

Electronic Records Management and System Design: Trends and Vision*

전자문서관리와 시스템 설계의 동향과 전망

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<ABSTRACT>

This paper aims to introduce the background history and development of records management in brief prior to and after the 1990s based on the records life cycle. This paper also explains the development of electronic document imaging systems and shifts to ERM systems in the 1990s. The paper explains functional requirements in archival management and software application standards suggested by the industry of electronic records management. The paper concludes with providing problems and issues associated with software design in electronic records management for further development.

Key words: Electronic records management, ERM software, Electronic Document Imaging Systems

<초 록>

문서관리와 전자문서관리가 1990년대를 전후하여 변화 발전해 온 배경과 현재의 경향을 살펴보고, 전자문서관리 소프트웨어 디자인에 관련된 아카이브적인 기능과 업계의 기술표준, 현재 나와 있는 소프트웨어 등을 고찰함으로써 전자문서관리의 현단계와 앞으로의 개발방향을 제시한다.

주제어: 전자문서관리, 시스템 설계, 전자문서관리 소프트웨어

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1. Introduction: What and Why Electronic Records Management?

Records management is a specialized business discipline concerned with the systematic analysis and control of recorded information, which includes any and all information created, received, and maintained, or used by an organization in accordance with its mission, operations, and activities(Saffady, 2004, p.1). Records are physical objects that contain such information. *ISO 15489-1, Information and Documentation Records Management, Part 1: General* emphasizes the role of records as “evidence of and information about business activities and transaction.” (International Organization for Standardization, 2001). By its definition, records contain written evidence in a medium container as opposed to memory or verbal expression. Assuming that records management methods generally apply to recorded information in all formats, including paper documents, and electronic records, electronic records indicate “records created, received and maintained in *electronic form* by individuals or agencies in the course of conducting business.”(Saffady, 2004, p.5). Examples of electronic records include computer files and databases, word processing files, e-mail, voice mail, instant messages, electronic document images, computer-generated graphics, audio recordings, video recordings, and so on. As long as records contain evidence regardless of their formats, would records management methods be applicable to electronic records in the same manner? This question has been one of the main research questions over some research projects on electronic records management for several years¹⁾ and still under discussion. To understand why this question is asked, we need to take a historical approach to tracing the development of records management and turn to electronic records management and system design. Although records are assets in organizations, their value is subject to changing environments and requirements over time by their usage. Until the 1990s, records are mainly maintained by their requests that are referenced frequently for a period of time following their creation or receipt. It results from the fact that theory of an information life cycle is well established in records management theory and practice until the early 1990s. After that time, electronic document imaging systems have been expanded into encompassing several information systems functions and

1) For examples on this question, see details of publications of the InterPARES project at <http://interpares.org> Read Anne J. Gilliland-Swetland, and Philip Eppard, “Preserving the Authenticity of Contingent Digital Objects: The InterPARES Project.” *D-Lib Magazine* 6, no.7(2000). Or see the University of British Columbia, The Preservation of the Integrity of Electronic Records Project, available from <http://www.slais.ubc.ca/users/duranti/intro.html>, May 20, 2005 Luciana Duranti and Heather MacNeil, “The Protection of the Integrity of Electronic Records: An Overview of the UBC-MAS Research,” *Archivaria*42(Fall 1996): 46-67.

adding archival requirements identified by owner organizations.

This paper aims to introduce the background history and development of records management in brief prior to and after the 1990s based on the records life cycle. This paper explains the development of electronic document imaging systems and changes to electronic records management systems in the 1990s. The paper also explains functional requirements in archival management and software application standards suggested by the industry of electronic records management. The paper concludes with providing problems and issues associated with software design in electronic records management for further development.

2. Records Management Prior to the 1990s

2.1 Development of Records Management

Records management as a professional area has been started after the World War II, when a huge amount of paper records was created as a result of the war with the changes in the volume of records, the type of media, and the amount of information in records at office environments (Read-Smith, 2002). Since then, with the introduction of personal computers in the 1970s, the rapid spread and use of personal computers and automation boom, such as office automation, factory automation, and library automation, changed previous practices into automate management of paper records as well. The first stage of automating paper records is using computerized tracking systems to organize records folders by attaching bar codes to each folder (Phillips, 2004). Tracking systems made it efficient and effective to index, file, store, retrieve, and search. In this process, the main responsibilities of records managers in organizations are: 1) to create filing (indexing) systems; 2) to classify records by filing systems; 3) to input records at database; 4) to attach bar codes to records folders and input bar codes to computers; 5) to store records in records box; 6) to track records by bar codes; 7) to retrieve requested records at database for users; and 8) to provide users with the requested records, which are searched at different computers by users (Phillips, 2004). As seen in Figure 1, the boundaries of records managers and users are divided into two separate zones by place and access rights. Users search their own computers or computers in libraries or/and records centers. Records managers use their working computers. Physical and legal access to paper records is not allowed by users, permitted only by records managers. Physically these

records are stored at records depositories in offsite, or sometimes, onsite storage facilities. The connection between users and records managers are done by check in and check out of requested records. These activities are drawn in Figure 1.

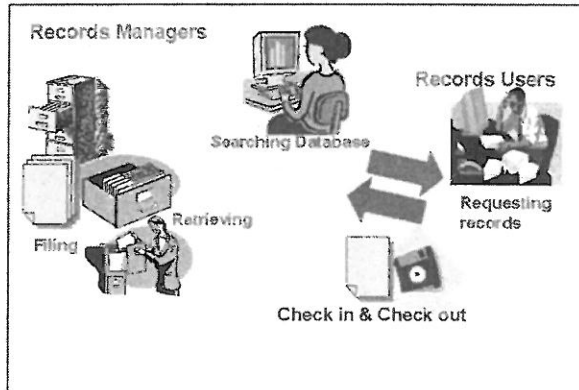


Figure 1. Model of Paper Records Management

2. 2 Records Life Cycle

Understanding records management in paper format can be clearly achieved by explaining the records life cycle that is well established in records management practice.

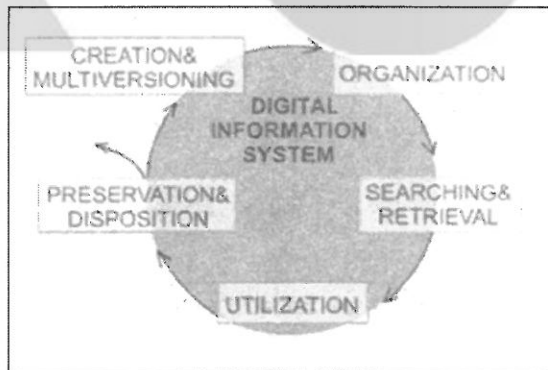


Figure 2. The Life Cycle of Objects in a Digital Information System(Gilliland-Swetland, 2000)

The life cycle model originated from biology was adopted as the information life cycle model in the field of information science. It consists of five stages such as creation/multiversioning, organization, searching/retrieval, utilization, and disposition/preservation as

shown in Figure 2 (Gilliland-Swetland, 2000). Records life cycle indicates the life span of a records as expressed in the five phases of creation, organization, searching/retrieval, utilization, maintenance, and final preservation/disposition (Robek, 1987). First, at the creation stage, records are produced in a wide variety of forms and formats using technologies and equipments. At the organization stage, records are organized in a meaningful and systematic ways by adding cataloging or descriptive information to records and creating as secondary information. These records are searched or retrieved by users or librarians. At the utilization and distribution phase, records are distributed and transmitted to the person needs for its use. Records are commonly used in decision making, for documentation or reference, in answering inquiries or in satisfying legal requirements. As time passes, the use of records declines like most organizational asset and their value also tends to be declined and become useless and finally discarded by the frequency of usage (Robek, 1987). At the storage and maintenance phase, when a decision is made to keep the records for use at a later date, it must be housed in some type of storage device, and protected in the maintenance of records. After records are stored, a request is made to retrieve it from storage for use. During this phase, records are frequently referred to and remain active. At the disposition and retention phase, when records decline in value and retrieved records are no longer needed for use, records become inactive, and are then removed from active storage in office space, are destroyed, or transferred to an inactive storage facility for the duration of their retention life. The last phase in the records life cycle is disposition by destruction. When records contain a permanent value, the records are preserved at a permanent storage place for a long-term period of time. In terms of records usage frequency, records are managed as the following Figure 3.

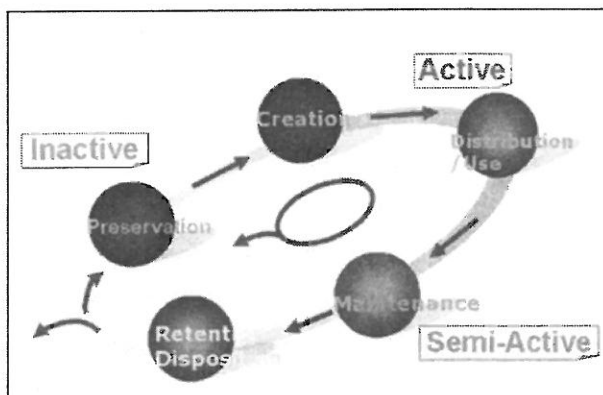


Figure 3. Records Usage by the Records Life Cycle

The records life cycle is important in knowing the meaning and importance of each phase of the entire records life cycle. Records managers should be able to understand what is needed to manage all records in each stage.

The records life cycle is only a conceptual model which is used in records and archives management. Records managers use the life cycle model to accomplish archival functions because it enables them to identify the important functions and related issues concerning electronic records at the different stages. Based upon the records life cycle, a linear process of archival functions include: creation of records, appraisal, accessioning(registry), archival description, holding, access and search tools, deaccessioning(disposition), and preservation. Due to the topic limitations, specific explanations of each function are not provided in this paper, these functions are incorporated into developing software applications of electronic records management with other requirements over several decades of years.

3. Records Management after the 1990s

3. 1 Electronic Document Imaging Systems

Since the 1970s, especially after the mid-1990s, electronic records and documents became a hot potato on the oven pan in this field. The more electronic records have been created than paper counterparts. Most of organizations transited into producing more electronic records, or at least, organizations created and used both of electronic and paper records at the same time. The first phase of electronic records management systems during this period of time started shifting to images in microfilm, microfiches, or a variety of image formats (Read-Smith, 2002, p. 10). It is called as "COM(Computer Outputs to Microfilm)" (Saffady, 2004). A huge amount of records were transferred onto microfiches. It purposes to preserve records as they were in a more durable medium than paper formats. It prevents media deterioration and damages to the original paper content(Dodson, 2001). For the purpose of preservation, COM method is one of the proven durable methods ever. It is also cost efficient to owner organizations. The COM method has become so popular since the 1970s until the present, although there are also some disadvantages and dislikes over this method(Saffady, 2004, p. 119). While COM is still available, a new method "COLD(Computer Outputs to Laser Disc)" was introduced because a new medium laser disc became more attractive and easily

retrieved. It proved more reliable and cost effective than microfiches(Saffady, 2004, p.188). It is also far more user friendly to retrieve and store than microfiches or microfilms. These two methods are used to convert paper records to electronic images. In the similar manner, recently, converting originally electronic files into image file formats are also available. For example, PDF solutions are another way to convert records contents and forms into image formats and preserve for a longer period of time. Although a PDF solution is one of the current image formats, there are other types of formats, of which advantages and disadvantages are still under discussion and needs to examine more. Many studies on media reliability are in progress as well. In this manner until now, electronic document imaging systems are still favored and frequently used by organizations.

3. 2 Shaping of Electronic Records Management(ERM) Systems

During this slowly moving initial period, organizations are creating, storing, and using more electronic records, and the systems used to create and manage these records are increasingly being integrated with each other. Until the early 1990s most records management related activities continued to be performed by capturing records at the end of the records life cycle in paper format. Paper records were classified for retention, packed for storage in boxes, and tracked with bar code labels placed on physical document or file folder. This is still a major method of records storage today. However, organizations relaxed that it was far more desirable to work directly with the electronic records management activities into electronic document management systems became critical to the implementation of well-planned information management systems. As organizations become increasingly automated administrative business processes, the use of digital files and data became predominant in information processing(Phillips, 2004). Organizations announced that prolific electronic records are considered as official records and tend to make new retention and disposition schedules for electronic records. In the early to mid 1990s, electronic records management systems software integration occurred. Contemporary common software applications that are frequently used in offices can do exchange data, create graphics, and information content between different types of software packages. Most of these applications have been able to directly exchange data and content so that an office worker with these applications can create sophisticated and integrated informative electronic documents.

More importantly, electronic document imaging systems started incorporating workflow

management and business process modeling, only to later incorporate the ability to manage multiple types of electronic document objects(Phillips, 2004). As a study of information systems has been flourished in the field of information science, computer science, and business administration, concepts of indexing, storage, and retrieval were also integrated into electronic document systems. The initial imaging systems contain only images in different media. However, sophisticated electronic document indexing, storage, and retrieval capabilities were soon integrated with imaging systems.

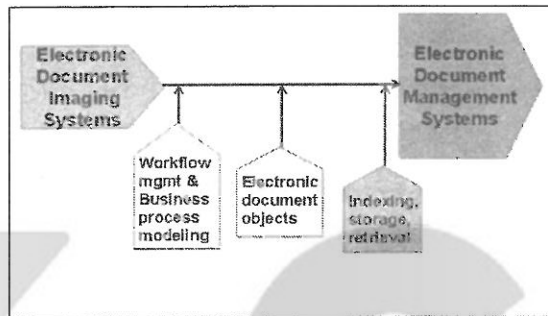


Figure 4. Functions Added to Electronic Document Imaging Systems

In addition, workflow capabilities could make electronic records management as “systems” and became, in general, one type of information systems. In the beginning, retrieving and searching are users’burden or records managers’ responsibilities at that time. However, those capabilities are systems’built-in functions. Later, users assume that indexing, storage and retrieval functions are supposed to be given by any information systems and ERM systems as one type of information systems should be built upon these functions. Images are accepted as one kind of document objects and a unit of system processing. Regardless of document type, any unit should be dealt with systems as the scope of document is expanded. As enterprise information systems tend to combine capabilities in other standalone accounting, payroll, and human resources systems, integrated systems incorporate records management functionalities as well. As a result, electronic document management(EDM) systems and electronic records management(ERM) systems are converged. EDM systems create, store, and manage electronic documents, while ERM systems facilitate the application of an organization’s retention schedule to electronic records(Read-Smith, 2002, p.11). As organizations, especially, corporations, integrate their systems and technologies, they place a great emphasis on their information and knowledge resources, including recorded and unrecorded information.

Knowledge management is the effective management and use of an organization's comprehensive resources and provides new opportunities for records and information management professionals (Read-Smith, 2002, p. 11). In the same sense, content management expands non-recorded information including any objects created by organizations, which is a new challenge to deal with to records managers. Eventually all of these concepts are encompassed and enlarged into content management, knowledge management and electronic publishing capabilities.

4. ERM Software

4. 1 Functions of Records Management

As organizations began to expect systems integration and open architecture, at the same time, the software industry assumed that electronic records management functions should be integrated with ERM systems. Organizational software began to specify the electronic records management functions required from some government requirements²⁾. Many international bodies began to create requirements for electronic records management functions as well³⁾. These functions identified by archival bodies include in Figure 6: appraisal, accessioning(registry), archival description, authority control, custodial management, workflow management, access and search tools, deaccessioning(disposition), ordering(reproductions), reporting capabilities, and feasibility with current standards(MARC, EAD, ISAD, etc.).

These functions are a series of a linear process from receiving records at archives. Continuously, records are registered and described in finding aids and metadata. Records custody is identified. When records are useless, records are disposed. If current records are transferred to a new archival system, the previous metadata scheme may be converted into a new one or transferred as they are. Fitting with current metadata schemes can be advantageous or disadvantageous. Functions such as authority control, workflow management,

2) Some examples of ERM functional requirements or software design standards suggested by government agencies include: US Department of Defense, DoD5015.2-STD; Australia Public Record Office Victoria, Management of Electronic Records PROS 99/007; European Commission's Model Functional Requirements for Electronic Records Management); and UK the Public Record Office's Functional Requirements for ERMS.

3) Examples of ERM requirements and standards are the OAIS reference model and ICA (International Council on Archives)'s Market Survey of Commercially Available Off-the-Shelf Archival Management Software(ICA Study 12), 2003, available at <http://www.ica.org>.

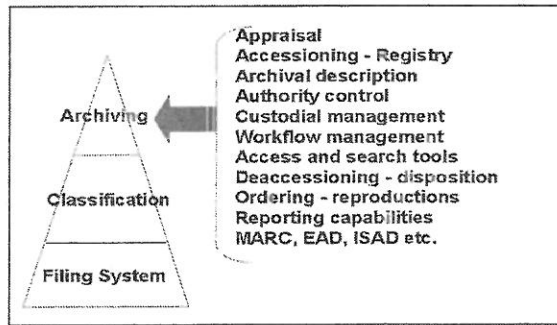


Figure 5. Hierarchy of Archival Functions

access and search, ordering reproduction, and reporting capabilities are information systems' general activities in present. These functions can be divided into upper layer, middle layer, and lower layer, where three layers are hierarchical. Among three layers, archiving functions are the highest requirements that are designed for ERM systems.

4. 2 Standards of Software Design

A number of national and international electronic records software standards outline what is required in design specifications, technical requirements, and functional requirements at ERM design levels. There is no one solution in considering all possible factors. Nevertheless, these standards work as a basis in selecting software design and selecting vendors that offer electronic records software products. In the same sense, many organizations began to create or suggest electronic records software requirements. At first, the Reference Model for an Open Archival Information System(OAIS) model is a comprehensive conceptual model that describes all of the functions, actors, and processes of archives systems as a digital repository (Consultative Committee for Space Data Systems, 2002). It outlines how digital objects can be prepared, submitted and processed to an archive, stored for long periods, maintained, and retrieved as needed and provided to consumers. This can be applied to a variety of organizations including libraries, archives, government, nonprofit organizations, corporations, and others.

One of the well known electronic records software requirements in the States is the Department of Defense(DoD) 5015.2 STD standard that documented the electronic records management functionality needed at U.S. federal government(US Department of Defense, DoD5015.2-STD, 1997). This standard provides implementing and procedural guidance on the management of records in the Department of Defense. This Standard began with mandatory baseline

functional requirements for Records Management Application(RMA) software used by DoD Components in the implementation of their records management programs, defines required system interfaces and search criteria and describes the minimum records management requirements that must be met. In addition, Victorian Electronic Records Strategy(VERS), suggested by the Public Records Office, Victoria, Australia, is a framework of standards, guidance, and implementation projects of capturing, managing, and preserving electronic records, which aims to achieve reliably and authentically archiving electronic records(Public Record Office Victoria, 2005).

In British and other European countries create electronic records management standards to assist software buyers in those countries, such as MoReq(Model Requirements for the Management of Electronic Records) (Cornwell Management Consultants, 2001), and Functional Requirements for ERMS(Public Records Office, UK).

It is important to notice that using these standards as software design guidelines are subject to each country's priorities, organizational culture, and business processes of the originating organization. Standards are a general guide to the potential functionality that electronic records systems should offer, not as mandates for all records management functions in public and private sectors.

Some leading ERM systems software vendors today in the States and Canada include Hummingbird(www.hummingbird.com), Open Text(www.opentext.com), Documentum(www.documentum.com), MDY Advanced Technology, Inc.(FileSurf)(www.mdy.net), FileNet Corporation(www.filenet.com), and others. These vendors dominate software markets in records management. Although detailed specifications of each product may be somewhat different, architectural models for classifying and protecting electronic records are similar in their design and archival functions. These applications allow users to file electronic records from desktop computers to a central repository. Original electronic records are created from desktop computers and are transported, moved, filed, or migrated into records management depository. Some of vendors are imported and customized in Korean market, too.

5. Conclusion: Future Directions

A record is recorded information, regardless of its format. Records management is the control of all records in paper and electronic formats. While records are classified according

to their use, and value to organizations, records management is influenced by new technologies. Electronic records management has been evolved into a way that began with imaging systems, encompassed document and objects, and finally incorporated into one integrated systems that include ERM, EDMS, content management, knowledge management, and integrated information procession in one organization. To support these demands of organizations, ERM software technical and functional requirements have been suggested and are available in the field, although these requirements are a general guideline. It is important to remember that when selecting electronic records software, factors should be considered: 1) organizational culture, functional requirements, life cycle of records management within an organization, vendor technology and architecture, applicable standards, electronic records management priority.

Unlike some predictions that paper records would become obsolete, paper records continue to increase and electronic records dramatically increase all the places. To effectively manage electronic records, research on ERM systems design will continue to progress with design specification, based upon the current findings. ERM is moving toward solving records' creation, preservation, and access at the time of their creation and for good by one integrated system. ERM is understood as a module of one umbrella systems for comprehensive knowledge management and content management in organizations. One noticeable thing is that archival functions are indispensable tasks to fulfill legal requirements at organizations. Additionally, research on metadata of ERM systems is one area of further developing. Applications of research to customize into different types of communities will be another area of more development.

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