

RECENT TRENDS IN KNOWLEDGE ORGANIZATION

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Abstract—

A preliminary investigation of the prevalent knowledge organization (KO) tendencies in recent days was launched using qualitative analysis. The information for this study was gathered by searching the Library, Information Science, and Technology Abstracts database for articles with the terms ‘knowledge organization’ in the title, abstract, or descriptors. These first findings imply that the substance of the KO literature has evolved since the internet’s inception. Although traditional KO concepts are prevalent in both eras, the addition of new content categories, such as metadata, indicates a shift in KO tendencies. The literature in the previous era was heavily reliant on indexing and abstracting. The post-web era, on the other hand, is dominated by cataloguing and classification concerns. Those interested in understanding about the upcoming trends in the KO literature will find the data in this research very useful.

IndexTerms— Knowledge organization, Information organization, Classification, Digital library.

I. INTRODUCTION

Knowledge Organization (KO) has long been an essential component of library and information science education. As a result, early courses in the subject field focused on cataloguing, subject analysis, classification, and resource description in-depth, whereas rising trends in Knowledge Organization now include courses in metadata development and electronic resource organization. Through the unseen colleges of scholarly communication networks, newer courses in Knowledge Organization intersect with growing research topics in natural language processing, the semantic web, and social networking. To better educate tomorrow's library and information professionals, several of these courses go beyond resource descriptions while preserving links to resource descriptions through subject analysis and metadata generation.

II. LITERATURE REVIEW

The current trends in knowledge organization research are examined in this paper. Topics include universal systems, mapping vocabularies and interoperability concerns, bias issues, the Internet and search engines, and visual presentation. A bibliography of recent research on the topic is also included. (Mcilwaine, 2003). Panelists will discuss the importance of knowledge organization in library and information science curricula, as well as emerging trends that will have an impact on the field in the coming years. (Aytac et al., 2011). The author uses an automatic topic mapping method to analyze records of knowledge organization papers published between 1988 and 2008. The findings revealed that the second decade (1998-2008) was characterized by the emergence of more specialized issues, owing to the pervasiveness of the Web environment. (Sanjuan, 2010). An analysis of the scientific production was reviewed in the supplement 'Knowledge Literature', published in the journal Knowledge Organization. Results show the increasing importance of knowledge organization automation research. The cry for a universal thesaurus, and concern for the quality of indexing and cataloguing procedures. (Dahlberg, 2008). Knowledge organization (KO) is about the activities such as document description, indexing, and classification performed in libraries, databases, archives, etc. These activities are done by librarians, archivists, and subject specialists as well by computer algorithms. Public library suffers more due to a lack of standard tools. (Harh, 2019).

III. DEFINITION OF KNOWLEDGE

There have been numerous attempts in recent years to clarify what is meant by the term “knowledge.” None of the definitions have satisfied the researchers, with the exception of the one below, for which no longer have the source: “Knowledge is the subjectively and objectively decisive certainty of the existence of a factor of a state of a situation. It is impossible to convey knowledge. It is only possible to obtain it by one's own rethinking.” We may not be able to grasp this “certainty” of anything, but we can build and have done so throughout history so called “knowledge units” of something and these units can be managed extremely well.

IV. HOW WILL THE KNOWLEDGE UNIT COME INTO BELONGING?

Let's explain what has been referred to as "Referent-oriented, Analytical Concept Theory" (Dahlberg, 1978) in several publications. When we talk about knowledge units, we're dealing with concepts, as you can see from the title. Indeed, by mentally referring to any object of reality or unreality and making assertions and predictions about that item of reference, we are demonstrating what we know about it and generating pieces of the concept we are forming through such claims. The number of knowledge elements, also known as features of our knowledge unit, the concept, is the number of necessary and true statements about one item of reference. Thus, "referent oriented" suggests that something must constantly exist in the real world or in our minds to be predicated, and "analytical" implies that we may already determine the specific features that our idea in question possesses by making various claims on the item of reference. The only thing left to do is identify the fundamental qualities and summarize them into a definite identifier.

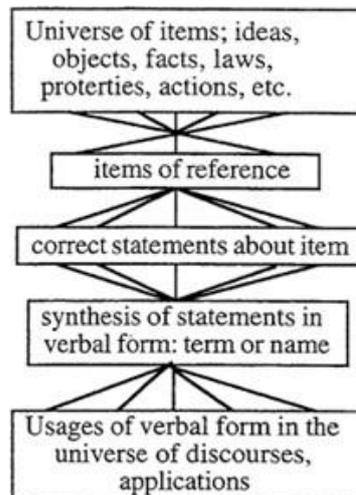


Figure 1: Model for concept construction

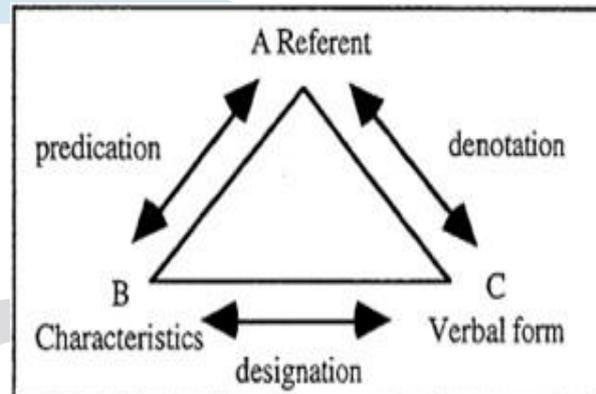


Figure 2: Concept triangle, the formal representation of a knowledge unit

Figures 1 and 2 serve as a model for this generation or development of a new notion. The reconstruction of an existing "in use" notion might follow the same lines; however, it requires an extension by employing a matrix for the statements and their recurrence in various sources (Sartori, 1984).

V. THE ORIGIN AND USE OF KNOWLEDGE ORGANIZATION SYSTEMS

In a physical library, categorization schemes such as the Library of Congress Classification (LC), Dewey Decimal Classification (DDC), and Universal Decimal Classification (UDC) reflect functions such as the necessity to store a single item on a shelf. Subject headers are used to give various access points beyond the confines of a particular physical place. Subject heading systems are designed for specific content or collections, such as LCSH, Sears, or other schemes. Libraries have employed authority files to manage different forms of personal, organizational, and geographic names at this level; an understanding of KOSs available from alternative sources is useful when developing a Digital Library for a specific audience.

VI. PURPOSES OF KNOWLEDGE ORGANIZATION SYSTEMS

Information retrieval and collection management are the primary goals of knowledge Organization systems. Users should be able to identify an object of interest, whether by browsing, direct searching, or themes on a Web page or site, using a knowledge organization system as a bridge between their needs and collection contents. The Search Engine also leads the user(s) through a discovery process in order to answer the query about the collection's scope.

VII. THE USEFULNESS OF KOS IN DIGITAL LIBRARY

Like physical libraries, all the digital libraries use one or more Knowledge Organization Systems (K.O.Ss) to offer collection material and facilitate retrieval. The schemes could be a traditional Knowledge Organization System (KOS) that is relevant to the scope of the material and the intended audience for the Digital Library (as DDC or the INSPEC thesaurus), commercially developed schemes (as Yahoo or Excite categories), or locally developed schemes for a corporate Intranet. It must also be applied in the digital library, either automatically or by human cataloguers, and it must be meaningful to users while the material is included in the collection, as it is important to the Digital Libraries.

VIII. CHARACTERISTICS OF KNOWLEDGE ORGANIZATION SYSTEM

Humans are typically referred to as the "inherent" or "true" knowledge organizers, however, there are various variations. Despite these differences, the Knowledge Organization system for Digital Libraries has the following common feature.

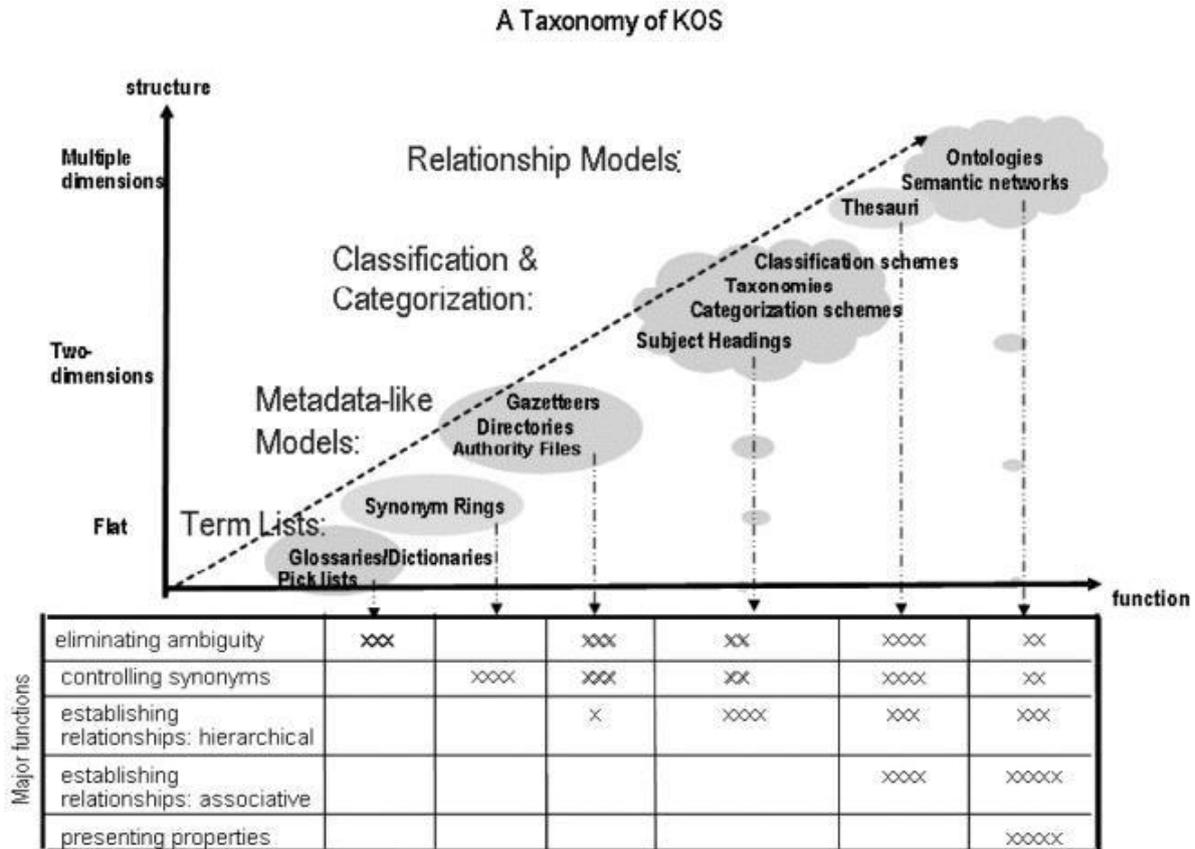
- The K.O.S. imposes a particular view or a collection and items in it.

- Some entities can be characterized in different ways, depending on K.O.S that is used.
- There must be sufficient commonality between the concept expressed in K.O.Ss and the real- world object to which that concept refers that a knowledgeable person could apply the system with reasonable reliability. Thus one user seeking relevant material by using KOSs must be able to connect his concept with its representation.

IX. OVERVIEW OF TYPES OF KNOWLEDGE ORGANIZATION SYSTEM

The class of KOS can be explained according to four major groups, from simpler to more complicated structures: term lists, metadata-like models, classification and categorization, and relationship models (Hodge 2000, NISO 2005, Hill et al. 2002). Figure 3 shows the types of KOS, arranged according to the complexity of their structures and major functions.

Figure 3: An overview of the structures and functions of KOS



Term Lists

- Lists (pick lists): limited sets of terms in some sequential order.
- Dictionaries: alphabetical lists of terms and their definitions that provide variant senses for each term, where applicable.
- Glossaries: alphabetical lists of terms, usually with definitions.

Metadata-like models

- Authority Files: lists of terms that are used to control the variant names for an entity or the domain value for a particular field.
- Directories: lists of names and their associated contact information.
- Gazetteers: geospatial dictionaries of named and typed places.

Classification and Categorization

- Subject Headings: schemes that provide a set of controlled terms to represent the subjects of items in a collection and sets of rules for combining terms into compound headings.
- Categorization Schemes: loosely formed grouping schemes.
- Taxonomies: divisions of items into ordered groups or categories based on particular characteristics.
- Classification Schemes: hierarchical and faceted arrangements of numerical or alphabetical notations to represent broad topics.

Relationship Model

- Thesauri: sets of terms representing concepts and the hierarchical, equivalence, and associative relationships among them. Thesaurus structures of this type are based on NISO Z39.19-2005 and ISO 2788 -1986 standards. Another type of thesaurus (e.g., Roget’s Thesaurus) represents only the equivalence (synonymy) of terms, with

the addition of classification categories.

- Semantic Networks: sets of terms representing concepts, modeled as the nodes in a network of variable relationship types.
- Ontologies: specific concept models representing complex relationships between objects, including the rules and axioms that are missing in semantic networks.
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X. ANALYSIS OF RECENT TRENDS IN KNOWLEDGE ORGANIZATION

The qualitative study of the targeted KO literature revealed the following broad-level trends:

Organizing Corporate and Business Information

The pre-web KO literature did not include many discussions of how to arrange information for corporate or business goals, but this has altered in the post-web period. According to a recent study, some firms have begun to construct taxonomies in order to provide more efficient access to web-based business knowledge, while others have turned to ontologies to assist them to manage corporate events — bringing together and organizing events from many sources. The avalanche of emails that employees get is increasingly being regarded as a problem that businesses must handle. There is an understanding that this information must be classified to ensure effective retrieval – but one study found that people prefer to categorize their own emails to ensure that they can retrieve relevant information. Another study looked at the vast majority of emails in terms of archiving - businesses are increasingly wasting virtual space with unnecessary emails (i.e. not related to corporate interests). Computer programs, it has been pointed out, have the ability to filter relevant from irrelevant information, allowing a company to select whether or not to preserve emails that are not of immediate significance to the business or corporate body. Finally, the necessity to assess the organization of company data is becoming increasingly widespread. More precisely, some studies have found that organizing records in a decentralized system is wasteful (due to a lack of consistent standards across departments) and can make records more difficult to locate.

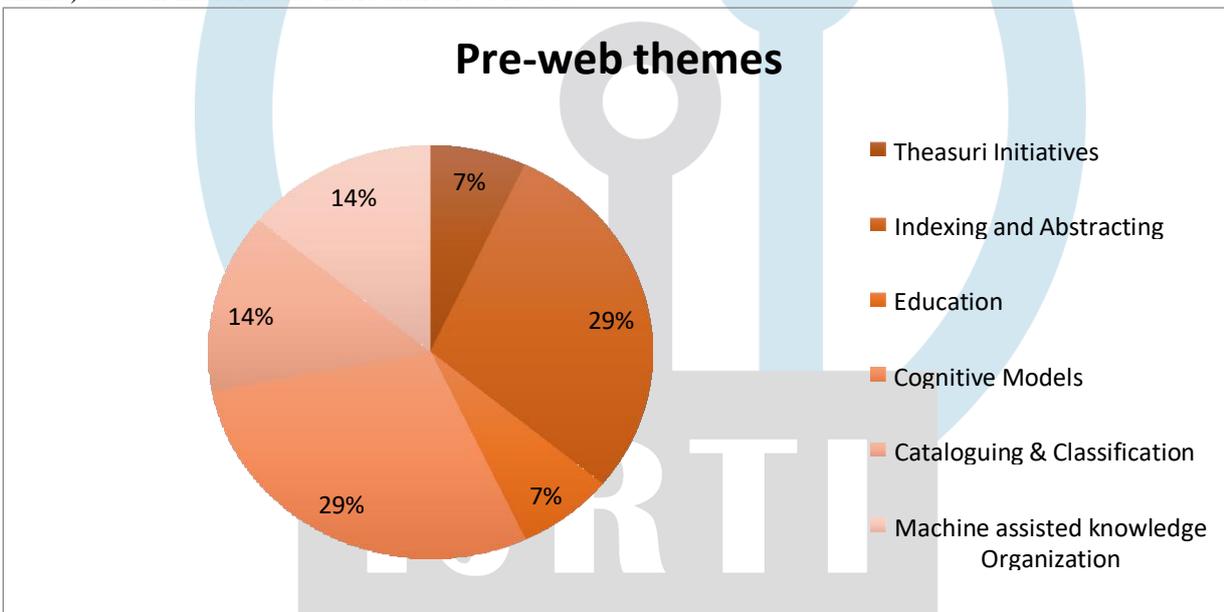
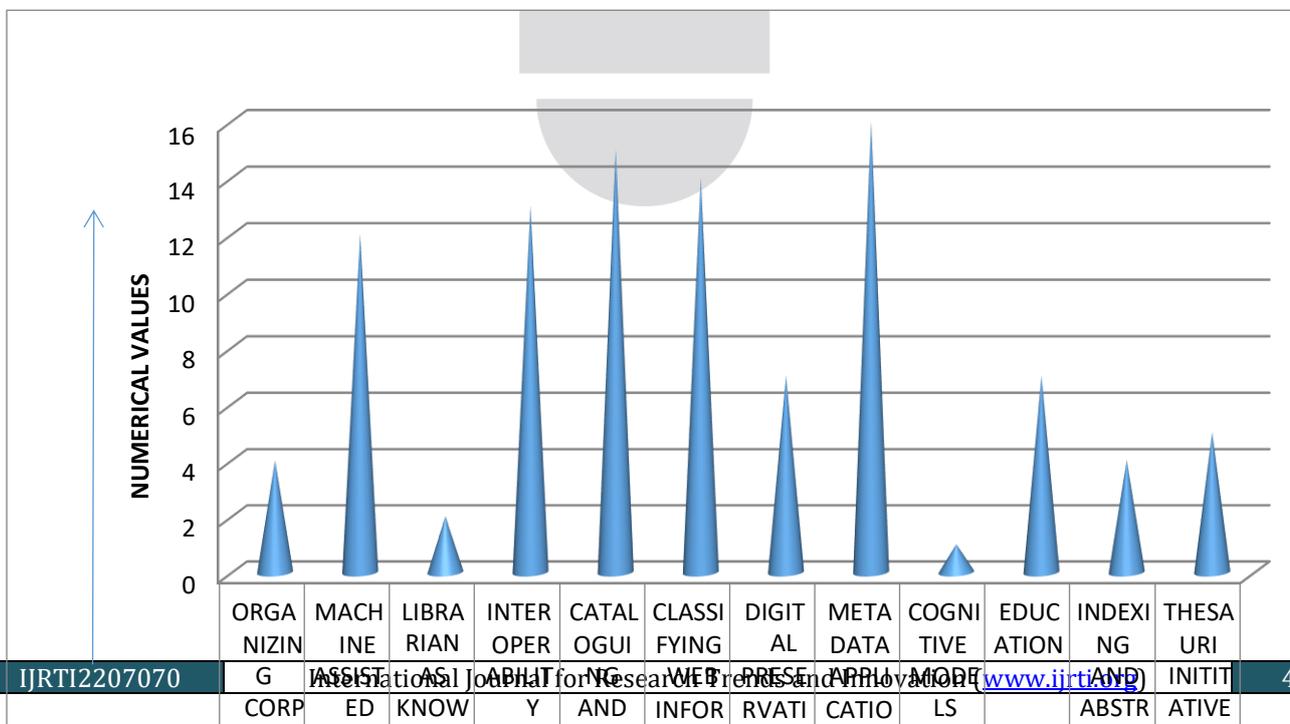


Figure.4: Numerical Representation of pre web themes



Machine Assisted Knowledge Organization

Steps were being done in the pre-web period toward the employment of technology to organize knowledge. Perhaps nowhere was this more apparent than in the realm of indexing and abstracting. The development of systems like FASIT (Fully Automatic Syntactically Based Indexing of Text) demonstrated that computers were being used to index content. The ability of computers to construct abstractions from the complete text of a resource was being pursued in various areas of the indexing and abstracting industry. In the knowledge organization literature, evaluating the computer's ability to efficiently arrange information was also a common theme, with some claiming that computers were just as good at indexing as people. The amount of information to which individuals were exposed skyrocketed with the introduction of the internet, and finding necessary information became increasingly difficult. As a result, it became increasingly vital to investigate the computer's ability to classify materials based on meaning and context. TDT (Topic Detection and Tracking) was one of the projects that demonstrated the ability of computers to filter news stories so that they could be categorized into the right topic. Other experiments investigated the ability of computers to index by genre, offering further context for the resource. Computers' capacity to map keywords identified in a document's text to the correct term in a thesaurus was also examined. For example, The Meta Map System at the National Library of Medicine was able to map terms from a document's free text to their Unified Medical Language System (UMLS) meta thesaurus. Additionally, as metadata became more widely used, methods for automatically attaching and harvesting metadata were investigated. Computers were also used to cluster semantically comparable concepts for reasons such as building thesauri and classifying materials in a digital library. Some critics claimed that computers did not always index items in ways that were semantically meaningful to searchers in an evaluative capacity.

Librarians as the Knowledge Organizers of the Web

Despite some initial reservations, librarians are today seen as a crucial service in the post-web era, owing to their knowledge organizing abilities. Indeed, others argue that as digital libraries and the digital world as a whole get more complicated, human classification will become more necessary. This may be due to the fact that computers will never be able to fully grasp the subtle semantic nuances found in language.

Interoperability

The phrase interoperability does not appear in any of the sources examined prior to the internet. However, as the internet grew in popularity, the term "interoperability" became more often used in the literature. Organizations are increasingly wishing to share their digital resources with other organizations; however, this necessitates the creation of metadata standards, schemas, and crosswalks. METS (Metadata Encoding and Transmission Standard), Dublin Core, and XML protocols were all deemed necessary for data sharing between repositories. METS is a digital archiving solution that allows digital objects to be moved between digital repositories as well as over the internet. Because it essentially produced a single metadata framework for defining a document, Dublin Core was considered vital to the interoperability movement because it enabled this common metadata structure to be shared among repositories or digital libraries. Finally, XML protocols are seen as critical for supporting cross-repository meta searches. The advent of 'interoperable' metadata allowed robots to harvest metadata from a variety of repositories, in addition to allowing users to search across many repositories; interest in this feature sparked after the creation of the Open Archives Initiative Protocol for Metadata Harvesting. The fact that all of these studies are so recent shows that this topic is only now gaining traction in the field of knowledge organization.

Classification and Cataloguing

Cataloguing and classification were common topics of discussion in the KO literature, which is unsurprising. Surprisingly, themes relating to classification seemed to be more prevalent in the pre-web age. There were arguments on mutual exclusivity when categorizing material, for example, and others looked into the usage of cosine and single matching functions for classifying data. Articles about cataloguing and/or classification were extremely prevalent in the post-web period. One-piece, for example, looked into what cataloguers should know in terms of their abilities to classify electronic items. Other articles discussed the usage of the internet to give cataloguing tools. The University of Colorado-Boulder conducted an evaluation to see if cataloguers were using the Library of Congress' online resource 'Classification Web' to help them with their cataloguing operations. The impact of Electronic Resource Management Systems (ERMs) on serials cataloguing in the future was also discussed. Not every discussion of cataloguing in the post-web age was focused on the internet. Some looked at copy cataloguing processes, others at the use of international MARC records, yet others at the necessity to comprehend manuscript cataloguing, and still others at how to categorize the increasingly popular graphic book. In the post-web knowledge organization literature, there were also specific discussions of new difficulties linked to AACR2. The authors indicated that decentralization in the development and maintenance of the UN Classification Scheme was related to weaknesses in its simplicity, use of mnemonics, brevity, and collocation. Many authors came out with suggestions for future directions. There were discussions about using vertical integration to classify scientific knowledge, using classic classification principles (e.g. relevance, precision) to classify research information, using patent co-citations to classify patents, using seminal mnemonics to create taxonomies, looking beyond DDC and Library of Congress Classification to create new classification structures, and classifying undergraduate information by course and year. A discussion of genre classification emphasizes the necessity of context when classifying material. In particular, proposals were given for using approaches to classify digital resources for the classification of artifacts in the digital or post-web era. Users of Walden's Path point to the value of combining different links into a single path in relation to this categorization of digital resources. The use of topic

maps is becoming more prevalent in the field of categorization. A subject map is used to provide literary linkages with the great literary personality Thomas Mann in one particularly fascinating example.

Classifying Web Information

Because of its pervasiveness in the literature, the classification of web material requires a separate study from that of more general cataloguing and classification challenges in this post-web era. Metadata is increasingly being used to organize and provide access to web-based knowledge. The topic of metadata is discussed in a variety of ways. One topic of interest is the translation of print-based bibliographic records into a format that is more appropriate for the classification of content on the internet, such as Dublin Core. Importantly, metadata schemas can also be used to get web-based information; however, there is some evidence that metadata schema and meta tags are underutilized, resulting in limited access to information.

Aside from metadata, faceted classification appears to be gaining traction as a technique of organizing content on the web. When it comes to organizing product information on commercial websites, faceted categorization has taken on a particularly prominent role. In addition, faceted categorization can be considered a useful method for organizing data obtained throughout the data mining process (e.g. linking terms found in data mining to terms found in a thesaurus). Along with faceted classification, there has been a push to embrace library-specific organizational approaches — maybe with the assistance of a librarian. Dewey Decimal Classification, for example, is seen as advantageous when browsing large collections. Ontologies are important for classifying web data because they increase interoperability by bringing materials from different sources together.

Taxonomies are another technique that may be used to organize web-based information. Taxonomies, for example, are a great way to organize subject-specific information into an easily navigable style. When looking at Yahoo's site, which uses a taxonomy/subject hierarchy to organize its indexed information, you can see how useful taxonomies are for displaying web information. Furthermore, the Integrated Museum and Archives System Taxonomy is seen to be quite useful when looking for cultural treasures in museums and archives. Finally, utilizing Dewey Decimal Classification and the IEEE Web Thesaurus, efforts to construct a taxonomy of computer science terminology have been effective.

Digital Preservations and Digital Library

In the pre-web period, issues linked to the digital preservation of materials were not visible, but in the post-web era, they became a focal point of knowledge organization talks. In particular, it became clear that the web was an ideal tool for virtually distributing tangible resources across geographically or topically diverse places. As the value of these digital resources became clear, it was likely unavoidable those recommendations for improving access to them surfaced. Clustering approaches, for example, have been proposed as a means of improving the navigational structure of a digital library. Others emphasized the need of using standards when creating and structuring metadata. Another option for how to organize content in a digital library proposes that a task-based strategy may be more efficient than either a subject-based or alphabetical method. As the use of digital collections grew in popularity, so did evaluations of their utility and content. A user-centered analysis was employed in one study to assess how well a digital library was organized, while another study looked at the key trends in digital libraries (one of which was knowledge organization systems).

Metadata is perhaps the most prevalent topic of conversation when it comes to knowledge organizing and digital collections. Metadata is thought to be a necessary component for retrieving information in digital collections. Thesauri, lists of subject headings, and classification schemes are among the most commonly utilized knowledge organization methods to assist in the generation of metadata, according to a Canadian study. Metadata is a critical tool for guaranteeing that metadata from one digital collection can be used across numerous instances, which is related to the earlier discussed concept of interoperability. METS has been shown to be one method of ensuring interoperability.

Cognition

Knowledge is organized in such a way that human beings can find it more quickly. With this in mind, it's maybe not unexpected that human cognition models have been influential in the development of knowledge organizing systems. In both the pre-web and post-web eras, the use of cognitive models has remained critical in the design of knowledge organization systems. For example, a study of how individuals group information (on a cognitive level) becomes a technique for analyzing how effectively a batch retrieval system performs in the pre-web period. Other research from this time period looked at how cognitive differences affect how people judge the importance of a document and whether you prefer access points other than the title, author, and subject. The use of cognitive models after the internet appeared to be pretty similar in nature. One study looked at how children categorize knowledge in order to establish how information should be ordered in a children's library, while another looked at how people's cognitive organization is influenced by their beliefs. Despite the fact that cognitive models are still widely used, some critics argue that they fail to account for socio-cultural variables that may alter the language people use to retrieve information.

Education

Another popular topic in the knowledge organization literature is evaluating the education that knowledge organization professionals receive. Surprisingly, this pattern appears to have started during the post-web period. This could be due to a growing understanding among knowledge management professionals that the web has altered the way information is organized in numerous ways. For example, there is now a requirement to teach students how to secure digital library interoperability. Knowledge organization specialists are also considering a larger focus on how to utilize metadata as a new capability. Descriptions of knowledge organization courses in various geographical regions, as well as an understanding of what core competencies knowledge organization professionals require when joining the workforce, are other topics of attention when discussing knowledge

organization. There is also a feeling that knowledge organization instruction should be moved out of the hands of librarians and into fields like computer science.

Indexing and Abstracting Applications and Procedures

In the pre-web age, indexing and abstracting were frequently discussed. The quality of the indexing was given a considerable lot of consideration. To assure the quality of retrieval, a study was done to validate which of the two indexing strategies worked better. Another study looked into the necessity for more terms to be included when indexing an object in order to improve the user's chances of retrieval. PRECIS (PREserved Context Index System) was created to aid in the improvement of the British National Bibliography's subject indexing procedure.

Indexing and abstracting studies after the web are frequently linked to the indexing of digital material. One study, for example, looked at how Novel Space Partitioning (NSP) could be used to index multidimensional non-ordered discrete data spaces like a genomic database. Another study looked at how the Laurin Thesaurus was used to index keywords and proper names in digital newspaper clippings, which helped with indexing.

Thesauri Initiatives

This theme refers to the widespread use of thesauri that occurred after the web's introduction, as well as the fact that thesauri were invented and utilized long before the web, but only by specific and individual information retrieval systems, rather not on a huge scale as is the case today. The construction of the Universal Source Thesaurus and how it could be utilized to generate concordance amongst classification schemes is one example of this focus. With the rise of the internet, thesaurus use is becoming more prominent in knowledge organization research. In this age, there are various examples of thesauri development. The Chinese Thesaurus was created to standardize the retrieval language in China. The Meta Map was produced by the National Library of Medicine to allow free web-based literature to be mapped to terms in the Unified Medical Language System Meta thesaurus. The Laurin Thesaurus was created to help with digital clipping indexing. In the post-web era, new patterns in developing thesauri have emerged. The construction of thesauri utilizing conceptual clustering approaches, for example, has received some interest. Others have suggested that bibliometrics could help with the design and maintenance of thesauri if used in a semi-automated manner. Others have suggested that terms contained in document titles can be used to identify terms that should be included in the thesaurus. Thesauri have regained popularity to the point where review articles analyzing the patterns in web-based thesauri have been written.

XI. PROBLEMS IN CURRENT TRENDS

An analysis of the literature and contributions to conferences, even those aimed at a wider audience, such as the IFLA general conference, rapidly indicates that the academic setting generates the vast majority of activity in the subject. The majority of the literature is created by university professors and their research assistants. The other significant competitor in the sector is a huge organization with the financial resources to run a robust research and development program, of which OCLC is perhaps the most well-known, but far from the only example. Large organizations such as OCLC, Elsevier, and Wilson Company have the manpower and financial means to maintain a well-planned and ongoing research program (Vizine-Goetz, 2001). This isn't always the case with universities. In today's academic world, research is usually funded by the government or is reliant on a usually short-term grant from a company that is looking to complete a certain task. The two DESIRE projects, as well as RENARDUS, were all supported by the European Union (EU), which is commendable given the EU's willingness to fund such endeavors and recognition of their relevance. The British government financed HILT as part of a series of awards for short-term projects (RSLP). Applying for research grants takes a long time and can be depressing because there are always more applications than the resources available can fund, and no matter how important retrieval techniques and their development are in the age of the Internet, they don't always win out over other computer or management projects. The word "project" poses a bigger challenge. Given that the maximum length for which financing is likely to be granted is usually in the order of two years, much of the research is short-term, and often a six-month pilot study is an initial step, which may or may not be followed up with further support. As a result, a lot of little projects emerge, many of which are designed to tackle a single, typically domestic problem, even if they are dressed up to appear to have broader significance in order to gain support. The findings must be published and, ideally, presented at conferences as part of this process. In the 18th century, Denis Diderot and Jean le Rond d'Alembert, as well as the Encyclopaedists, felt the same way, and they weren't alone. That generation's natural historians were particularly preoccupied with organizing knowledge: However, gathering the material was easy compared to the challenges of processing it for scientific purposes. Because it was still difficult for naturalists to communicate with one another and exchange specimens and books, names were cumbersome for the most part, usually consisting of a long string of Latin words that attempted to epitomize the features of the species, and thus difficult to memorize; and because it was still difficult for naturalists to keep in touch with one another and exchange specimens and books, the same species was repeatedly given different names by different authorities. To add to the confusion, almost no two people used the same classification scheme. This has a familiar ring to it. For generations, people have been looking for a universal solution. Between 1880 and 1914, 116 artificial languages were created, none of which were considered successful (Waquet, 2001). Indeed, the long-tested Latin language was kept as the language of study and the church for another fifty years, at least as a method of communication during scholarly conferences between speakers of minority languages. The use of Latin in the Roman Catholic Church came to an end with Vatican II, while it is still one of the languages in which the weekly newspaper *L'Osservatore Romano* is published. No one today would consider using Latin as a means of communication at an international conference; instead, English would be the preferred language. However, because English is so much more flexible than Latin, with fewer grammatical rules and a less clear and comprehensible structure, it is also much

less successful as a means of communication between non-native speakers. For well over 500 years, no one was a native speaker of Latin, which is one of the reasons it has maintained its status. Millions of individuals are native English speakers, but millions more are not, and they are unable to fully comprehend what is being communicated. So, perhaps what should be aimed for is the employment of a systematic organization, whether named a classification, an ontology, or a taxonomy, coupled with a verbal system, preferably multilingual, such as a thesaurus. This draws together all of the threads discussed in this brief overview, including linguistics, artificial intelligence, so-called "conventional" systems, thesaurus, interoperability and multilingualism issues, and the physical display for the user. There is no single solution, otherwise, there would not be so many separate endeavors. Above all, the end-user should not be neglected, as he or she is the ultimate goal of all these endeavors, a reality that is sometimes overlooked in the higher and more esoteric realms of Knowledge Organization study.

XII. CONCLUSION

These findings, taken together, imply that the substance of the knowledge organization literature has evolved since the first graphical web browser was introduced. The qualitative analysis highlights the important role that metadata is playing and will continue to play in knowledge organization research and practice, highlighting the post-web age's shifting look in comparison to the pre-web period. Indeed, metadata is a term that appears in many of the qualitative analysis' main themes. Within the "Machine Assisted Organization" subject, for example, computers are being used to help generate as well as harvest metadata. The trends identified in this study have been detected automatically without requiring human effort. Researchers, instructors, and students in library and information studies who are interested in learning about the direction that the KO literature is taking will benefit from the findings of this paper, which will provide specific insight into how things have changed since the advent of the internet. Researchers may find it helpful for both creating new ideas and informing their literature studies, while students may find it valuable for learning about a new field of study.

Figures

Figure 1	Model of concept construction
Figure 2	Concept triangles, the formal representation of a knowledge unit
Figure 3	An overview of functions and structures of KOS
Figure 4	Numerical representation of pre web schemas
Figure 5	Numerical representation of post web schemas

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