),
(37, 331, 'Penglibatan dalam operasi INDERA IV', 'Lt. Kol. Abdul Jalil Bin Makmor', 'Transkrip temubual dengan Lt. Kol. Abdul Jalil Bin Makmor mengnenai penglibatan beliau dalam operasi Indera iv di Sungai Reloh, Karak Pahang', '2014-04-24 23:12:52', '2014-04-25'),
(38, 332, 'Pengalaman sewaktu bertugas untuk misi pengaman PBB', 'Omar Bin Darus', 'Transkrip wawancara dengan Prebet Hj. Omar Bin Darus mengenai pengalaman beliau sewaktu bertugas untuk Misi Pengaman PBB di Congo, Afrika selatan pada tahun 1961', '2014-04-24 23:12:52', '2014-04-25'),
(39, 333, 'Pengalaman ketika ditahan oleh komunis', 'Hj. Mohd Yusoff Bin Md Taib', 'Transkrip wawancara dengan Hj Mohd Yusoff Bin Md Taib, AMN mengenai pengalaman beliau ketika ditahan oleh komunis di Slim Village, Slim River Perak', '2014-04-24 23:12:52', '2014-04-25'),
(40, 334, 'Peristiwa pertempuran dengan komunis', 'Hj. Omar Bin Mohd Yusof', 'Transkrip temubual bersama dengan Sarjan Tuan Haji Omar Bin Mohd Yusof mengenai peristiwa pertempuran dengan pengganas komunis di Batu 49 Kota Tinggi, Mersing pada tahun 1956', '2014-04-24 23:12:52', '2014-04-25'),
(41, 335, 'Peristiwa pertempuran tentera Jepun', 'Haji Ahmad Bin Hj. Abdul Rahim', 'Transkrip temmubusl bersama dengan Konstabel Haji Ahmad Bin Haji Abdul

Rahim mengenai peristiwa pertempuran Tentera Jepun di Johor Bahru, Johor pada tahun 1969', '2014-04-24 23:12:52', '2014-04-25'),
(42, 336, 'Pertempuran dengan pihak komunis', 'Tuan Haji omar bin Haji Mohamad Yusuf', 'Transkrip temubual dengan Tuan Haji Omar Bin Haji Mohamad Yusuf mengenai pertempuran dengan pihak komunis di batu empat puluh sembilan Kota Tinggi Johor', '2014-04-24 23:12:52', '2014-04-25'),
(43, 337, 'Peristiwa penentangan komunis', 'En. Abd Manap Bin Man', 'Transkrip wawancara dengan Encik Abd Manap Bin Man mengenai peristiwa penentangan komunis di Kuak Ulu, Gerik Perak pada tahun 1975', '2014-04-24 23:12:53', '2014-04-25'),
(44, 338, 'Peristiwa pengeboman trak polis oleh komunis', 'Hj. Ismail Bin Abdullah', 'Transkrip wawancara dengan Koperal (B) Haji Ismail Bin Abdullah mengenai peristiwa pengeboman trak polis oleh pengganas komunis di Bukit Semayang, Kemasik Kemaman pada tahun 1950-an', '2014-04-24 23:12:53', '2014-04-25'),
(45, 339, 'Sejarah penubuhan fakulti Pengajian Maklumat', 'YM. Dato Dr. Raja Abdullah Raja Yaacob', 'Transkrip wawancara bersama Ym. Dato Dr. Raja Abdullah Bin Raja Yaacob mengenai sejarah penubuhan Fakulti Pengajian Maklumat, Shah Alam', '2014-04-24 23:12:53', '2014-04-25'),
(46, 340, 'Pengalaman semasa pertempuran dengan komunis', 'Haji Miskon Bin Muhammad Kassan', 'Transkrip wawancara dengan Konstabel Khas Haji Miskon Bin Muhammad Kassan mengenai pengalaman beliau semasa pertempuran dengan pihak komunis pada tahun 1955 di Tanjung Karang, Selangor', '2014-04-24 23:12:53', '2014-04-25'),
(47, 341, 'Peristiwa Konfrontasi antara Malaysia-Indonesia', 'Tuan Haji Buang Bin Md Yatim', 'Transkrip temubual dengan Tuan Haji Buang B Md Yatim peristiwa konfrontasi antara Malaysia Indonesia: pendaratan Parti Komunis Indonesia (PKI) pada tahun 1964', '2014-04-24 23:12:53', '2014-04-25'),
(48, 342, 'Pengalaman Semasa Menganggotai pasukan polis', 'Dato Abu Bakar Bin Said', 'Transkrip wawancara bersama Dato Abu Bakar Bin Said mengenai ketokohan dan pengalaman beliau semasa menganggotai pasukan polis', '2014-04-24 23:12:53', '2014-04-25'),
(49, 343, 'Pengalaman sebagai wartawan foto', 'Tuan Haji Anuar Bin Hashim', 'Transkrip temubual bersama Tuan Haji Anuar Bin Hashim tentang pengalaman beliau sebagai wartawan foto', '2014-04-24 23:12:53', '2014-04-25'),
(50, 344, 'Peristiwa pendudukan komunis di Kuching', 'Haji Mohd Ismail Salleh', 'Transkrip temubual bersama dengan Mejar (B) Haji Mohd Ismail Salleh mengenai peristiwa pendudukan komunis di Kuching, Sarawak pada tahun 1970 hingga 1972', '2014-04-24 23:12:53', '2014-04-25'),
(51, 345, 'Penglibatan dan pengalaman sebagai tentera Jepun', 'En. Sanip Bin Juna', 'Transkrip wawacara dengan En. Sanip Bin Juna mengenai penglibatan dan pengalaman beliau sebagai Tentera Jepun di zaman pemerintah Jepun pada tahun 1941 dan sebagai anggota SC yang menentang Komunis semasa zaman British pada tahun 1948', '2014-04-24 23:12:53', '2014-04-25'),
(52, 346, 'Pertempuran dengan pengganas komunis', 'En. Mohd Azahar @ Abdul Aziz Bin Itam', 'Transkrip temubual bersama dengan En. Mohd Azahar @ Abdul Aziz Bin Itam mengenai penglibatan beliau dalam pertempuran dengan pengganas komunis di Sungai Liang Raub, Pahang', '2014-04-24 23:12:53', '2014-04-25'),
(53, 347, 'Pengalaman Koperal Aziz Taib menghadapi Peristiwa 13 Mei 1969', 'En. Aziz Bin Taib', 'Transkrip wawancara dengan Koperal Aziz Bin Taib mengenai pengalaman beliau semasa peristiwa 13 Mei 1969 di Kuala Lumpur', '2014-04-24 23:12:53', '2014-04-25'),
(54, 348, 'Peristiwa serangan pengganas komunis di balai polis Bukit Kepong', 'Tuan Hj. Yusoff Bin Rono', 'Transkrip wawancara dengan sarjan bersara Tuan Hj Yusoff Bin Rono mengenai peristiwa serangan pengganas komunis di Balai Polis Bukit Kepong, Muar Johor pada 23 Februari 1949', '2014-04-24 23:12:53', '2014-04-25'),
(55, 349, 'Zaman penjajahan Jepun di Tanah Melayu', 'Pn. Jamisah Binti Hj. Sidek', 'Transkrip temubual bersama Puan Hajah Jamisah Bt Haji Sidek mengenai pengalaman beliau semasa berada di zaman penjajahan Jepun dan Komunis di Tanah Melayu pada tahun 1940 sehingga kemerdekaan di Tanah Melayu', '2014-04-24 23:12:53', '2014-04-25'),
(56, 350, 'Tokoh pemimpin sebagai ketua kampung', 'Tuan Hj. Sudar Bin Hj. Ismail', 'Transkrip temubual bersama Tuan Haji Sudar Bin Haji Ismail mengenai tokoh pemimpin (sebagai ketua kampung)', '2014-04-24 23:12:53', '2014-04-25'),
(57, 351, 'Peranan dan pengalaman Sarjan Khalid Daud ketika 13 Mei 1969', 'Sarjan (B) Hj. Khalid Bin Daud', 'Transkrip wawancara bersama yang berusaha Sarjan Haji Khalid Bin Daud mengenai peranan dan pengalaman beliau sebagai anggota polis sewaktu menghadapi peristiwa 13 Mei 1969', '2014-04-24 23:12:53', '2014-04-25'),
(58, 352, 'Sejarah dan pengalaman menyertai polis pada zaman komunis', 'En. Zainal Abidin Bin Alwi', 'Transkrip temubual bersama dengan Zainal Abidin Bin Hj Alwi mengenai sejarah dan pengalaman hidup beliau semasa menyertai polis pada zaman komunis juga mengenai kisah komunis Di Batu Pahat serta daerah lain di Johor hingga tahun 1960', '2014-04-24 23:12:53', '2014-04-25'),

(59, 353, 'Pengalaman semasa menentang komunis ketika darurat', 'Ayob Bin Sidek', 'Transkrip wawancara dengan "Special Constable" Ayob Bin Sidek mengenai pengalaman beliau sewaktu menentang komunis ketika darurat semasa zaman pemerintahan British di Klang pada tahun 1949', '2014-04-24 23:12:53', '2014-04-25'),
(60, 354, 'Pengalaman sebagai anggota tentera', 'Abdul Rahman Bin Omar', 'Transkrip wawancara dengan Encik Abdul Rahman Bin Omar mengenai pengalaman beliau sebagai anggota tentera di dalam seksyen tiger yang terlibat secara langsung bertempur dengan bertempur dengan Komunis di Bukit Belacan Ampang, Selangor pada tahun 1956', '2014-04-24 23:12:53', '2014-04-25'),
(61, 355, 'Pengalaman menentang komunis', 'Ibrahim Hj. Dapi', 'Transkrip wawancara bersama Pegawai Waran En. Ibrahim Hj. Dapi mengenai penglibatan beliau dalam operasi Kelong II oleh Pasukan Melayu 10 Diraja menentang komunis di Simanggang (Sriaman) pada tahun 1974', '2014-04-24 23:12:53', '2014-04-25'),
(62, 356, 'Kegigihan Tn Hj Nordin Ali mengumpul barang antik', 'Tuan Hj Nordin Bin Hj. Ali', 'Transkrip temubual bersama Tuan Hj Nordin Bin Hj Ali mengenai kegigihan beliau dalam mengumpul barang antik sehingga kediamannya di wartakan sebagai ''rumahku muziumku'' oleh Kerajaan Negeri Melaka', '2014-04-24 23:12:53', '2014-04-25'),
(63, 357, 'Peristiwa berdarah di Kalabanan, Sabah', 'En. Ibrahim @ Ali Bin Dollah', 'Transkrip temubual bersama Pegawai Ibrahim @ Ali Bin Dollah mengenai peristiwa berdarah di Kalabanan, Sabah pada tahun 1963', '2014-04-24 23:12:53', '2014-04-25'),
(64, 358, 'Peristiwa operasi pembersihan komunis', 'En. Hj Abd Rahman Bin Lebai Musa', 'Transkrip temubual dengan Koperal (B) Hj. Abd Rahman Bin Lebai Musa mengenai peristiwa operasi pembersihan komunis di Padang Lembu, Kedah pada tahun 1956', '2014-04-24 23:12:53', '2014-04-25'),
(65, 359, 'Pengalaman sebagai ketua kampung', 'Tuan Hj. Shahid Bin Hj. Abdullah', 'Transkrip temubual dengan Tuan Haji Shahid Bin Hj Abdullah ketua kampung meru mengenai pengalaman beliau semasa peristiwa 13 Mei 1969 di Kampung Meru Klang, Selangor Darul Ehsan', '2014-04-24 23:12:53', '2014-04-25'),
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(67, 361, 'Penglibatan dalam bidang penerbitan', 'Tuan Haji Khalid Bin Mohd Ali', 'Transkrip temubual dengan Yang Berbahagia Tuan Haji Khalid Bin Mohd Ali mengenai penglibatan beliau dalam bidang penerbitan', '2014-04-24 23:12:53', '2014-04-25'),
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(255, 549, 'Pertempuran dengan pengganas komunis di Teluk Mengkuang, Banting Selangor pada tahun 1954.', 'Tuan Haji Marlan Bin Sapar ', 'Transkrip temubual bersama Special Constable Tuan Haji Marlan Bin Sapar mengenai pertempuran dengan pengganas komunis di Teluk Mengkuang, Banting Selangor pada tahun 1954.', '2014-04-24 23:12:54', '2014-04-25'),
(256, 550, 'Pengalaman dan penglibatan beliau sepanjang berkecimpung di dalam bidang politik', 'DatoGÇÖ Basari Bin Mohd. Kasim', 'Transkrip temubual bersama DatoGÇÖ Basari Bin Mohd. Kasim mengenai pengalaman dan penglibatan beliau sepanjang berkecimpung di dalam bidang politik', '2014-04-24 23:12:54', '2014-04-25'),
(257, 551, 'Peristiwa 13 Mei di Chow Kit Kuala Lumpur pada tahun 1968', 'Sarjan Mejar Hj. Abdul Jalal Bin Sulaiman ', 'Transkrip temubual bersama Sarjan Mejar Hj. Abdul Jalal Bin Sulaiman mengenai pengalaman beliau ketika peristiwa 13 Mei di Chow Kit Kuala Lumpur pada tahun 1968', '2014-04-24 23:12:54', '2014-04-25'),
(258, 552, 'Pengalaman beliau sebagai Exco Kerajaan Negeri Sembilan merangkap Pengerusi Jawatankuasa Bertindak Pembangunan Wanita, Keluarga dan Kebajikan Masyarakat.', 'DatoGÇÖ Norhayati Binti Omar ', 'Transkrip temubual bersama DatoGÇÖ Norhayati Binti Omar mengenai pengalaman beliau sebagai Exco Kerajaan Negeri Sembilan merangkap Pengerusi Jawatankuasa Bertindak Pembangunan Wanita, Keluarga dan Kebajikan Masyarakat.', '2014-04-24 23:12:54', '2014-04-25'),
(259, 553, 'Pengalaman beliau sebagai anggota Konstabel Khas (SC) semasa menentang komunis di Gersik, Muar Johor pada tahun 1955.', 'Encik Abdul Bin Haji Omar ', 'Transkrip temubual bersama Encik Abdul Bin Haji Omar mengenai pengalaman beliau sebagai anggota Konstabel Khas (SC) semasa menentang komunis di Gersik, Muar Johor pada tahun 1955. ', '2014-04-24 23:12:54', '2014-04-25'),
(260, 554, 'Pengalaman beliau sebagai Pegawai Tadbir dan Diplomatik di Kementerian Pertahanan Malaysia', 'Encik Ismail Bin Ibrahim ', 'Transkrip temubual bersama Encik Ismail Bin Ibrahim mengenai pengalaman beliau sebagai Pegawai Tadbir dan Diplomatik di Kementerian Pertahanan Malaysia.', '2014-04-24 23:12:54', '2014-04-25'),
(261, 555, 'Sumbangan beliau dalam bidang keagamaan dan pendidikan', 'Sahibus Samahah DatoGÇÖ Paduka Syeikh abdul Majid Mohd Noor ', 'Transkrip temubual bersama Sahibus Samahah DatoGÇÖ Paduka Syeikh abdul Majid Mohd Noor sumbangan beliau dalam bidang keagamaan dan pendidikan.', '2014-04-24 23:12:54', '2014-04-25'),
(262, 556, 'Pengalaman beliau sebagai angggota AC ketika penentangan komunis di Teluk Intan, Perak pada tahun 1951', 'Sarjan (B) Haji Shafie Bin Nasir ', 'Transkrip temubual bersama Sarjan (B) Haji Shafie Bin Nasir mengenai pengalaman beliau sebagai angggota AC ketika penentangan komunis di Teluk Intan, Perak pada tahun 1951.', '2014-04-24 23:12:54', '2014-04-25'),
(263, 557, 'Kejayaan beliau menentang komunis pada tahun 1944 di Balai Polis, Paloh, Kluang, Johor.', 'Tuan Haji Ahmad Bin Noordin ', 'Transkrip temubual bersama Tuan Haji Ahmad Bin Noordin mengenai kejayaan beliau menentang komunis pada tahun 1944 di Balai Polis, Paloh, Kluang, Johor', '2014-04-24 23:12:54', '2014-04-25'),
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(265, 559, 'Seniman Abdul Aziz Sattar sebagai tokoh filem melayu', 'Seniman Abdul Aziz Sattar ', 'Transkrip temubual bersama Seniman Abdul Aziz Sattar sebagai tokoh filem melayu.', '2014-04-24 23:12:54', '2014-04-25'),
(266, 560, 'Penglibatan dan pengalaman beliau di dalam kerjaya polis.', 'Zulkifli Bin Hashim ', 'Transkrip temubual bersama Encik Zulkifli Bin Hashim mengenai penglibatan dan pengalaman beliau di dalam kerjaya polis.', '2014-04-24 23:12:54', '2014-04-25'),
(267, 561, 'Penglibatan beliau dalam menjalankan Misi Pengaman di Somalia pada tahun 1994', 'Mohd Faizal Bin Ahmad ', 'Transkrip temubual bersama Pegawai Waran Mohd Faizal Bin Ahmad mengenai penglibatan beliau dalam menjalankan Misi Pengaman di Somalia pada tahun 1994 ', '2014-04-24 23:12:54', '2014-04-25'),
(268, 562, 'Pengalaman beliau sewaktu peristiwa di Mengkuang, Pahang pada tahun 1951', 'Koperal Shaharif bin Haji Perel ', 'Transkrip temubual bersama Koperal Shaharif bin Haji Perel mengenai pengalaman beliau sewaktu peristiwa di Mengkuang, Pahang pada tahun 1951', '2014-04-24 23:12:54', '2014-04-25'),
(269, 563, 'Perjalanan dan penglibatan beliau dalam bidang seni.', 'Datuk Hj. Jamali Shadat ', 'Transkrip temubual bersama Datuk Hj. Jamali Shadat mengenai perjalanan dan penglibatan beliau dalam bidanag seni.', '2014-04-24 23:12:54', '2014-04-25'),
(270, 564, 'Pengalaman beliau sebagai Ketua Pengarah Kesihatan pada tahun 1971 hingga 1976.', 'DatoGÇÖ Seri Dr. Hj Abdul Majid ', 'Transkrip temubual bersama DatoGÇÖ Seri Dr. Hj Abdul Majid mengenai pengalaman beliau sebagai Ketua Pengarah Kesihatan pada tahun 1971 hingga 1976.', '2014-04-24 23:12:54', '2014-04-25'),

(271, 565, 'Pengalaman dan sumbangan beliau sebagai Ketua Pengarah Jakim', 'DatoGÇÖ Haji Wan Mohammad Bin Haji Abdul Aziz ', 'Transkrip temubual bersama DatoGÇÖ Haji Wan Mohammad Bin Haji Abdul Aziz mengenai pengalaman dan sumbangan beliau sebagai Ketua Pengarah Jakim', '2014-04-24 23:12:54', '2014-04-25'),
(272, 566, 'Peristiwa pertempuran anggota polis dengan komunis di Keroh pada tahun 1968', 'Tuan haji Mansor Bin Haji Jalil', 'Transkrip temubual bersama Tuan haji Mansor Bin Haji Jalil mengenai peristiwa pertempuran anggota polis dengan komunis di Keroh pada tahun 1968', '2014-04-24 23:12:54', '2014-04-25'),
(273, 567, 'Pengalaman beliau sewaktu melalui zaman keperitan hidup ketika pemerintahan Jepun di Tanah Melayu di antara tahun 1942 hingga 1945.', 'Haji Mat Aris Bin Haji Meon', 'Transkrip temubual bersama Tuan Haji Mat Aris Bin Haji Meon mengenai pengalaman beliau sewaktu melalui zaman keperitan hidup ketika pemerintahan Jepun di Tanah Melayu di antara tahun 1942 hingga 1945.', '2014-04-24 23:12:54', '2014-04-25'),
(274, 568, 'Penglibatan beliau dalam pertempuran anggota komunis dengan cGÇÖ company, paltun 3 Batalion ke 14 Rejimen Askar Melayu di Raja, di Air Keroh, Perak dalam tahun 1970.', 'Mohd Hussin B. Muzir', 'Transkrip temubual bersama Tuan Haji Mohd Hussin B. Muzir mengenai penglibatan beliau dalam pertempuran anggota komunis dengan company, Platun 3 Batalion ke 14 Rejimen Askar Melayu di Raja, di Air Keroh, Perak dalam tahun 1970.', '2014-04-24 23:12:54', '2014-04-25'),
(275, 569, 'Peristiwa pelarian Islam Kampuchea ke Malaysia pada tahun 1971', 'Mejar (B) Haji Ismail Bin Ali ', 'Transkrip temubual bersama Mejar (B) Haji Ismail Bin Ali mengenai peristiwa pelarian Islam Kampuchea ke Malaysia pada tahun 1971.', '2014-04-24 23:12:54', '2014-04-25'),
(276, 570, 'Pengalaman beliau sepanjang menjadi ahli politik.', 'YB Zaili Bin Cha', 'Transkrip temubual bersama YB Zaili Bin Cha mengenai pengalaman beliau sepanjang menjadi ahli politik.', '2014-04-24 23:12:54', '2014-04-25'),
(277, 571, 'Pengalaman beliau sepanjang menjadi ahli politik.', 'Tan Sri DatoGÇÖ Sri Sabbaruddin Chik', 'Transkrip temubual bersama Tan Sri DatoGÇÖ Sri Sabbaruddin Chik mengenai pengalaman beliau sepanjang menjadi ahli politik.', '2014-04-24 23:12:54', '2014-04-25'),
(278, 572, 'Pertempuran dengan pengganas komunis di Hutan Labuhan Dagang Banting pada tahun 1959', 'Tuan Haji Saring Bin Ahmad', 'Transkrip temubual bersama Tuan Haji Saring Bin Ahmad mengenai pertempuran dengan pengganas komunis di Hutan Labuhan Dagang Banting pada tahun 1959.', '2014-04-24 23:12:54', '2014-04-25'),
(279, 573, 'Pengalaman dan sumbangan beliau sebagai seorang anggota tentera.', 'Mejar (B) Ir Abu Bakar Saud A.M.N', 'Transkrip temubual bersama Mejar (B) Ir Abu Bakar Saud A.M.N mengenai pengalaman dan sumbangan beliau sebagai seorang anggota tentera.', '2014-04-24 23:12:54', '2014-04-25'),
(280, 574, 'Penaklukan Jepun ke atas Tanah Melayu', 'Koperal (B) Tuan Haji Abdul Rahman Bin Haji Yusop', 'Transkrip temubual bersama Koperal (B) Tuan Haji Abdul Rahman Bin Haji Yusop mengenai penaklukan Jepun ke atas Tanah Melayu.', '2014-04-24 23:12:54', '2014-04-25'),
(281, 575, 'Operasi menentang komunis di Gunung Jerah, Kedah pada tahun 1960', 'Leftenan (B) Adnan Bin Mohd Ali', 'Transkrip temubual bersama Leftenan (B) Adnan Bin Mohd Ali mengenai operasi menentang komunis di Gunung Jerah, Kedah pada tahun 1960.', '2014-04-24 23:12:54', '2014-04-25'),
(282, 576, 'Peristiwa berdarah 13 Mei di Kuala Lumpur pada tahun 1969', 'Mejar (B) Hj Mahat Mason ', 'Transkrip temubual bersama Mejar (B) Hj Mahat Mason mengenai peristiwa berdarah 13 Mei di Kuala Lumpur pada tahun 1969.', '2014-04-24 23:12:54', '2014-04-25'),
(283, 577, 'Ketokohan beliau sebagai Mantan Ketua Pengarah di Jabatan Hal Ehwal Orang Asli.', 'DatoGÇÖ Fadzil Bin Mahamud', 'Transkrip temubual bersama DatoGÇÖ Fadzil Bin Mahamud mengenai ketokohan beliau sebagai Mantan Ketua Pengarah di Jabatan Hal Ehwal Orang Asli.', '2014-04-24 23:12:54', '2014-04-25'),
(284, 578, 'Pengalaman beliau dalam ATM unit pancaragam', 'Salim Bin Haji Sulaiman', 'Transkrip temubual bersama Tuan Haji Salim Bin Haji Sulaiman mengenai pengalaman beliau dalam ATM unit pancaragam.', '2014-04-24 23:12:55', '2014-04-25'),
(285, 579, 'Pengalaman beliau sebagai anggota polis mengetuai peristiwa darurat di Padang Besar, Perlis.', 'En Damanhuri Bin Abd Rahman', 'Transkrip temubual bersama En Damanhuri Bin Abd Rahman mengenai pengalaman beliau sebagai anggota Polis mengetuai peristiwa darurat di Padang Besar, Perlis.', '2014-04-24 23:12:55', '2014-04-25'),
(286, 582, 'Peristiwa semasa berlakunya serangan komunis di Perak sekitar tahun 1950-an.', 'Lans Koperal Hashim Bin Omar', 'Transkrip temubual bersama Lans Koperal Hashim Bin Omar mengenai peristiwa semasa berlakunya serangan komunis di Perak sekitar tahun 1950-an.', '2014-04-24 23:12:55', '2014-04-25'),
(287, 583, 'Peristiwa semasa berlakunya serangan komunis di Perak sekitar tahun 1950-an.', 'Lans Koperal Hashim Bin Omar', 'Transkrip temubual bersama Lans Koperal Hashim Bin Omar mengenai peristiwa semasa berlakunya serangan komunis di Perak sekitar tahun 1950-an.', '2014-04-24 23:12:55', '2014-04-25'),
(288, 584, 'Pengalaman beliau sebagai pegawai pemerintah no 881/2 yang pertama bagi pasukan angkatan tentera darat', 'Abd Rahman Othman', 'Transkrip temubual

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bersama Leftenan (B) Abd Rahman Othman mengenai pengalaman beliau sebagai
pegawai pemerintah no 881/2 yang pertama bagi pasukan angkatan tentera darat.',
'2014-04-24 23:12:55', '2014-04-25'),
(289, 585, 'Penglibatan dan pengalaman beliau di dalam bidang seni lakonan.',
'Kuswadi Bin Bujang', 'Transkrip temubual bersama En Kuswadi Bin Bujang
mengenai penglibatan dan pengalaman beliau di dalam bidang seni lakonan.',
'2014-04-24 23:12:55', '2014-04-25'),
(290, 586, 'Pengalaman beliau sebagai seorang penggiat sastera tanah air',
'Tengku Alias Tengku Taib', 'Transkrip temubual bersama Tengku Alias Tengku
Taib mengenai pengalaman beliau sebagai seorang penggiat sastera tanah air.',
'2014-04-24 23:12:55', '2014-04-25'),
(291, 587, 'Pengalaman dan penglibatan beliau semasa peperangan di Congo,
Afrika Selatan.', 'Zainuddin Samsuddin', 'Transkrip temubual bersama Tuan Haji
Zainuddin Samsuddin mengenai pengalaman dan penglibatan beliau semasa
peperangan di Congo, Afrika Selatan.', '2014-04-24 23:12:55', '2014-04-25'),
(292, 588, 'Pengalaman sebagaipensyarah selama 22 tahun', 'Sohaimi Bin
Zakaria', 'Transkrip temubual bersama Profesor Madya Dr. Sohaimi Bin Zakaria
Pegawai Khas Akademik 1 kepada Naib Canselar dan Pensyarah Fakulti Pengurusan
Maklumat, Universiti Teknologi Mara mengenai pengalaman beliau sebagai
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-- --------------------------------------------------------

--
-- Table structure for table `contenttaxonomy`
--

DROP TABLE IF EXISTS `contenttaxonomy`;
CREATE TABLE IF NOT EXISTS `contenttaxonomy` (
  `CTID` int(11) NOT NULL AUTO_INCREMENT,
  `ContentID` int(11) NOT NULL,
  `TaxID` int(11) NOT NULL,
  PRIMARY KEY (`CTID`)
) ENGINE=InnoDB  DEFAULT CHARSET=latin1 AUTO_INCREMENT=37 ;

--
-- Dumping data for table `contenttaxonomy`
--

INSERT INTO `contenttaxonomy` (`CTID`, `ContentID`, `TaxID`) VALUES
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(3, 4, 46),
(4, 4, 9),
(5, 4, 20),
(6, 4, 23),
(7, 4, 2),
(8, 4, 3),
(9, 1, 47),
(10, 1, 48),
(11, 1, 32),
(12, 1, 34),
(13, 2, 50),
(14, 2, 51),
(15, 3, 52),
(16, 3, 53),
(17, 3, 54),
(18, 3, 32),
(19, 3, 34),
(20, 3, 21),
(21, 3, 3),
(22, 4, 55),
(23, 4, 32),
(24, 4, 56),
(25, 5, 57),
(26, 5, 58),
(27, 7, 59),
(28, 7, 60),
(29, 6, 61),
(30, 6, 58),
(31, 8, 62),
(32, 8, 63),
(33, 2, 49),
(34, 2, 11),
(35, 2, 21),
(36, 8, 21);
```

```
-- --------------------------------------------------------

--
-- Table structure for table `contenturl`
--

DROP TABLE IF EXISTS `contenturl`;
CREATE TABLE IF NOT EXISTS `contenturl` (
  `id` int(5) NOT NULL AUTO_INCREMENT,
  `contentID` int(5) NOT NULL,
  `URL` varchar(255) NOT NULL,
  `type` varchar(30) NOT NULL,
  PRIMARY KEY (`id`)
) ENGINE=MyISAM  DEFAULT CHARSET=latin1 AUTO_INCREMENT=8 ;

--
-- Dumping data for table `contenturl`
--

INSERT INTO `contenturl` (`id`, `contentID`, `URL`, `type`) VALUES
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(2, 3, 'http://ohms.uitm.edu.my/audio/roslan_hussin_1_b.mp3', 'audio/mpeg'),
(3, 3, 'http://ohms.uitm.edu.my/audio/roslan_hussin_2_a.mp3', 'audio/mpeg'),
(4, 8, 'http://ohms.uitm.edu.my/doc/atkah_abdullah.pdf', 'application/pdf'),
(5, 8, 'http://ohms.uitm.edu.my/audio/atkah_abdullah.mp3', 'audio/mpeg'),
(6, 8, 'http://ohms.uitm.edu.my/audio/atkah_abdullah2.mp3', 'audio/mpeg'),
(7, 8, 'http://ohms.uitm.edu.my/audio/atkah_abdullah3.mp3', 'audio/mpeg');

-- --------------------------------------------------------

--
-- Table structure for table `taxonomy`
--

DROP TABLE IF EXISTS `taxonomy`;
CREATE TABLE IF NOT EXISTS `taxonomy` (
  `TaxID` int(11) NOT NULL AUTO_INCREMENT,
  `ParentID` int(11) NOT NULL,
  `Node` varchar(150) NOT NULL,
  PRIMARY KEY (`TaxID`)
) ENGINE=InnoDB  DEFAULT CHARSET=latin1 AUTO_INCREMENT=64 ;

--
-- Dumping data for table `taxonomy`
--
INSERT INTO `taxonomy` (`TaxID`, `ParentID`, `Node`) VALUES
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(2, 1, 'Project field'),
(3, 1, 'Events'),
(4, 1, 'Topics'),
(5, 1, 'Interviewes/Profile'),
(6, 1, 'Oral History Projects Plan'),
(7, 2, 'Security'),
(8, 2, 'Rescue'),
(9, 2, 'Defence'),
(10, 2, 'Entertainment'),
(11, 2, 'Technical field'),
(12, 2, 'Sports'),
(13, 2, 'Education'),
(14, 2, 'Arts'),
(15, 2, 'Politics'),
(16, 2, 'Social work'),
(17, 2, 'Culture & Heritage'),
(18, 2, 'General'),
(19, 3, 'Events Name/Title'),
(20, 3, 'Date'),
(21, 3, 'Involvement'),
(22, 3, 'Contribution'),
(23, 3, 'Places'),
(24, 3, 'Theme'),
(25, 4, 'Lesson learned'),
(26, 4, 'Diary'),
(27, 4, 'Impacts'),
(28, 4, 'Experience'),
(29, 4, 'Reflection'),
```

```
(30, 4, 'Best Practices'),
(31, 5, 'Personal development'),
(32, 5, 'Background'),
(33, 5, 'Recognition'),
(34, 5, 'Present position'),
(35, 6, 'Guidelines'),
(36, 6, 'Stakeholders'),
(37, 6, 'Resources'),
(38, 35, 'Significant contribution'),
(39, 35, 'Age'),
(40, 35, 'Recording format'),
(41, 35, 'Question format'),
(42, 38, 'Evaluation'),
(44, 9, 'Serangan PARAKU 1969 Sarawak'),
(45, 20, '1969'),
(46, 23, 'Sarawak'),
(47, 32, 'Abu Bakar Bin Saud '),
(48, 34, 'Mejar (B) Ir'),
(49, 11, 'Jurutera'),
(50, 32, 'Maluddin bin Limbong'),
(51, 21, 'Penembak Meriam'),
(52, 32, 'Roslan Bin Haji Hussin'),
(53, 34, 'Mejar '),
(54, 21, 'Misi PBB di Kuwait'),
(55, 32, 'Abdul Jalal Bin Haji Sulaiman'),
(56, 34, 'Sarjan Mejar'),
(57, 32, 'Mohd Safari bin Abd Hamid'),
(58, 34, 'Lt Kol (B) '),
(59, 32, 'Abdul Rahim Bin Sainon'),
(60, 34, 'Kolonel '),
(61, 32, 'Ab. Halim Bin Awang'),
(62, 32, 'Atkah Binti Abdullah'),
(63, 21, 'Ahli Politik');

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/*!40101 SET COLLATION_CONNECTION=@OLD_COLLATION_CONNECTION */;
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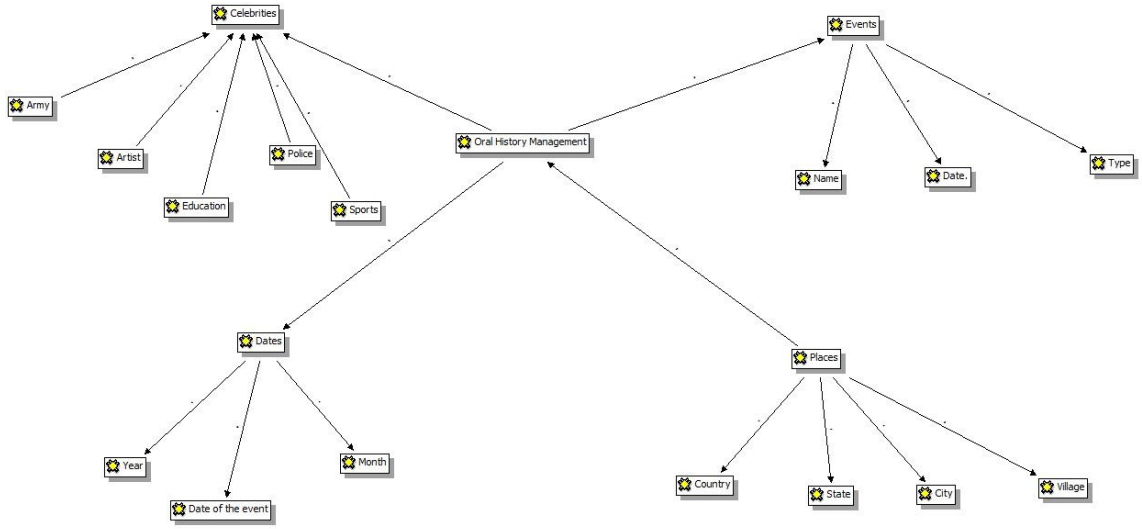
Appendix D:

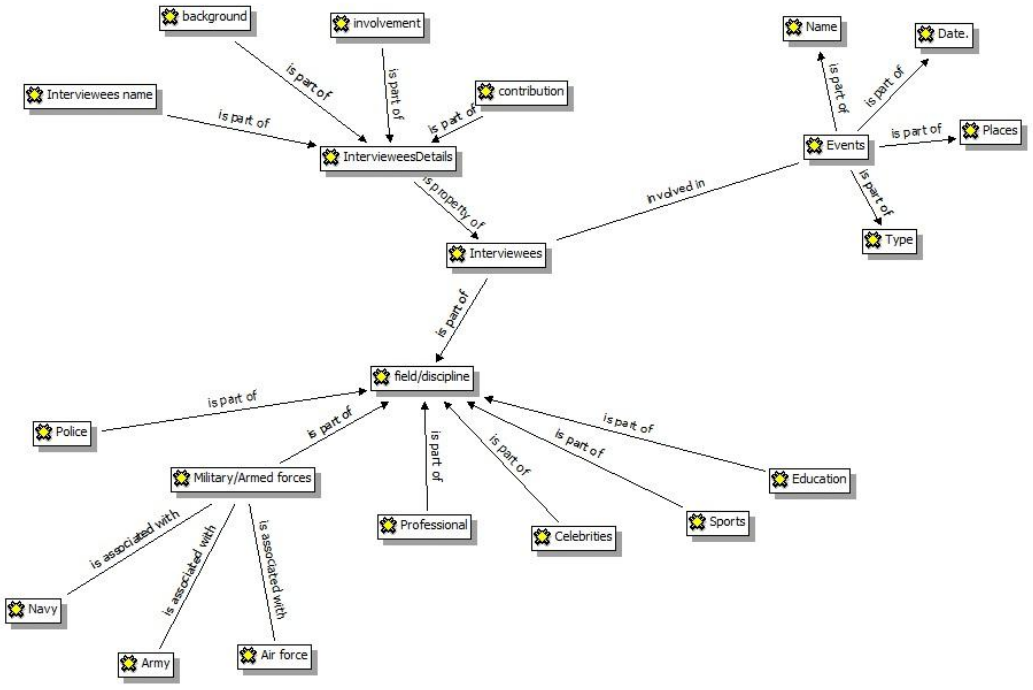
Details of Solution Evaluation

The seven iterations for improving proposed ontology development through focus groups interviews:

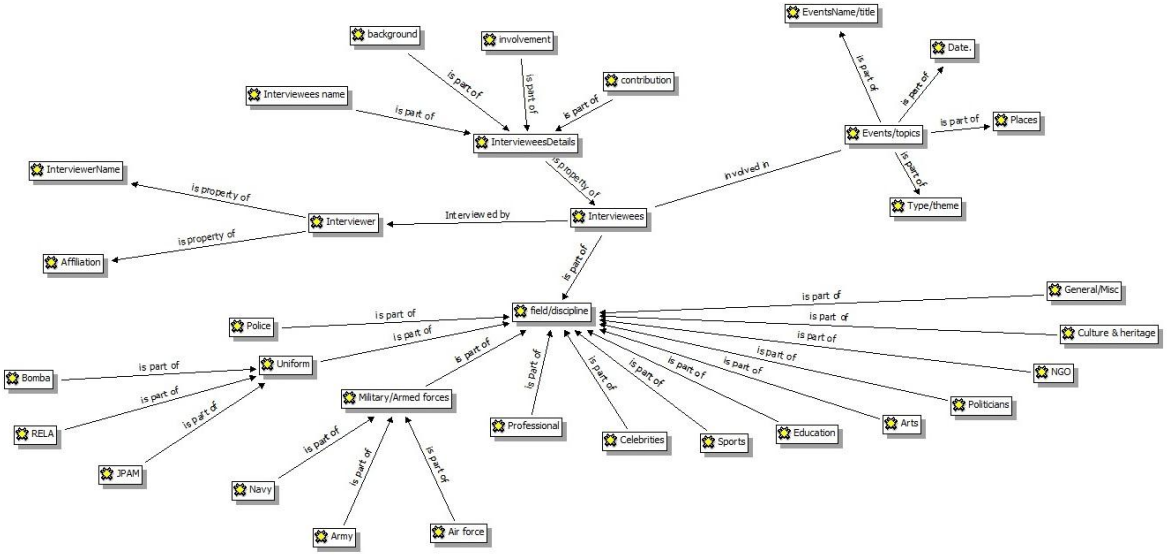
First iteration: Draft 1.1



Second iteration: Draft 1.2



Draft 1.3



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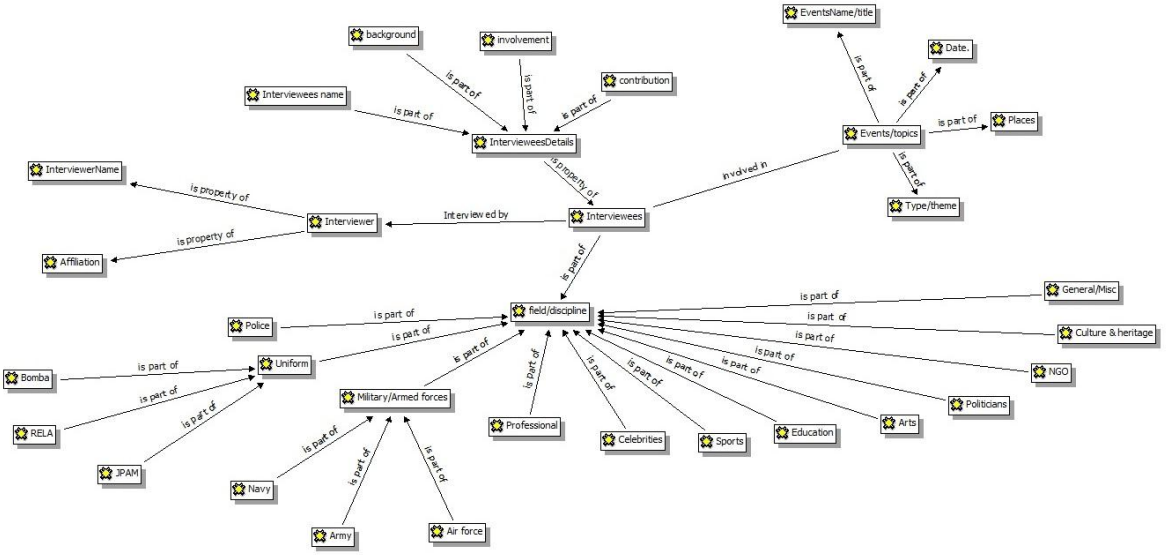
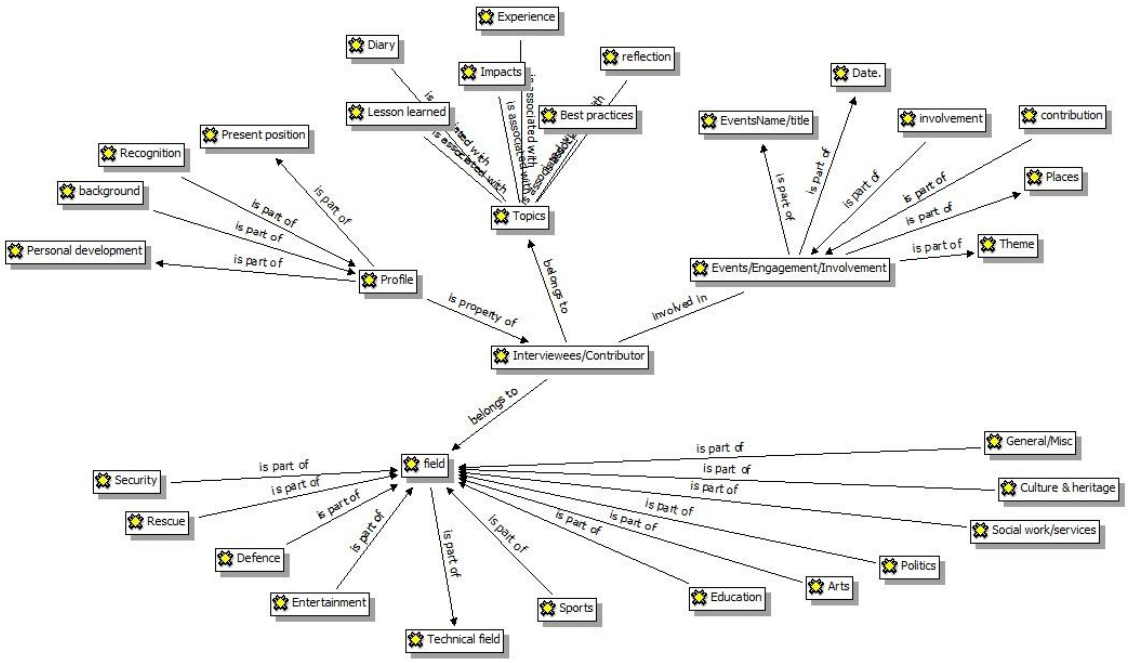
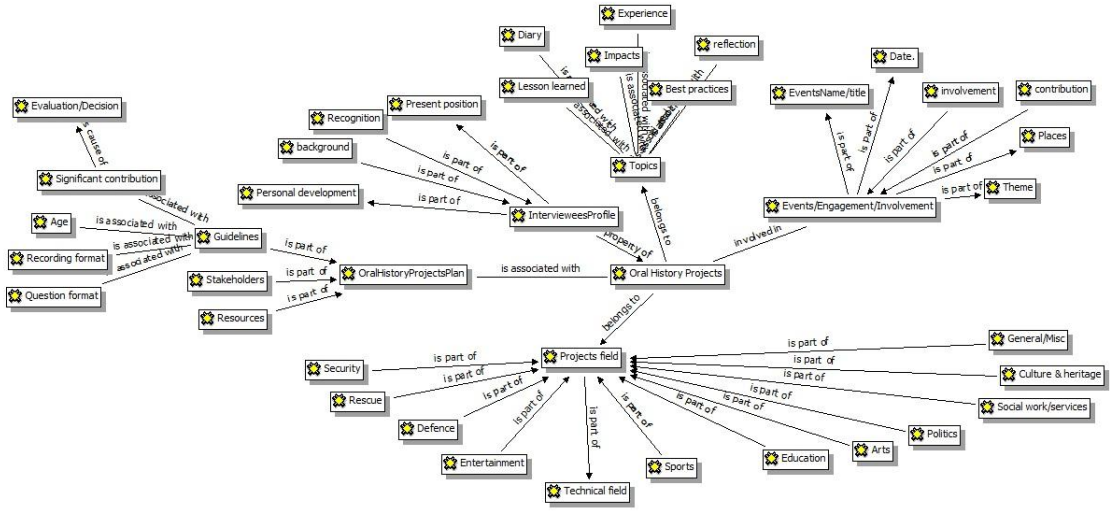


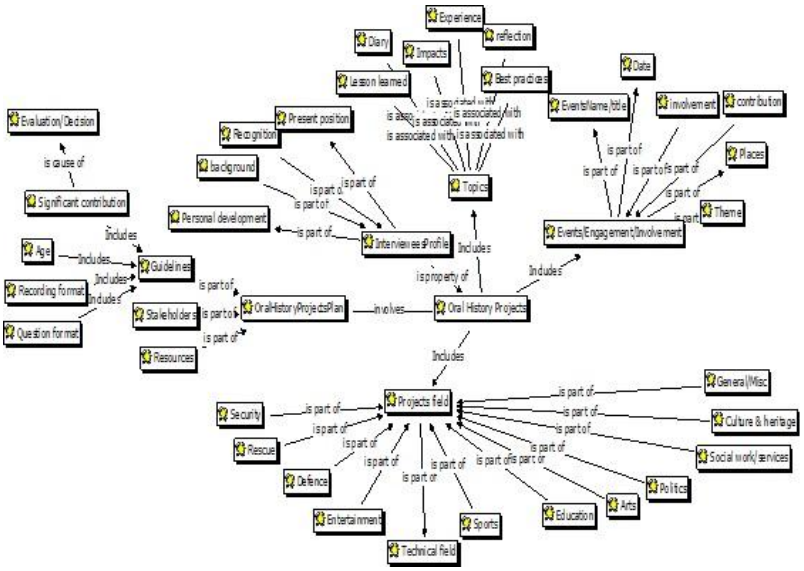
Draft 1.5



Draft 1.6



Draft 1.7


Experience
reflection
Diary
Impacts
Lesson learned
Best practices
Date
Events/Name/title
involvement
contribution
Evaluation/Decision
Present position
Recognition
is associated with
is cause of
Significant contribution
background
Places
is part of
Theme
Personal development
Topics
Includes
Age
Interviewees Profile
Events/Engagement/Involvement
Guidelines
Recording format
is property of
Oral History Projects
Question format
Stakeholders
OralHistoryProjectsPlan
involves
Resources
Projects field
General/Misc
Culture & heritage
Social work/services
Politics
Arts
Education
Sports
Technical field
Entertainment
Defence
Rescue
Security

Appendix E:

Research Publications from the PhD Project over the past(Front page only)

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ISSUES OF ENTERPRISE RECORD MANAGEMENT APPLICATIONS: A SEMANTIC ONTOLOGY-BASED SOLUTION PERSPECTIVE

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Abstract: *Enterprises have increasingly been employed various enterprise record management (ERM) applications for better managing records and contents electronically. However, there are issues in existing ERM applications that impact negatively on users' support, specially to resolve their information query on various records.Throughout a literature review this study identifies both common issues of ERM applications and potential use of semantic ontology, in order to outline a solution foundation. For conducting the investigation the study takes a particular focus on a case of records management in educational institutes. The discussion in this paper helps create a basis for developing a suitable ontology based solution by offering practical benefits to users.*

Keywords: *Semantic ontologies, enterprise record management, content management, education institutes*

1. INTRODUCTION

Various approaches for effective enterprise record management (ERM) have been employed to meet user's access demands within organisations. Approaches vary organisation to organisation due to the fact of various regulatory compliances and types of records (Brett, 2005) they have in place. Records can be physical records and electronic or digital records that can be seen in all formats (Sprehe, 2005). While enterprises carry on their activities today almost universally with the use of information technology (IT), the demands of access and storing older and new form of digital records in electronic repository are growing for their better management and preservation.

Over the history of information systems (IS) application development, technologies of enterprise record management have still been underdeveloped to meet the growing demand of industry's record preservation, meeting regulatory compliances and its further effective use for decision makers (Katuu, 2012; Alalwan and Weistroffer, 2012). Beyond the provisions for records and documents preservation simply in record repository, existing approaches do suffer on providing useful features to meet the regular information access demand within their different business conditions.

Sprehe (2005) highlights three case studies that demonstrate the positive benefits of ERM in terms of enterprise content management. Katuu (2012) evaluates the implementation of

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A SEMANTIC WEB-BASED APPROACH FOR ENHANCING ORAL HISTORY MANAGEMENT SYSTEMS

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Abstract: *Semantic web (SW) technologies have become one of the well-accepted tools for enhancing web application usages. However, the technology has been immature for the enhancement of knowledge management (KM) systems usages. This paper reports an investigation on current issues of a KM system, so-called Oral History Management Systems (OHMS) and benefits of SW over the issues. The study first conducts interviews to identify issues and benefits of the current applications in parallel to a literature survey that finds potential benefits and issues of SW technologies. The initial outcomes are then used to develop both frameworks of current OHMS and preferred SW based in order to compare for achieving the betterment of OHMS usages in the targeted problem context, specially for enhancing decision making provisions. In this paper, we summarize the entire research project highlighting not just a conceptual and theoretical issue, but also for the enhancement of practical usages of OHMS across the Universities in Malaysia.*

Keywords: *Semantic Web, knowledge management, records management systems.*

1. INTRODUCTION

Semantic web (SW) technologies have been a well-accepted tool for enhancing web application usages. Examples can be viewed in educational institutes (Cardoso, 2007) for developing a semantic course management system; and in law firms (Gliozzo et al., 2007) for enhancing their legacy system. However, there are limited studies on how the SW can be used to improve the practical usages through enhancing the capability of knowledge management (KM) system (In our case, an electronic document and records management systems- EDRMS is a type of KM system) for regular users. This study conducts an investigation on the current issues of the traditional OHMS in the Universiti Teknologi MARA, Malaysia. The aim is to improve overall OHMS application for users such as educators and students at both levels of postgraduate and undergraduate, specially to improve their searching and navigating abilities for quick decision making. With this aim, our study first empirically conducts interviews to identify issues and benefits of the current traditional applications in parallel to a theoretical analysis through literature survey that finds potential benefits and issues of SW technologies. The initial findings are then used to develop both frameworks of current OHMS and preferred SW based options, in order to compare for achieving the betterment of the traditional OHMS usages in the targeted problem context, specially for enhancing decision making provisions. The frameworks are based on taxonomy descriptions that demonstrate benefits and issues related to traditional OHMS and SW based approach. In this paper, we summarize the entire research project to

An Ontology-Based Record Management Systems Approach for Enhancing Decision Support

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Abstract

Within the field of information systems development, enterprise record management (ERM) technologies have largely failed to meet industry's demands specially for context-sensitive records management and document preservation. Electronic record management systems (EDRMS), as ERM tool, have become well-recognized applications to academic users in higher educational institutes. The system often shows limited decision support options that result lack of coordination and duplication of academic efforts. There is no common domain ontology developed yet so far for effective management of record and oral history. Using structured methodology this study develops and evaluates a semantic domain ontology to provide context-specific systematic record management approach. The lessons learnt from this project could be beneficial in general to the theory and practice of knowledge management decision support development in complex problem domains.

Keywords

Ontology, decision support, semantic web, records management

Introduction

Within the field of information systems (IS) application development, enterprise record management technologies have largely failed to meet industry's demands (Katuu, 2012; Alalwan and Weistroffer, 2012). In particular, beyond basic records management and document preservation, there is a real need for advanced context-sensitive decision support approach.

Enterprise Records Management (ERM) research has been nominated as an emerging IS development area. Sprehe (2005) conducted three case studies that demonstrate the positive benefits of ERM in terms of enterprise content management. Katuu (2012) evaluated the implementation of enterprise content management (ECM) in South Africa through a literature survey and revealed that a very limited number of studies represented institutional experiences related to implementing electronic document and records management. Katuu (2012) recommended that further research is required to develop more practical applications as well as the impact analysis of such implementations highlighting end users provisions. Moreover, Alalwan and Weistroffer (2012) pointed out the gaps in the field of ECM where further research is most needed in terms of improving records management. The paper provides a framework that also reinforced to develop practical solution according to meet users growing demand specially for decision support. To address this, the study investigates the requirements of developing a semantic ontology-based Records Management solution for the benefit of decision maker, though the use of a case study approach. This solution promises to address the real technical issues of searchability and