Consideration of a Collaborative Based Taxonomy for a Reusable Information Management System

재사용가능 정보관리시스템을 위한 협력기반 분류학의 고찰

Mari Torres*
Hyuk-Jin Lee**

ABSTRACT

This exploratory study outlines the rationalization of why Ontology's taxonomy requires a strong hierarchy, accuracy, and interoperability in order to be used as a successfully re-useable information management system. Finding the relevant information in a plethora of possible resources by bridging the gap between the user's needs and the resources of the information technology system is the goal that the information management field should find a way to achieve. This study is based on discussions and interviews with a taxonomist, information architect, and information manager, whose discussions were based on the usability and interoperability of the knowledge based information systems. These professional perspectives are necessary as they are the liaison between users and the information technology group. We found that in order for information managers to ensure successful sharing of knowledge across the end users, a common sense language must be issued in order to achieve reasoning for the artificial intelligence system.

초 록

본 논문은 온톨로지의 텍사노미에게 강력한 계층분류, 정확성, 그리고 상호운용성이 성공적인 재사용가능한 정보관리시스템을 위해서 요구되는 이유에 대한 이론적설명을 서술한다. 수많은 가용정보중 이용자의 요구와 정보관리시스템이 보유한 적절한 정보를 연결하는 것은 정보학이 성취해야하는 목적일 것이다. 컴퓨터기술과 방대한 양의 정보를 처리하는 기술력의 발전으로 이 목적은 가시화되고 있다. 본 연구는 분류학자들과의 심층인터뷰를 통해 최종이용자들을 위한 지식기반정보시스템의 가용성과 상호운용성에 대한 쟁점들에 대해 토론한다. 효과적인 정보관리시스템을 위해 온톨로지는 뛰어난 텍사노미를 요구하며, 텍사노미는 강력한 상호운용성을 필요로 한다. 본 논문은 특히 정보관리의 측면에서 상호운용성의 요소가 효과적인 텍사노미 구성의 주요요소임을 제안한다.

Keywords: ontology, taxonomy, metadata, information management
온톨로지, 텍사노미, 메타데이타, 정보관리

---

* Texas Woman's University, School of Library and Information Studies, Denton, Texas, U.S.A. (mtorres3@mail.twu.edu)
** Texas Woman's University, School of Library and Information Studies, Denton, Texas, U.S.A. (hlee@mail.twu.edu)

▪ Received : 27 May 2010 ▪ Revised : 4 June 2010 ▪ Accepted : 16 June 2010
▪ Journal of the Korean Society for Information Management, 27(2): 157-171, 2010.
〔DOI:10.3743/KOSIM.2010.27.2.157〕

1. Introduction and Previous Studies

Ontology is the basis of Artificial Intelligence (AI). It represents concepts within a domain and their relationships. Gruber (1993) defines ontology as the formal, explicit specification of shared conceptualization. AI may be a task that is seems overwhelming; but it is feasible when the proper taxonomy is applied. Crowston (1994) explains, "For example, before engineers can diagnose problems, they must know the symptoms of the problems; afterwards, they also know the diagnosis." He goes on to explain that sometimes it is difficult to predict if the diagnosis will be correct or not. There may be need for "refinements" so that the issue can be addressed more accurately. There must be a type of structure that will not need to be altered fundamentally, but only enhanced or reduced without damaging or altering the original diagnosis. Essentially, the model will never be complete because it depends on certain elements, situations, changes of events, and courses of action (5). In order to share knowledge across all information users, a common sense language must be issued to produce reasoning in the AI system. Applications in information retrieval and natural language are the true test of an accurate and effective ontology system. This study discusses the reason why ontology requires an excellent taxonomy and also why taxonomy requires a strong interoperability in order to be a successfully re-useable information retrieval system; one of the most important aspects for a metadata creator is economical effectiveness of metadata. Finding the relevant information in a plethora of possible resources and to apply the successful method to other domains and projects is the ultimate goal in the information retrieval field. Ontology and taxonomy are important tools that may facilitate realization of such a goal.

Developing the architecture used to bridge the gap between data and accurate search results involves injecting meaning into the query by classifying the ontology to reflect the users' view of their search topic. This ensures the information retrieved is appropriate to what the user is seeking. Information that is properly classified means time efficiency and ultimately cost savings for the end user because it drives exceptional user satisfaction with the search results and productivity can be maintained or even expedited. Bringing together ontology management and taxonomy successfully may result in access for all the users to information from a single interface to automate routine searches and activities. Beck (2008) explained that once objects are created using authoring tools and expressed internally using the data modeling language, it is possible to apply ontology reasoning techniques to manipulate data objects. She also argued that the main operation of interest is query processing, but there are others because a query is expressed by creating a query class; the query is expressed in the form of a new class. Then classification is used to automatically determine where in the existing object taxonomy the query class belongs.

This study is intended to facilitate the efforts towards building components for taxonomy for end users. Taxonomy is attractive to many end users

because they are able to see how the taxonomy is able to work for many queries; it is often able to suit their needs as well since their inter-alignment is flexible and thus, produced effective results. Ontology requires an excellent taxonomy and taxonomy requires a strong interoperability in order to be a successfully re-usable system in information retrieval services. This study suggests that interoperability is the key component to construct an effective taxonomy. Beck (2008) refers the challenges the information manager faces when it comes to various documents that apply to various data models and are complex in regards to content, viewing privileges and archival procedures. He explains the design of a data model is a daunting but essential task. She stated, "The types of complex content being dealt with appear in many applications. In the earliest applications, the need to manage conventional extension publications required a data model that could effectively handled documents. Documents are complex data objects that are variable in size and detail. Documents contain titles, authors, sections, subsections, paragraphs, text emphasis, figures, and complex tables. Designing a relational model to store such content is not easy or intuitive" (Beck 2008, 27). The information manager interviewed promotes the idea that efforts are made to develop at the very least, titles for documents in code to indicate what is in the document, discipline it pertains to, type of document, intended audience and author. Searching through contents of a document without having keywords in place through metadata because it may not be economically feasible or time may not be available. At the very least the title can be made by the author by a standard of rule codes in order for other end users searching for the information can find the document that contains the topic.

Collaboration is emphasized in business and organizational environments because valuing perspectives and understanding other points of view is important in order to be efficient in implementing a plan without having complaints and revisions. Malhotra (2000) emphasized, Organized learning, defined as and exchange of knowledge and an accumulation or problem solving within a group of people is the best way to expedite the development of new knowledge and perspectives in order to change the way of doing work for the better. Malhotra added, "Thus, individual mental model capability development, access to new knowledge, group-dependent changes in preferences or invoking conditions and the development of new action plans on an individual basis may lead to new individual understandings of the situation, which once put together through the use of aggregation rules, may result in a problem solution" (2000, 77). The collaboration concept is a realized essential element to information management efforts. There is no way that information management can understand the needs of the users and end users who are using the information for their work or recreational purposes without also understanding how to communicate with information technology groups to ensure that the technology developed is relevant and useful. While one end only understands what they want and another end only understands what can be done, information management is responsible for collaboration and us-

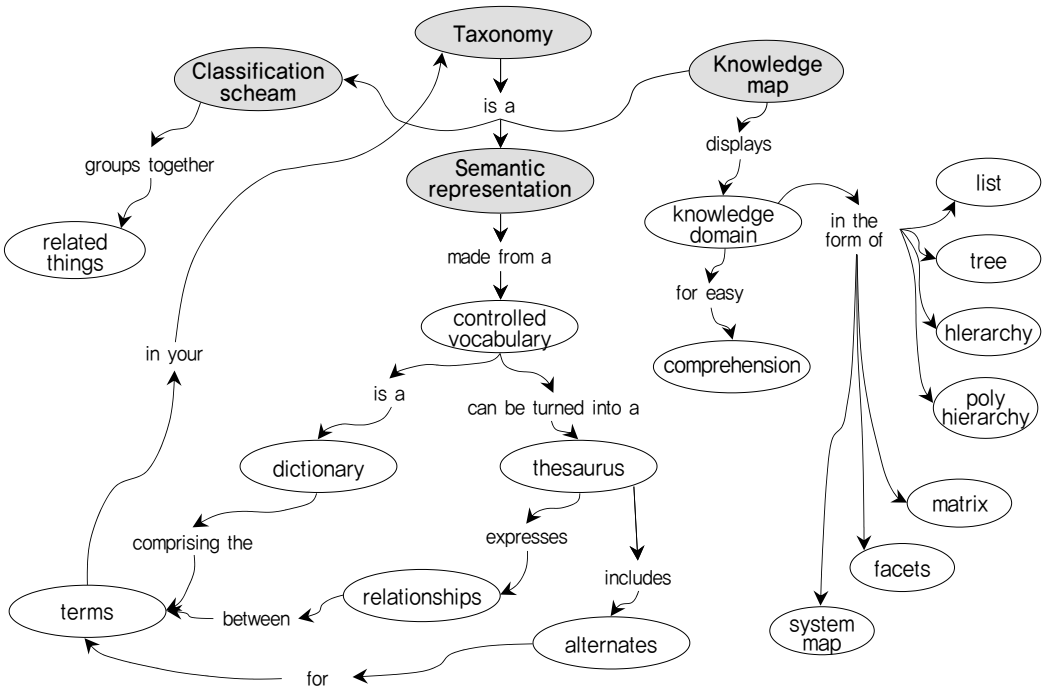
ing professional ideas to bring these groups together and ensure success.

1.1 Taxonomy and Ontology

We will focus primarily on Taxonomy in this study because building a standard taxonomy is essential in cultivating the architecture for ontology, AI, and ultimately interoperability. Our research explores literature that supports the ideas that entail the construction of building a taxonomy and questions/observations from professionals in the information industry that support the goal of interoperability in their information profession. To understand the importance of taxonomy, one must clearly realize the definition or root meaning on its concept. The word taxonomy comes from two Greek foundations, taxis and nomos. Nomos is described as anything assigned, usage or custom, law or ordinance, and taxis describes the arrangements of items, whether it is people, objects or words (Lambe, 2009). The root of taxonomy is based on the idea of arranging items in a certain assigned order. Taxonomy is the art of accurate organizational assignment of items. Taxonomy promotes accuracy by continually breaking down items into their root and organizing the searching in a certain order to achieve the best possible matches. For example, all living organisms are broken into seven basic components: Kingdom, Phylum, Class, Order, Family, Genus and Species. As the organisms are broken down in the components from Kingdom down to Species, each organism is broken down into a better defined organization. This allows every organism to be placed in a group of other organisms that best defines that organism.

Taxonomy researches the item and breaks the wording down into multiple classifications until the items are placed into a well- organized group of items that all meet a certain criteria. Ontology uses taxonomy to achieve accuracy in its understanding of the world and how the artificial intelligence would successfully categorize the items it computes. This allows every organism to be placed in a group of other organism that best defines that organism. Therefore, ontology uses a type of taxonomy to reach its level of accuracy. It continues to break items to their root, as well as shows the relationships between them. Ontology is a more complex, high-level type of taxonomy, but the basic knowledge of taxonomy is needed to achieve a successful ontology development. Figure 1 (Lambe 2007) gives a visualization how taxonomy is broken down.

A hierarchy enables the taxonomy to define its contents, relationship to other terms and creating a hierarchal relationship involves arranging objects, names, values, categories, etc. First, the subject must be defined into a class or nodes. Then, a parent/child relationship is assigned. This involves the decision of whether they relate directly or indirectly. A tree as illustrated above strengthens the vision of where information belongs and what the most productive avenue for the users to access the information according to their topics. While it could be relatively simple to establish the standard framework for taxonomy, the task of establishing a hierarchical relationship could be a tricky, but necessary task.



〈Figure 1〉 Structure of Taxonomy

2. Methodology

We believe that a common sense language should be issued in order to achieve reasoning for the artificial intelligence system hierarchy; by establishing an interoperable system that unique hierarchies can be placed in into, taxonomy may be applicable towards several projects or intentions for several years once an accurate ontology is established by understanding the users and their common language. Thus, interoperability is the key concept to construct an effective taxonomy. To affirm which components of taxonomy is important and necessary for the end users, we conducted in-depth interviews with three taxonomists in 2009, which have enough experiences in taxonomy development for such an interview.

The in-depth interviews were conducted with a taxonomist and an information architect working at NASA Johnson Space Center, and an Oil & Gas Industry information manager in order to find out what components the current taxonomy needs and why they are important for the end users. The taxonomist has a Master of Library Science who has worked in Phuket, Thiland developing and promoting a new library from scratch. She has worked for the NASA Johnson Space Center Scientific Information Center for several years and has worked her way to being a leading librarian and supports the efforts towards developing an internal Google search engine for the space center. The information architect works for

a company that is contracted to help develop an ontology system to organize the information and work with the information technology team to get the system up and running so that the taxonomists can input and develop the system according to the needs of the space center users. He also has a Master of Library Science from Washington, has worked for major companies such as Microsoft and has led other companies into the field of information management in order for them to maintain accountability and organize their information in order to save money and jobs. The information manager interviewed has a Masters of Software Engineering. He worked at his present workplace for 5 years as an information manager and now leads a team of information managers, data managers, document managers, and 3D model managers who support a group who is working to develop a refinery abroad.

The interviews were conducted in their places of work, over the phone, and through email. Observations were made throughout the work day and shadowing meetings with the professionals (see Appendix A). All three of the professionals work daily with their end users and participate in their meetings, work with them on their documentation, support their information storage usage and often technology usage in general. These professionals are seen as part of the IT team while also a part of the end users work towards their purpose on the job. They are able to communicate with the end users using their jargon, understanding what they do in their career, and attend trainings on learning about the different disciplines that they are supporting. Many of the people on their team come from different background ranging from scientific, engineering, education, and technology. These backgrounds and professional knowledge of information management cultivate a creative team in discovering different ideas and finding new experiences in creating new and effective information management services. They are not the conventional librarians who work isolated and must be sought out to obtain specific information. Their goal is to be proactive; anticipate the needs of the users before they even know that they need it. They want to be sure that their productivity escalates quickly and in order to do this, they must become aware of the end user, experts in their own field of work and able to communicate information to the developers of the technology that needs to be made. The questionnaire (see Appendix A) was used and the interview took about one hour for each taxonomist.

The information manager was observed and the collaboration, data, document, and 3D modeling management systems were discussed in order to understand how they are integrated into enforcing project information management. There as more interest expressed by the information manager concerning collaboration management. He explained that it involves trainings, support, and interaction it applies to the information management intentions for the project. By helping the users understand how to use information management applications, standards and tools, there can be a better working relationship between the users, information management, and information technology, as information management must also understand the needs and concerns of both

the users and information technology. The comments and results are embedded in the following sections.

3. Discussions

3.1 Monohierarchy and Polyhierarchy

It is often difficult to clearly associate a single concept to a single type of parent, and a child concept should be allowed to have a single or several parents according to the situation (Schwartz, 2005). Monohierarchy and polyhierarchy can further complicate the organization of information unless there is a structure to which information must be positioned. The intention of the hierarchical relationship is to bring a general concept to specific; this is when schemes must come into play. Classifying synonyms for commonly used words for specific information that is being sought out is a way that a hierarchy is able to make retrieved information more specific. Schemas must be customized to the particular needs of certain types of users and are often outgrown. The metadata creator must update and prioritize information that is most frequently needed so that the institution's users can access the information that is needed the most often. Finding the correct language or ontology involves interviewing and mini focus groups in order to ensure that the taxonomy developed is accurate and thorough. While speaking to the information manager, he insisted the use of "children" terms and sub-terms are essential in order to aim for a more accurate information retrieval. Recognizing that the terms can have relation to one another such as keywords used can also be associated with a subject that could be of interest. This assists in accessing further information that could be practical to the user.

An example given in an interview with a taxonomist was that some users might use the term "moon buggy" while some other users may use the term "moon vehicle apparatus." She agreed that it is not necessarily what the taxonomist is knowledgeable to create terms, but to understand her users and what their language is and how to categorize it into a hierarchy effectively for the users. The information architect working with the taxonomist insisted that during a meeting they, "Simply stated, using relationship mapping rather than hierarchical structures means that a flatter, broader, more flexible way to identify terms and concepts is created and can be used across multiple systems such as content management, taxonomy management, or search management." The information architect went on to illustrate that when looking at a hierarchy structure versus a honeycomb structure, hierarchies force a path; a honeycomb allows multiple entry/exit points. Honeycombs mean that multiple associations can be mapped together with a central "hub" of meaning (e.g. a term has many contact points with other terms, and can allow terms to be related through "mediator" terms) As far as interoperability with multiple systems, as long as the terms can be mapped to a GUID (Global Unique Identifier) and are built with a data structure such as RDF (Resource Description Framework) or OWL (Web Ontology Language). Then, the classification schemas can be used outside of the taxon-

omy/ontology management system and used in other systems, which is really where the value is derived.

3.2 Interoperability

Interoperability is extremely important to establishments who are in need of a taxonomy system where information must be accurate and usable to the departments. Rasmussen, Pejtersen, and Schmidt (1990) proposed, "What we need is a kind of teleological taxonomy (i.e. a pragmatic, goal directed taxonomy useful for the analyst), derived from our need for a framework which can serve prediction of changes in behavior in response to introduction of new information systems" (17). Alternative terms for "controlled words" can be something to aspire to when creating interoperability for the users. The hierarchy helps facilitate the goal that is intended in mapping information. Gruber (1993) argued that several technical problems stand in the way of shared, reusable knowledge-based software. Like conventional applications, knowledge-based systems are based on heterogeneous hardware platforms, programming languages, and network protocols. According to Gruber (1993), however, knowledge-based systems pose special requirements for interoperability and such systems operate on and communicate using statements in a formal knowledge representation; the systems ask queries and give answers, and take background knowledge as an input. And as agents in a distributed AI environment, the systems negotiate and exchange knowledge (Gruber 1993).

The negotiation and exchange of knowledge leads to the thought of potential relationships. A well established system has a flexible structure so that it can be customized to meet different or the same users' unique goals and constraints. Rather than making a new system for each situation, developing a strong and stable taxonomic framework may be the key to the success of an effective taxonomy structure. Of course such a framework should represent the functions and processes that must be accepted as elements of work by people in the system so that the framework can facilitate in various fields.

A practiced method by many corporate information management departments facilitating to a variety of disciplines is the allowing the users to create the appropriate ontology. The information repositories used by the corporation allow the users to apply the appropriate keywords as they release their information to the repository in order to make it available to others. This enhances the effectiveness of the information manager's work in making sure that those who need access to the information gain the access. This of course cannot be the only course of action in ensuring the effectiveness of the ontology for information managers. It is important that the information managers are physically and intellectually active in the meetings users and listening to their needs that they may not directly communicate always. By understanding the front users and end users of the information systems used by the corporation, there can be a better relationship gained when building taxonomy with the ontology used.

Based on the interviews with the taxonomist, information architect, information manager, and many

inspirational ideas by Dave Clarke presented on the podcast (2004), we found that how important integration is to interoperability. Clarke (2004) speaks of the components of taxonomy, talking to each other in taxonomy and how information can be pushed around. The use of schema to push data in and out is effective in enforcing open standards, thus making it easier to implement interchangeably with different data. There is a model of relationships and transferring this into the system; and this is when hierarchy work begins. Transferring such elements through the software through the relationship rules that were already established would be the next step Clarke (2004). During the interview, the information architect explained that a template is then created in order to express the semantic relationships. If the result is agreeable, the taxonomy/ontology is ready to be published. Software would then be able to display the information. Mapping taxonomies is a huge activity in the business world. Businesses often take a taxonomy that has a lineage. They pull from different companies where the taxonomy works. An example would be SuperPages.com- yellow pages for the web. There are products, businesses and services. They are using the taxonomy tool in order to wire all of this content together, wiring the web of relationships.

The framework of any taxonomy system has the ability to be used by any operator or system. The operator has to find the bases for which they plan to develop the hierarchy of the system. For example, taxonomy is used in the hierarchy of living organisms and that same framework or outline can be used in many other systems. Again, the operator must determine the divisions that will be required for their system. As with taxonomy, ontology framework can be used across the board with multiple systems. For example, Jung (2008) said that resources in virtual organizations are classified based on their local taxonomies; however, heterogeneity between these taxonomies is a serious problem for efficient cooperation processes (e.g., knowledge sharing and querying-based interactions). Therefore, he argued that in order to overcome this problem, he proposed a novel framework based on aligning the taxonomies of virtual organizations. Thereby, the best mapping between two organization taxonomies has to be discovered to maximize the summation of a set of partial similarities between concepts in the taxonomies. Jung (2008) considered two levels of alignment processes; (i) intra-alignment in a virtual organization for building an organizational taxonomy and (ii) inter-alignment between organizational taxonomies. He found that the inter-alignment of multiple taxonomy systems led to greater percentage of precision in the results. We agree that taxonomy is more attractive to more establishment users because when they are able to see how the taxonomy was able to work for so many queries, it should be able to suit their needs as well since their inter-alignment is flexible and produced the effective results. Subject matter experts are necessary in order to make the ontology accurate. However, not all subject matter experts agree with the language used or anticipate problems that others feel are not issues.

Artificial intelligence is an idea that has been developed over generations. It has evolved between a flat

ontology to a dimensional, complicated information scientific method that can be an essential cornerstone to a business or other users. The information architect knows first hand how important it was to bring a unanimous agreement on the terms use to build artificial intelligence, but also considers that not all situations are ideal. When the information architect was asked how he handles pushback of terms from users and Subject Matter Experts, he suggested a solution that he used while working with his responsibilities of improving the user experience of fundability, rather than simply building out a taxonomy that is technically correct, but not immediately useful. He gave the example of one healthcare company who was his client, involving iterating on one vocabulary that related to Policy subjects, rather than building out a shallower but more comprehensive taxonomy for their entire intranet. It was decided that working with end users (nurses, policy processors, compliance officers) in a highly-iterative process over a three-week period was preferred, rather than spending the time/money to create a broad taxonomy. The end users started by building a simple, primary level vocabulary that covered most topics for Policies, then added only one relationship to each—Business Unit—so that we had two related "levels" to each topic. For example, they had: administration policies, consent policies, drug policies, employee health policies, finance policies, general operating policies, human resources policies, information management policies, medical staff policies, mission integration policies, patient care policies, smoking policies. The end users then added a single term relationship (human resources policies à HR department) under each node. They had built out a "Business Unit" vocabulary that was only two levels deep (e.g. HR Department à Policies and Procedures Group). We then were able to classify documents immediately as Policy Type and, by extension, Policy Owner. As they went through more than 10,000 documents in a spreadsheet, we were able to quickly add value to each document by mapping Type relationships to the owners.

The alternative would have been to build out an extensive "Policies" taxonomy that would cover Policy subjects in-depth, but they would not have been able o relate the Policies back to the owners. The end result was that when users searched for Policies, they were presented with a Policy Type, and also a Policy Owner. From this relationship, the end user was able to mentally "map" the relationship from Type to Owner, and determine how to narrow (or broaden) their search for the right document. This is opposed to mapping to specific "deep" subjects for Policies, which would have forced the user to click through many sub-topics to find the right document, and would have forced the client team to tag the documents with multiple, specific tags, which may have been questionable, depending on the tagger's expertise.

4. Conclusions and Future Study

When the taxonomy is made in the right way,

interoperability is made possible. This involves a strong ontology, which requires extensive understanding of the subject matter and the language usage of the users. We found that information management perspectives involve an understanding of information technology, an understanding of user experience, and a third understanding of end users. The ability to translate the needs to all three aspects while also keeping in mind the necessities needed in providing a successful information management system is becoming a strong realization for the companies who have suffered from loss of information, lack of information, or need or recorded information and had to pay substantially from the errors that could have been avoided with the aid of information managers.

A responsibility at our current position involves working to overlap two phases of a project into an interoperable hierarchy without causing and effect to the information retrieval precision. For example, looking for documents related to one project but still maintaining the document listing within the two hierarchies is the goal. Taxonomy rules are being applied that can merge the two phases of the project while also making distinguishing properties to avoid retrieving the wrong information. Conflicting terms are added as Entry Terms after determining the Preferred Term. The Information Management team works with the Information Technology team to implement the software to manage the terms to reference back to the authoritative source, the industry specific taxonomies. The bottom line is that simple feedback is mitigated through the information manager's knowledge of best practices in taxonomy construction.

Artificial intelligence is an idea that has been developed over generations. It has evolved between a flat ontology to a dimensional, complicated information scientific method that can be an essential cornerstone to a business or other users. In these modern days it is lucrative to have a re-usable source and this research finds that interoperability is the key component to construct an effective taxonomy. By using knowledge based language on related researches and the findings from the interviews and observations in this study in this study, taxonomy system's usability is evaluated by finding how the common-language could be established. Success in meeting the needs of the dual phases of the project is our goal.

Beck (2008) insists, "Whatever technique is used, authors are able to create objects on-line, and exchange objects over long distances automatically without the need to transfer files. This leads to on-line collaboration as multiple authors can cooperate on the same project from remote distances. This is in the current fashion of "wiki" development, but the objects created are much more complex than is offered through typical wiki authoring environments" (30). The heart of the document management for the information manager's project is the software that is web based. Beck's theory of enforces the necessity of having this web based tool. Document owners issue their own documents into the software, inputting property values that they feel pertain to the document that is written and is of great importance to their phase of the project. The information manager explained that the Information Management group's responsibility is to supervise

the correct standards are being met when properties are entered, evaluating the efficiency of the processing of the documents so that it can be available globally via the web, and to train those who are struggling to find the appropriate property terms that pertain to their document. Realizing the on-line collaboration is essential to the execution and accountability for a project as Beck (2008) explains as the direction Information Management is moving towards puts companies above the rest.

Project management meetings organized by project directors, managers, and Information Management is done weekly to evaluate and measure the success of the taxonomy developed. By having the metadata and ontology development as user-based, the metadata creators provide multiple perspectives which may give more strength to the accurate Artificial Intelligence. We hope to contribute to evolving the knowledge- based research methods to gain more accuracy and interoperability for the taxonomy system for the dual projects.

Further studies will be made as the project progresses and the overlapping phases come to a close. Interviews and observations will be made while working with Data Managers, Document Managers, Collaboration Managers, Information Managers, 3D Modeling Information Managers and Engineering Managers. These managers utilize their skills to contribute and work together in order to achieve an interface that successfully achieves usability for their end users and accuracy in results by consulting with the Information Technology teams in the programming of software. An analysis of the result of the project once in concludes all phases are going to be made as well.

References

Beck, H. 2008. “Evolution of database designs for knowledge management in agriculture and natural resources.” [online]. [cited 2009.4.1] <http://www.jitag.org/ojs/index.php/jitag/article/view/53/24>.

Clarke, D. 2004. *Integrating Taxonomies into Your Infrastructure.* PodCast. City: iKMS.

Crowston, K. 1994. “A Taxonomy of organizational dependencies and coordination mechanisms.” [online]. [cited 2010.5.27]. <http://ccs.mit.edu/papers/CCSWP174.html#fn0>

Gruber, T. R. 1993. “A translation approach to portable ontology specifications.” *Knowledge Acquisition,* 5(2): 199-220.

Jung, J. J. 2008. “Taxonomy alignment for interoperability between heterogeneous virtual organizations.” *Expert Systems with Applications: An International Journal,* 34(4): 2721-2731.

Lambe, P. 2007. *Organising Knowledge: Taxonomies, Knowledge and Organisational Effectiveness*. Oxford: Chandos Publishing.

Lambe, P. 2009. "Defining taxonomy." [online]. [cited 2009.4.10]. <http://www.greenchameleon.com/gc/blog_detail/defining_taxonomy>.

Malhotra, Y. 2000. "Knowledge management for e-business performance: advancing information strategy to 'internet time.'" *Information Strategy, The Executive's Journal,* 16(4): 5-16.

Pejtersen, A. M., J. Rasmussen. and K. Schmidt. 1990. *Taxonomy for Cognitive Work Analysis*. Riso National Laboratory. Roskilde: Cognitive Systems Group.

Schwartz, K. 2005. *Domain Model Enhanced Search-A Comparison of Taxonomy, Thesaurus, and Ontology*. Timo Kouwenhoven, CIBIT Consultants Educators.

Appendix A

■ Interview questions for the information architect:

1. Please tell me about your experiences in which building relationships between terms rather than broadening a hierarchy has helped you in developing taxonomy.
2. How do you resolve pushback with terms from SME's?
3. How does relationship building contribute to greater interoperability in the classification of content?

■ Interview questions for the taxonomist:

1. Please tell me about situations where it is important to build relationships between terms in the taxonomy rather than a hierarchy.
2. What problems have you encountered where relationship building was difficult and how did you overcome these problems?
3. When building the first taxonomy for an agency, what are some problems that you have encountered and how did you overcome them?
4. Is building taxonomy for an agency's intranet easier when creating repositories of information and the taxonomy guides the user to the correct repository?
5. Why is it important to have sub-committee members and how does it cause problems if any?

■ Discussion with the taxonomist (sample data):

An example given in an interview with a taxonomist was that some users might use the term “moon buggy” while some other users may use the term “moon vehicle apparatus.” She agreed that it is not necessarily what the taxonomist is knowledgeable to create, but to understand her users and what their language is and how to categorize it into a hierarchy effectively so that the “usability” is the best for her users.

■ Observations and discussions with the information manager (sample data):

While working with him, he explained his logic in creating terms and children terms in order to increase productability. Recognizing that terms can have relation to one another such as keywords used can also

be associated with a subject that could be of interest and assist in accessing further information that could be useful to the user.

A practiced method by many corporate information management departments facilitating to a variety of disciplines is the allowing the users to create the appropriate ontology. The information repositories used by the corporation allow the users to apply the appropriate keywords as the release their information to the repository in order to make it available to others. This enhances the effectiveness of the information manager's work in making sure that those who need access to the information gain the access. This of course cannot be the only course of action in ensuring the effectiveness of the ontology for information managers. It is important that the information managers are physically and intellectually active in the meetings users and listening to their needs that they may not directly communicate always. By understanding the front users and end users of the information systems used by the corporation, there can be a better relationship gained when building taxonomy with the ontology used.