Knowledge Taxonomy for Developing Organizational Memory System (OMS) for Public Institutions of Higher Learning (IHL) in Malaysia

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Abstract. Knowledge in organization, supported by appropriate technology will produce organizational memories that provide necessary support for organization to learn and grow. As the scope of organizational memory in one organization is too broad, it is necessary to classify them into acceptable narrower view. Using organization memory computer base literature related, this study found some basic understanding of organization memory system, and produce knowledge taxonomy and metadata as a base to develop organizational memory system in IHL; Malaysia scenario. The taxonomy and metadata is developed base on pertinent literature of organizational memory system model, organizational memory sources types and knowledge management technology. Further study can be conducted to validate and verify the developed taxonomy.

Keywords: Knowledge, taxonomy, organizational memory, corporate memory, knowledge management.

1 Introduction

The usage of Information and Communication Technology (ICT) has become the norm in our daily activities and businesses. Organizations' processes including registration, applications submission and operations, marketing and customer services have been computerized. ICT enable data, information, knowledge, and wisdom of organization to be shared. Organizational Memory (OM) is being treated as human memory that consists of history, good and bad experiences of the organization. It is one of way to manage knowledge at organization level. Learning curve is shortened and organization becomes mature with appropriate OM. As organizations realize the importance of OM, there has been so many knowledge management system developed to support organizational memory. Knowledge applications blooms and people are having more access to knowledge but some knowledge repositories remains in their own group or team instead of being shared across the organization. The reality on computerized system is that they have not being shared across organization. Finally, when the knowledge cannot be used as references and lessons learned, organization failed

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to become learning organization; a reflection of failure in organizational memory concept.

A classification principle of Organization Memory System (OMS) will bring new concrete views related to roles of Knowledge Management System (KMS) in organization; in particular focus to the cross functional knowledge sharing. This study aims to develop taxonomy for OMS. The taxonomy serves as a benchmark on organization for producing framework of OMS in IHL organization in Malaysia. This study differ from other framework that integrating information system (IS) in their knowledge production environment.

This paper is organized as follows. First section is the Introduction (Section 1). Section 2 covers theoretical framework from literature related to organizational memory and taxonomy before presenting method for developing the taxonomy (Section 3). Next is developing OMS taxonomy (Section 4) and finally summarizing results and providing suggestions for future research (section 5).

2 Theoretical Framework

2.1 Knowledge in Organization

The last twenty years have seen a major shift in world wide access to codified knowledge [1]. Human kind able to capture most of knowledge into computer system that provides access to its authorized user whenever necessary. To be effective, organizations must exploit example of best practice, improve their efficiency and contribute to their overall organizational learning [2]. Knowledge resides in various places and format such as database, knowledge bases, filing cabinets and peoples' head and is distributed right across the enterprise [3]. [4] emphasized that organization which adopts image of memory as a guide to the way in which it operates needs to address its ability to learn in real time: for its members to be able to make sense of a changing environment and for their sense making to spread rapidly throughout the organization or at least to those part where it is needed. Knowledge generated by organization activities often stays within a laboratory or research team and rarely crosses disciplinary boundaries, in most setting it is resides in individual knowledge cluster; so it is the challenge of institutional leadership to motivate their staff to share in many ways [5]. Decisions and reason could not be concluded as a whole because some of the knowledge remains in its save repositories. OM plays a role to centralize repositories in organizations so that there is only one repository in one organization contain the most update and reliable knowledge cross organization.

For a corporate or organizational memory to live and grow with organization, members of organization must support the Knowledge Management (KM) processes that are knowledge creation, organize, refine and transfer [6].Team learning is the ability of each team member to envision an alignment, between individual ability and the team's vision to produce greater results than can otherwise be delivered [7]. In one organization, knowledge gained by individual and teams has to be shared. Internal knowledge exchange process is actually a learning process to the organization. KM should archive the dynamic management of process creating knowledge out of knowledge rather than static management of information on existing knowledge [8].

For an organization to become one learning entity, it has to overcome barriers of individual/team learning; able to arrive at common understanding of company purpose and known organization problems; and exhibit a certain level of error tolerance (i.e incorrect learning or learning from bad/critical experiences) [9]. Organizational memory must not include only characteristic of just certain individuals, organizational memory is independent from any members. Organizational memory is knowledge from the past where experience mapped on present activities, thus resulting in higher of organizational effectiveness [10]. Lack of memories due to staff replacement can cause "corporate amnesia" [11].

2.2 Organizational Memory System (OMS)

OM term has been introduced since early 80s. Since then the term has been used in various research as listed in Table 1.

Table 1. Evolution of OM terms [12] & [13]

Author/s	Year	Terms used
Duncan and Weiss	1979	Corporate, organizational, enterprise wide knowledge base
Hedberg	1981	OM
Pautzke	1989	Corporate, organizational, enterprise wide knowledge base
Walsh and Ungson	1991	OM
Pralahad and Hamel	1994	Corporate Knowledge or Corporate Genetic
Rao and Goldmann	1995	OM, Corporate Memory
Rose et al.	1998	Corporate Memory
Annie	1999	Corporate Memory
Dieng et al.	1999	Corporate Memory (CM) (noncomputational CM, document-based CM, knowledgebased CM, case-based CM and distributed CM)

Studies on OM has been intensified since 1980's. Researchers have used the term OM interchangeable with Corporate Memory (CM), Corporate Knowledge (CK) and Enterprise Knowledge Base (EKB). Previous studies focus on the concept of OM and

OMIS. Those researchers concentrate on the concept of OM systems for solving information system and knowledge management problems. From definitions provided by those pioneers in the field, it can be concluded that OM is enterprise wide knowledge management focusing on centralize, transparent and cross departmental access. Among all researchers, [14] has made an effort to categorized sources of OMS and proposed six types of OM depicts in table 2.

Table 2. Types of OM [14]

No	Type of OM	Creation of OM
1	Non computational OM	Paper based documents on knowledge that had never been elicited previously
2	Document based OM	All existing docs of firm can constitute the OM – not well indexed
3	Knowledge based OM	Knowledge engineering for building OM
4	Case based OM	Collection of pasts experiences (successes or failures) that can be represented explicitly
5	Construction of distributed OM	Supporting collaboration and knowledge sharing between several groups of people in organization
6	Combination of several techniques	Both informal knowledge (such as documents) and formal knowledge (such as knowledge explicitly). represented in a knowledge base)

The categorization of OMS source proposed by [14] is adopted in this study because it reflects the context of knowledge resources and information in IHL.

In developing the taxonomy for this research, a critical analysis related to OMS are conducted. A compilation of studies from [12], [13] and [15] on models and frameworks related to OMS are listed in Table 3.

Table 3. Studies of OMS

No	Year	Outcome of Research *(OMS name)*	Short Description of Outcome *(OMS components)*
1	1986	Transactive Memory System	i) Individual System ii) External Memory iii) Transactive memory
2	1989	Organizational Knowledge Model	Knowledge accessible and not accessible within organization projected through overlapped circle.
3	1991	Organizational IT Memory framework called Bins.	i) Individual culture ii) Culture iii) Transformation iv) Structure v) Ecology vi) External Environment

Table 3. (*continued*)

4	1992	OMIS Success Model	i) System Quality, ii) Information Quality, iii) Success Measure in Terms of Usage, iv) Individual Impact, v) Organizational Impact
5	1995	Five Metadata types *(TeamBox)*	i) Meta-data ii) Structured data iii) Semistructured Data iv) Unstructured Data v) Temporal Data
6	1995	Two layers OMIS framework -IT and Non IT- Improved previous study	i) Effectiveness functions (integration, adaptation, goal attainment, pattern maintenance) ii) Mnemonic functions (knowledge acquisition, retention, maintenance, search and retrieval)
7	1996	FAQ in tree structure Information System *(Answer Garden)*	Database with answers to FAQ supported by expert.
8	1996	Knowledge Construction in material practice *(SHAMAN)*	Foster sharing of knowledge and experience
9	1996	OM informal knowledge *(QuestMap)*	OM creation and usage must occur in work group activity. Conversations in meetings represented in a graphical map format. Consist of hypertext, groupware and rhetorical method.
10	1997	Three components of OMIS	i) Paper Documents, ii) Computer Documents, iii) Self Memory
11	1997	Managing discussions *(Virtual Participant System)*	Developed for computer supported collaborative learning environment.
12	1998	Closed user group *(Knowledge Sharing Environment)*	Agent filters information obtained from database according to the profile defined by the user.
13	1998	OMIS Success Model - Five success factor/block- Improved previous study	i) System Quality, ii) Information Quality, iii) Success Measure in Terms of Usage, iv) Individual Impact, v) Organizational Impact

Table 3. (*continued*)

14	1998	OM model	i) Capture ii) Store iii) Disseminate iv) Facilitate use
15	1998	Organizational memory model	i) People (role, culture, position, social network), ii) Text (table, document), iii) Multimedia (image, audio, graphic, video), iv) Model, v) Knowledge
16	1999	Organizational Memory framework -IT and Non-IT- Improved from previous study	i) Individual culture ii) Culture iii) Transformation iv) Structure v) Ecology vi) External Environment vii) Non-IT Record viii) Files Elements
17	2000	OM of cooperative work *(WSISCO, OMUSISCO and PRIME)* using OMIS model	Web based system to manage structured discussion on the agenda item to be included in a decision making meeting. Consist of hypertext, groupware, rhetorical method, retrieval information system and privacy.
18	2000	Internet Based Knowledge Management	i) Acquire ii) Organize iii) Distribute
19	2004	Corporate Knowledge Management based on 6 types of Corporate Memory	6 types of Corporate Memory (Non computational, document based, knowledge based, case based, construction of distributed and combination of several techniques) Individual memory, project memory and managerial memory
20	2005	IHL Framework of KM system based on KM characteristics	5 components of KM framework (Psychological, culture, process, functionality, architecture)
21	2005	OM Knowledge Sharing	Formal and informal knowledge forming knowledge repositories for OM

Table 3. (*continued*)

22	2006	IHL OMIS implementation using previous study*(MemorIS)*	Evaluation of OMIS implementation for academic management: i) Staff characteristic ii) Work culture iii) Meta-memory as repository
23	2009	IHL OMIS implementation using previous study *(MemorIS)*	3 databases (user, programs & checklist), 5 success factors (system quality, information quality, usage success measure, individual impact & organization impact), metadata curriculum

The compilation of studies related to OMS provides various views of OMS done by previous researchers from 1986 to 2009. The 23 years of studies shows that 61% of the researchers studied on components of OMS. The rest came out with identification of success factors, processes and database manipulation to represent their view of OMS. The analysis of their researches falls into 4 categories as describe in Table 4.

Table 4. Categorization of OMS previous researches

No	Category of previous OMS research	Research numbered
1	Components	1,2,3,5,6,9,10,15,16,17,19,20, 21 and 22
2	Success factor	4, 13, 23
3	Process	6, 8,14,18
4	Database manipulation	7,12, 23

Previous researchers categorized the outcome of their study to OMS components (14 researches), success factors (3 researches) and processes (4 researches). Researches numbered 7, 12 and 23 manipulated database for problem solving. Out of 23 previous studies, 7 of the researchers proposed framework or model that view knowledge at individual level (researches numbered 1, 3, 4, 10, 13, 16 and 19). Metadata is included as main components in OMS by researches numbered 5, 22 and 23. The OMS initiation is viewed on individual system as suggested by the 7 previous researches. This study agreed on the importance of metadata and therefore incorporates metadata as one of main components in the final outcome. Components category derivations are varies as listed in Table 5.

OMS derivation components decision in this study is based from analysis in Table 5. It is obvious that most researchers derived OMS components from combination of documents and memories. This common understanding among previous researchers found in this study proven that combination of documents and memories are the major components of knowledge in most organizations. The OMS for IHL incorporates OMS model from literature analysis discussed in Table 2 until Table 5. The implementation of KM; can be viewed from two main areas that are KM techniques and KM technologies [16] as listed in Table 6.

Table 5. Analysis of knowledge components derivation for OMS defined by previous researcher

No	Knowledge components derivation	Research numbered
1	Surrounding of work place	3, 16, 20 & 22
2	Categorization of data	5
3	Effectiveness and mnemonic functions	6
4	Combination of documents and memories	1, 2, 9, 10, 15, 17, 19, 21

Table 6. KM Techniques and KM Technologies [16]

KM techniques	KM Technologies
1. Mentorship programs, 2. After action reviews or project summaries, 3. Regular intra office or intra division meetings, 4. Storytelling, 5. Communities of practice and 6. Centers of excellence	1. knowledge storage tools, 2. search and retrieval tool, 3. collaboration tools and 4. communication tools under KM technology

[16] claimed that KM techniques are the most effective techniques at capturing tacit knowledge, whereas KM technology is best at capturing explicit knowledge. KM approaches may fail when stakeholders rely on inadequate technology [17]. Thus KM technology plays important roles in organization as enabler to complete KM processes in organization from knowledge creations until knowledge transfers so that knowledge is available and reliable for future use (organizational memory). KM technology also includes knowledge related contents [18]. Selecting and using appropriate technology will determine success of the knowledge management implementation [19]. This is the main reason why this study included KM technology into the OMS taxonomy. KM technologies in this study is derived from isolated researchers' observation, of technology available in IHL, and then mapped into OMS taxonomy level 5. OMS should be a center of knowledge in organization; where KM technology plays its role as a tool to share knowledge.

2.3 IHL Scenario

Developing OMS for public IHL has its own challenges. OMS facilitates learning for an organization specifically for public IHL in Malaysia. System flow relevant to daily activities and IT artifacts are the main focus in this study. OM creation and usage must not be considered as an isolated activity but as daily practices. People should be willing to contribute for OM retention when they get direct benefits from the system. For this reason, this research will use the Key Performance Indicators (KPI) report as a force for people participations. This decision is made because it will drive people to use the system and raise chances of success implementation. Humans have limited

ability of memory and have limited capacities to perform in their job responsibility [15]. Processes are the main component in delivering organizational goals. Thus, any approach that is not associated with processes will tend to fail or to be perceived as failures. Technology cannot be considered alone, it is limited to supporting humans because of its variable accuracy levels when performing simple mundane human tasks [17]. KM design without inputs from all stakeholders is one of the factors why KM approaches fail [12]. KPI report is the organization process and as part of organization culture to support the organization process. Employee is willing to support this process since it will return benefits to them. After all KPI is the widely used tool for employee performance evaluations in Malaysia. Information systems research is important here because it specifically deals with how the artifacts of IT interact with individuals in producing organizational outcomes [20]. [21] in his research illustrates how public sector organizations can avoid the ''great trap in knowledge management" by focusing on designing IT artifacts to make explicit the tacit knowledge from people, and not in the information contained in document repositories.

[22] notes that many universities in Malaysia were not optimizing knowledge (shared and reused to generate new knowledge). [23] came out with taxonomy of IHL k-portal. This is one initiative to identify initial knowledge sharing platform for organization to do retention of their corporate memory. Their study covers explicit information on selected IHL portal. [24] founded three dimensions of tacit knowledge among academician that are intellectual affirmation, self and social tacit knowledge, emerged when academician faced challenges. IHL's organization knowledge is scattered, unstructured and unorganized. Knowledge in organization is stored in various forms of sources such as in repositories, databases, data warehouse, organization documents and all digital communication medias such as email, video and audio. In academic sector, thesis, curriculum, subject registration are among many other academic artifact need to be managed wisely [15] While [22] suggested that researchers of Computer and Information Sciences work out the needs for which ICT system are adopted by the very remarkable user group. [5] proposed "Content must be described and accessed in standardized and interoperable ways". Both the suggestions lead to developing taxonomy in a specific domain. Suitable taxonomies play an important role in research and management because the classification of objects helps researchers and practitioners understand and analyze complex domains [26]. Any organization that needs to make significant volumes of information available in an efficient and consistent way to its customers, partners or employees, need to understand the value of a serious approach to taxonomy management [27].

2.4 Taxonomy

Science of classification or taxonomy is derived from Greek words (tassein + nomos) and Carl Linnaeus (1707 – 1778) was the first to use the idea of taxonomy to classify the natural world [28] At its simplest, taxonomy is a rule-driven hierarchical organization of categories used for classification purposes with the appropriate subject headings and descriptors. [28] points out that the components of developing corporate taxonomies are best understood by reviewing both the research literature as well as industry efforts; namely, key standards, metadata, classifiers, expertise locators and taxonomy tools available for automating what could be a massive undertaking.

Discussion on taxonomies is therefore not complete without an understanding of some of the fundamental vocabularies of knowledge organization and how they are derived.

When dealing with bases of explicit knowledge stored in electronic format, any taxonomy utilized is tightly coupled with the body of metadata utilized to define, identify, point, describe and characterize the contents of the knowledge base [29]. [28] has come out with Functionalities of Taxonomy Builders and Classifiers (Table 7). It projected all the main components related to taxonomy.

Table 7. Functionalities of Taxonomy Builders and Classifiers [28]

No	Item	Method
1	Classification Methods	Rule-based, Training Sets, Statistical Clustering, Manual
2	Classification Technologies	Linguistic Analysis, Neural Network, Bayesian Analysis, Pattern Analysis/ Matching, K-Nearest Neighbours, Support Vector Machine, XML Technology, Others
3	Approaches to Taxonomy Building	Manual, Automatic, Hybrid
4	Visualization Tools Used	Tree/Node, Map, Star, Folder, None
5	Depth of The Taxonomy	> 3 levels
6	Taxonomy Maintenance	Add/Create, Modify/Rename, Delete, Reorganization/Re-categorization, View/Print
7	Import/Export Formats Support	Text file, XML format, RDBS, Excel file, Others
8	Document Formats Support	HTML, MS Office document, ASCII/text file, Adobe PDF, E-mail, Others
9	Personalization	Personalized View, Alerting/Subscribing
10	Product integration	Search Tools, Administration Tools, Portals, Legacy Applications (e.g. CRM)
11	Industry-specific Taxonomy	Access Points to the Information: Browse Categories, Keywords, Concepts & Categories Searching, Topics/Related Topics Navigation, Navigate Alphabetically, Enter Queries, Others
12	Product Platforms	Window NT/2000, Linux/Unix, Sun Solaris system, others

The increasing volume of electronic records coupled with the frequency of records changes require the development and implementation of taxonomies to maximize efficient retrieval of records [30]. Previous study by [31] classify CBIS into three distinct elements: information support; decision support; and communication support. [28] combines numerous approaches from research and practice on taxonomies, classification and ontologies, to develop a knowledge-cycle driven framework for understanding and then developing corporate taxonomies for effective exploitation of an organization's valuable knowledge resources.

As difference scenario projected different taxonomy, most of the time, produced taxonomies only matched the studied environment and requirements. Since there is no knowledge taxonomy for OMS in IHL context produced before, a specific and comprehensive study is necessary. This study aims to understand what are the base knowledge components to produce the intended and specific OMS taxonomy (IHL Malaysia). The focus would be on individual knowledge located in the technologies in the IHL organization. Developing our own taxonomy, in our own environment is an advantage because we will not be influenced on the classification of item that is not necessary or not even existed in our organization.

3 Methodology

The objective of the study is to propose a k-taxonomy for OMS in the context of IHL. Analyses of literature related to the OMS are discussed in the previous section become the basis on the OMS development. In the context of this research, individual knowledge is located as the initial stage of knowledge. Observations into the archives of public IHL reveals that knowledge resources can be categorized into three main sources namely paper documents, computer documents and self memory. This is in line with OMIS proposed in 1997 (Table 3). The three components of OMS are mapped into the six OM or CM types proposed by [14] which are non-computational, documents bases, knowledge based, case based, construction of distributed and combination of several techniques OM or CM. The knowledge types have been aligned to knowledge management technology available in IHL. The findings of the analysis are fitted in the taxonomy developed and discussed in the next section.

4 Result and Discussion

Proposed taxonomy is as follows:

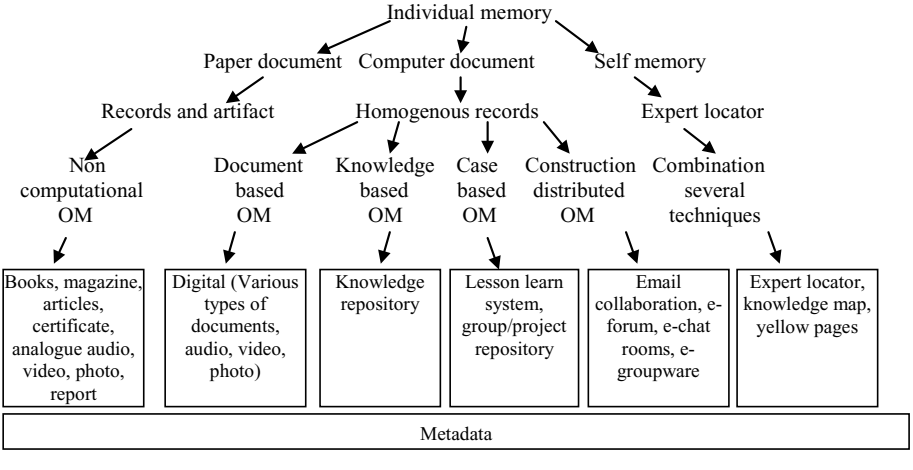

Fig. 1. Proposed OMS taxonomy

Metadata is the bottom layer of the proposed IHL OMS taxonomy. It plays an important role because it is the gist of knowledge and simplifies information about knowledge that leads to better identification of contents. Metadata describe knowledge kept and should be share among chosen components in the OMS taxonomy. It is also could be put as part of search engine components driving specific knowledge categorization. This will form values of knowledge worth transferring in OMS. Use of metadata helps to identify specific knowledge to be posted into repository. It is crucial that expert identify what is the related content to be highlighted before posting their knowledge.

[32] points that we must learn to capture the decision, the rationale behind the decision, the open questions related to the decision, the assumptions behind the decision, and any related supporting information. This would be important to describe the scenario or circumstances at that time supporting the existing of the knowledge. Another aspect that should be included in metadata is a very short conclusion of the story that relates to people's behavior or action that is moral. All good stories should end with a *moral* [33]. Moral reasoning involves how ethical decisions are arrived at, i.e., on what basis these decisions are supported or justified [34].At this level, the attributes describe the knowledge itself as well as its applicability in a context. Moral should cover the preventive action necessary to avoid problematic scenario.

Attributes that describe the knowledge itself include *aboutness, gist, ontological mappings and Web Ontology Language specifications* [35]. [28] notes standardized descriptive metadata with networked objects has the potential for substantially improving resource discovery capabilities by enabling field-based (e.g. *author, title, abstract, keywords*) searches, permitting indexing of non-textual objects, and allowing access to the surrogate content that is distinct from access to the content of the resource itself. Besides using the suggested metadata, this study identified its metadata for OMS through previous OMS studies in table 1. Finally it is concluded that metadata for OMS taxonomy are; *author, title, abstract (aboutness), keywords, subject category (gist ontology mapping), rational of decision/solution, moral/lesson learned, access (knowledge/expert), impact (individual, group, organization), type of story (success/failure)knowledge resources and knowledge physical location.*

The taxonomy and metadata found in this study will be the main element in designing OMS in IHL. Using KM technology as the base of components should interlink the existing tools in organization with organizational memories especially in providing cross functional knowledge sharing to organization. Since unit analysis of this study is individual academicians, individual memory is the uppermost layer in the taxonomy. Knowledge resources as detailed in Figure 1. will function as knowledge feeder to the OMS. In proposed OMS framework, all knowledge resources will go through OMS interface. This is where metadata will be extracted from those knowledge resources. Extracted metadata will be located into OMS central repository. OMS repository will consist all academician related activities and contributions. IHL able to use this repository to locate previous and existing knowledge in the organization. The repository able to produce academician's key performance indicator report extracted from all the knowledge resources in the organization. Figure 2 depicts OMS framework base from individual system perspective.

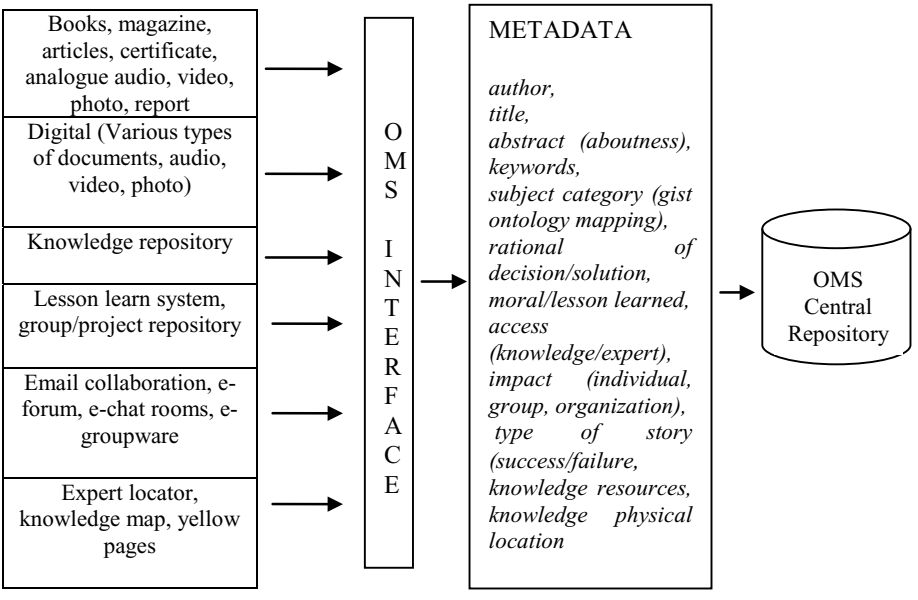

Fig. 2. OMS framework from individual system perspective

5 Conclusions and Future Work

This research reviews pertinent literature on OM computer base in the effort to develop OMS taxonomy for IHL. From the literature review researcher found that there are common understandings about forms and categorization of knowledge in organization. Observations are done in selected IHL and the findings from literature review are mapped into the synthesis of OMS components for a practical result. The OMS taxonomy and metadata produced filled up OMS framework from individual system perspective. Further study can be conducted to validate and verify the developed taxonomy.

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