

DESIGNING THE CONCEPTUAL MODEL OF AN ELECTRONIC DOCUMENT MANAGEMENT SYSTEM FOR THE INSTITUTE OF TECHNICAL AND VOCATIONAL HIGHER EDUCATION

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Abstract - This research discusses the process of designing a conceptual model for a new information system, i.e. Electronic Document Management System. The new system is designed for an educational institute (ITVHE) whose managers are the research population. The research methodology is based on structured analysis and design methodology (SSADM). In the end, the new system proposed the use of a data flow diagram (dfd), an entity relation diagram (erd) and functional decomposition diagram

Keywords - Conceptual Model, Systems Analysis and Design, Institute of Technical and Vocational Higher Education, Electronic Document Management System, Information System.

INTRODUCTION

The history of documents in human society goes back to thousands years ago. From the ancient empires to the modern organizations, document has been a vehicle of knowledge, transferring it through the organizations, places, societies etc., and carrying it generation by generation through the entire human civilization.

The importance of the documents, however, increased sharply after the world war two by helping the proper decision-making. James Martin, an expert in information engineering believes that less than 10 to 15 percent of the organization's information assets are in the form of databases and instead 60 to 80 percent of the information assets in those organizations are in the form of documents and forms [23].

The competing organizations need to decide instantly, precisely and correctly based on the suitable organizational knowledge, normally hidden in the labyrinths of paper, electronic or hybrid documents. Thus, making the documents accessible almost equals to good decision-making.

The way to improving the management of documents in an organization is not simple at all, though may be treated simple mindedly. Some of the managers, specifically in undeveloped and developing countries, believe that utilizing computers (hardware and software), is a good or may be mediocre solution, while experts claim that document management system (DMS) itself, is a kind of information system and as a consequence

should be treated as a system based on a scientific methodology.

Institute of Technical and Vocational Higher Education (ITVHE), as an educational organization, has some problems regarding the management of its documents. The clients, complains, errors and observations of the present system, played as incentives for the researchers to begin their investigation of the system and proposal of the new system.

THE PROBLEM STATEMENT

At the present, there is a mass of different documents like annual reports, laws and regulations, financial and credential documents, etc. in the form of reports or loose leaf and plenty of file cabinets all over the institute. As a rule, the whole documents in the institute are divided into three major categories: 1) documents produced in the institute 2) documents received by the institute and 3) legacy documents.

Overall, the problems concerning the documents in the institute is summarized as follows:

- There is not any specific procedure for the life cycle of the documents from the time they are produced until their final storage or disposition (the life cycle of documents is depicted graphically in Figure 1).
- File cabinets and large file folders occupy a vast amount of the space in the institute while the price of the each square meter of land in this part of the city is very high.
- There are not rules or regulations regarding the different phases of documents life cycle such as creation, manual of style, indexing rules, and access regulations, etc.
- There is not any room or repository predicted for storage of the documents. Thus, the distribution of the documents in the different rooms causes them to be lost, inaccessible and messed.
- The unruly storage of the documents, which is the consequence of lack of organizing, causes them or the content of them to be inaccessible.

The above-mentioned problems occur while there are plenty of computer CPUs' and hard disks' capacities unused.

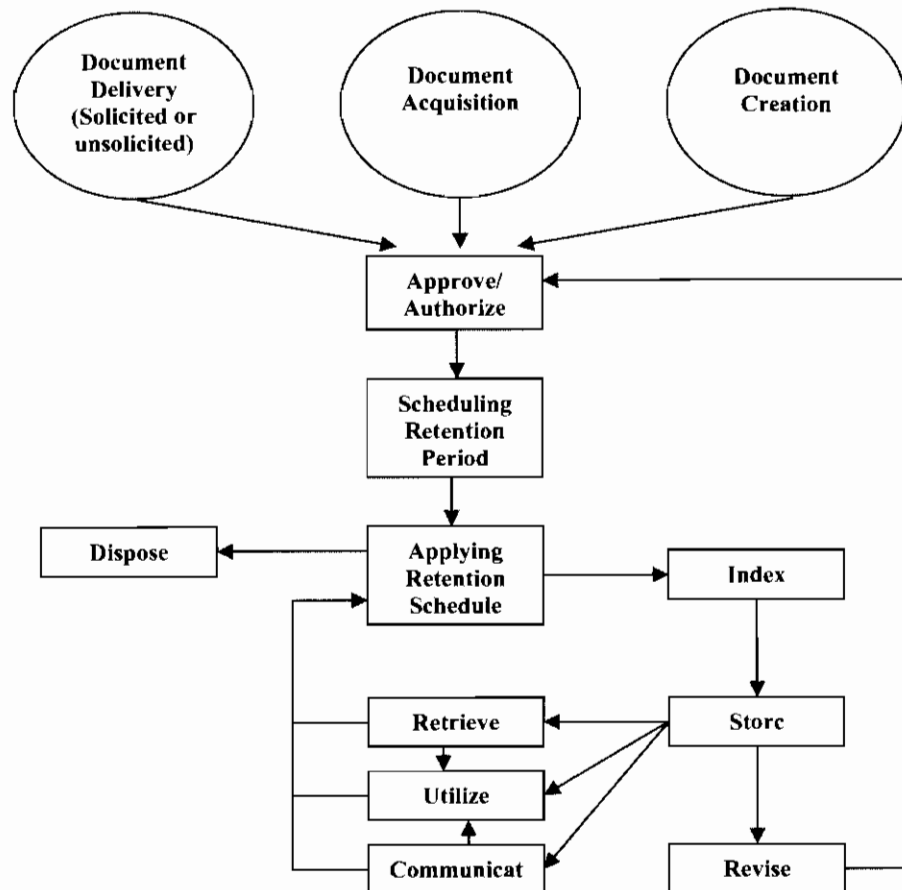


Figure 1: A diagram for showing the flow of documents in their life cycle.

The dominant belief in Iran, specifically in public sector, is that the mere utilization of computers in the organization could be a remedy for most of the problems. As a natural consequence of this belief, our organizations turned to depositories of hardware components of the computers that not only have not solved so many problems but also have caused a great amount of disadvantages. The institute of technical and vocational higher education (ITVHE) has not been an exception and in recent years has turned to an exhibition of computer components and peripherals.

LITERATURE REVIEW

Kuchack [14] had done one of the first researches in the field of document management in the public sector organizations of Iran. He analyzed the problems of document management in the *Cereal and Bread Organization* and the *Sugar Cube and Sugar Organization* of Iran.

Rahimi Moghadam [20] believes that the organizations that produce documents suffer from bureaucracy. When an engineering unit creates a document, then sends it to other units for assertion and in the end sends it to the employer. Control of the documents, specifically when there are thousands of them, is a very daunting task. The research had

been done using SSADM^[1] in the Design and Engineering Company of Petroleum Industries.

Lindsey [15] believes that the dramatic change in the workflow and document management fields will cause noticeable advances in short and medium terms. He describes his experiences in Xerox Company as:

“Document management requires the obtaining and flowing of information in an organization in order to inform the organization about the environment and its reaction to it. We mix the work flow with document management because apparently it is a suitable reflection of technology application in the business processes during which employees mix the information and develop competing approaches”.

Mahoney [17], while describing the hybrid documents, emphasizes on the importance of developing a change in the field of health care. He believes that information technology has the necessary conditions for implementing the change. The health care organizations have to use a kind of strategy that predict the information and document management for which an EDMS is a vital component.

Tanner [24] expresses two case studies that one of them has been done in a production company and the other in a medium-sized university. In both cases, the consumption of the paper work has been more than necessary and thus the consultant decides to design and implement an EDMS. The emphasis of both research is on the implementation and operation of the system.

“Public Service Electric and Gas (PSE&G) in Newark, New Jersey is the third largest gas and electric utility in the United States. To comply with Nuclear Regulatory commission requirements, PSE&G must maintain current documentation on virtually every component of its three nuclear generating plants and then make it available to the plants’ personnel. With over 10,000 physical components in each of the sites, this translates into over 300,000 documents, which are constantly being updated. PSE&G solved this problem with an EDMS from View Star Corporation” [4].

Lovell [16] explains the process of choosing an EDMS for the Wealden district council in East Sussex, UK. “The Wealden district covers an area of 325 square miles and with a population of 140,000. The authority is responsible for 60,000 council tax accounts, as well as the management of more than 20,000 housing Benefit claims, of which about 12,000 are live at any one time”. The production of that large amount of paper work has resulted in a huge archival system and difficulty in finding the desired documents. Therefore, in 1992 the authorities decided that an EDMS was necessary for coping with the problem of overfilling archives. The process of selecting the EDMS and analyzing phase is described in the article.

Wooton [29] tells how an EDMS in BNFL factory administers the operational, safety and control documents. More than 1200 users in 10 buildings have an instant and online access to more than 20000 documents with the ability to read and modify them at any

time.

Ainsbury [1] also in an article discusses the techniques of information organization for making the documents accessible in an organization. He analyzes the current methodologies for designing classification in documents too.

The EDMSs have a profound impact on administrative operations of the health care provider organizations. A case study shows a methodology for implementing all types of EDMSs including preparation of the vision and scope, business analysis, cost benefit analysis, and system specification and project plan [22]. To minimize the project risk successfully, the article reviews the importance of phasing, standards and integration and it provides six detailed examples of this methodology.

“The decision to implement an EDMS should not be made lightly. Such is the advice of a health care organization that pioneered the technology a decade ago”. The Pitt County Memorial Hospital implemented an EDMS in 1992 and then upgraded it in 1999. Foster [8] in this article tries to analyze the hard work done by PCMH during the difficult transition period to paperless automation which had been full of challenges for the officials of the hospital.

OBJECTIVES OF THE RESEARCH

The main objective of the research is the designing of an information system for facilitating the flow of documents in the ITVHE, from the creation to storage or disposition phase. The resulted model does not concern the hardware or software matters and instead regards the managers' principal requirements, improving the present methods, simplifying and shortening the access path and time and increasing the reliability of the documents accessibility. During the time of research, some forms, guidelines and graphs will be produced which are the means for improving the flow of the documents.

The research will analyze the advantages and limitations of the ITVHE for a new EDMS and suggests automation of the documents wherever required. Also, other than establishing the criteria for electronic documents, it will study their management, flow and retrieval critically.

Along with the main objective, the research will also deal with matters like the role of “the National Library and Archives of I.R. of Iran^[2]” in the flow of documents in the public sector organizations, the related official communiqués, the rate of attention towards them, and the deliberate usages of documents by the managers.

The researchers believe that one of the essential needs of the organizations is the provision of strong theoretical frameworks for action. The mere practicality in some of the organizations is a problem, which should be dealt with immediately.

RESEARCH QUESTIONS

- How is the present system of production, workflow, organization, retrieval, and disposition of documents working in the context of ITVHE?
- Does ITVHE have the necessary preparation and conditions for accepting the new EDMS?
- What is the new model of Electronic Document Management?
- What requirements should the new system (EDMS) have and what should be done for its implementation?

METHODOLOGY

Structured Systems Analysis and Design (SSADM) was first developed in UK in 1981 by the Central Auditing and communication Agency of England in order to standardize the systems approaches in government agencies.

With respect to the prior experience of one of the researchers in the field of designing an MIS for the same institute as a team member [18] and the resources available like [20], the last version of SSADM (4.3) has been chosen as the guiding methodology of the research.

For doing the research in different phases, the researchers used some instruments such as questionnaire, interview, camera, and observation; software packages such as SPSS 11, Version 2003, and Word XP.

RESEARCH POPULATION

The population of the research consists of the managers and employees of the headquarter of the Institute of Technical and Vocational Higher Education, which for the sake of space is called ITVHE throughout this article.

OPERATIONAL DEFINITIONS

In Persian language, *Sanad*, derived from an Arabic infinitive, which is the counterpart of document in English, means “something which could be referenced”. Alizadeh [3] along with study of the history of document in Iran gives a local definition of document with respect to its Persian etymology: “document is written facts about events and transactions of the organization which might be appeared in the form of letter, printed forms, card and papers or books. Therefore, any referable object like audio cassettes, films, microfilms, slides, maps, illustrations, etc. are documents until when they stay referable.

The Iranian civil code also defines the document in its article 1284 as “any written material which is referable in the case of a claim or defense” [3].

According to the above reasoning, a document should be “written” and “referable”. On the other hand, the same article mentioned above stated that the documents recorded in the notary offices, legal offices or by the government officers is formal provided the documents are in their line of duties. Therefore, the written material produced by the employees of any government organization is a formal document and has legal validity.

Sutton [23], however, believes that “the document is a set of related information records which are meaningful for their audiences”. The definition is very inclusive and widespread and covers almost all of the information materials. In other place, he proposes to derive a definition from Latin-root word *documentum*, discussed above. . Looking from an etymological point of the view, one could find out that the word document has a root in Latin word “documentum” which meant “edict” or “directive”. In modern language they mean, respectively, legally sanctioned and record. Thus, we can conclude that document is “a record or set of records like a business transaction which are legally sanctioned”. Similarly, a check, letter, form, or other materials like them are documents.

EDMS is an information system and its designation requires feasibility study. Being sure of the feasibility of the research in the context of the organization, one should start to analyze the present system. The new information system, which is an EDMS here, is designed based on the data gathered out of the analysis. In this phase, two types of models should be designed. The first one, which is the focus of this research, is the conceptual model. “This model is designed on the basis of the advantages of the old model and opportunities provided by the new model” [23]. The conceptual model, as described best by [23], establishes on the model for a records center and its corporate clients. First, a repository for a specific group of records is established- let us say administrative records. Then specific file rooms are established for this repository. This model is without any concern of implementation and operation of hardware and software. In fact, the second model, i.e. Physical model, is responsible for the designing and implementation of the devices.

FEASIBILITY STUDY

EDMS as an information system is eventually supposed to service the managers and experts of the institute. Thus, the ideas and orientation of the users towards the system and the current problems is very critical. As such, a survey has been conducted to fulfill the so-called needs.

A questionnaire was designed, which tested the opinions of the users in four categories:

- the problem encountered regarding the present system;
- the information literacy of the users, based upon their own opinions;
- the rate of agreement of users with the implementation of EDMS;
- the importance of documents for the users;

Finally, 32 out of 35 questionnaires have been gathered and analyzed using *spss for windows ver.11.00*.

The analyses show that over 65.6% of the users believe that documents are much or very much effective on their decision-making. On the other hand, 37.6% believe that the time consumed for searching the needed documents were much or very much. The observations of the researchers also confirmed the results. The missions of ITVHE as the headquarter of 30 educational centers, are decision-making oriented and as a consequence the managers of ITVHE are highly involved in decision-making efforts which are very much based upon documents such as rules and regulations, directives, constitutions, etc.

The overall conclusion of this part, according to the opinions of the managers, would be:

- the present status of the documents management in ITVHE is not satisfactory at all;
- users of the institute are information literate and their access to IT facilities is acceptable;
- the users are highly in agreement with the implementation of EDMS;
- documents are important decision-making means for the managers of the ITVHE;

Table 1: The area occupied by the archives of the ITVHE and their value in US \$.

Name	Area (m ²)	Location	Price(US\$/m ²)	Price (total)US\$
Offices	1320	Navvab	1000	1320000
Offices	600	Enghelab	1200	720000
Archives	100	Navvab	1000	100000
Archives	100	Enghelab	1200	120000
Archives	250	Khazanch	500	125000
SUM (total)	2370			2385000
SUM (archives)	450			345000
Percent	19%			14.5%

According to Table 1, the archives occupy 450 m² of the total pure official space of the institute. This figure is equal to 19% of the offices in three buildings of the institute (the third building does not actually belong to the institute and just embodies 250 m² of the archives). With respect to the prices of accommodation, derived from real states and a construction engineer, 14.5 percent of the whole value of the buildings is occupied by "paper".

A simple and straightforward calculation shows that about 124200 US\$ per year is spend only for the space occupied by the paper, which will increase sharply in the coming years, accordingly in next five years that figure will rise for sure. However, even by presumption of a fixed price, there will be about US\$ 624000 expenditure during next five years only for keeping the archives. At the time, the calculated value per year is equal to

the one-year budget of the department of library and information services.

SYSTEMS ANALYSIS AND DESIGN

The problems of the present system, as the users encountered them, have been extracted from more than 14 hours interviews done by the researchers; the interviewees being managers, archivists, and end users of the system.

The interviews were recorded using a handy cassette recorder and jotted down on the paper after the end of each interview. Then the problems (and requirements) were extracted. It should be mentioned, however, that at first the list was a mixture of effects, symptoms, and problems. Thus, there had been a need for analysis of the list. Finally, the list view was analyzed using Ishikava diagram (also called fishbone diagram).

Consequently, six major problems were distinguished among the observed effects, which are listed in Table 2.

Table 2: Major problems distinguished in the present document management system of ITVHE.

1. There seems to be a fundamental deficiency in legislative activities about electronic documents in the state that is affecting the public sector profoundly.
2. Lack of a specific organizational unit, responsible for planning, organizing, and managing a sophisticated document management system in ITVHE seems to be critical.
3. Duties of the organizational units in ITVHE, related to document management, are not defined and managed properly.
4. There are not any regulations and related standards for official correspondence, document workflow, security classifications of documents, etc.
5. There are not science-based procedures for document management in ITVHE.
6. There is a lack of training about the role of NDOS in disposal of documents and the related regulations.

A system requirement (also called a business requirement) is a description of the needs and desires for an information system. A requirement may describe functions, features (attributes) and constraints”.

The so-called needs and desires can originate from some resources, users, rules, and regulations, list of duties of the organizational units, organizational chart, standards, etc.

In Table 2, some of the most important requirements have been written. The table, contains other clarifying information as well.

Requirements number: Make the requirements documented and identifiable;

Requirements text: Provides a condensed summary of the requirement’s function;

Requirements type: Distinct functional requirement from nonfunctional;

Requirements detail and constraints: Clarifies the opportunities and obstacles that

will be present against the requirements fulfillment.

Table 3: A sample of new system’s requirements presentation used in the research.

Requirements	Explanation
No.	ITVHE.01
Title	Check-in, Check-out
Text	A locking mechanism for ensuring that only one document at a time can be modified.
Type	Functional
Details & constraints	Everybody who signs-in the repository system of EDMS can read any document within his defined security ranges, but if he has the right to modify the document, nobody else with the modify right can do the same job at that moment.

After preparing all of the requirements of the new system, it is time for discovery of entities (or simply elements of the new information system) and relating them to each other by a specific diagram. ERD or entity relationship diagram serves as a static data showcase in which the relationships between the entities are drawn.

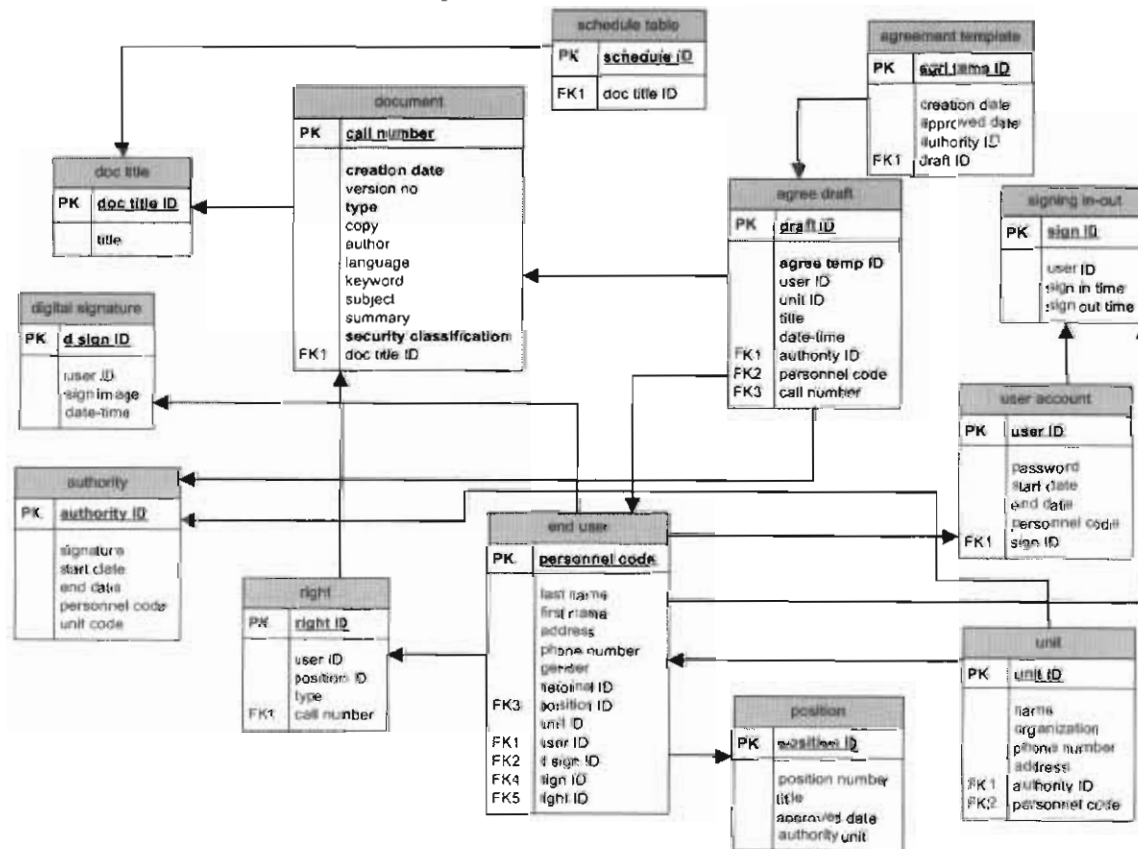


Figure 2: the entity relationship diagram (ERD), drawn using MS-VISIO 2003.

The next step is to show the current of data in and between the system and its

environment. The DFD drawn in Figure 3 shows that EDMS is related to three other external agents, namely National Library and Archives, User and Unit. Each of the external agents has different instances. For instance, the user has two counterparts in DFD of the system (Figure 2) that are end user and authority. On the other hand, unit has one counterpart that is the unit itself. National Library and Archives is another external agent.

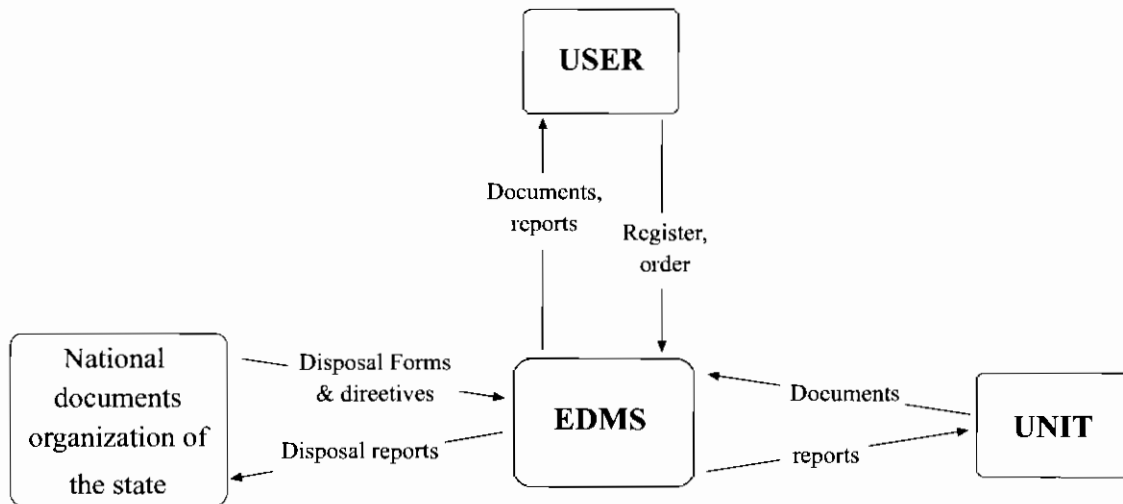


Figure 3: The data flow diagram (DFD), drawn using MS-VISIO 2003.

At last, the system in Figure 3, i.e. EDMS, decomposes to five subsystems or functions (Figure 4). For the sake of this research, though, the functions decompose just to the first level of events and not lower than that; but as a rule, the events must be decomposed further to the detailed DFDs. For example, Disposal subsystem consists of three events that are updating schedule, Disposal process, and Disposal Reports.

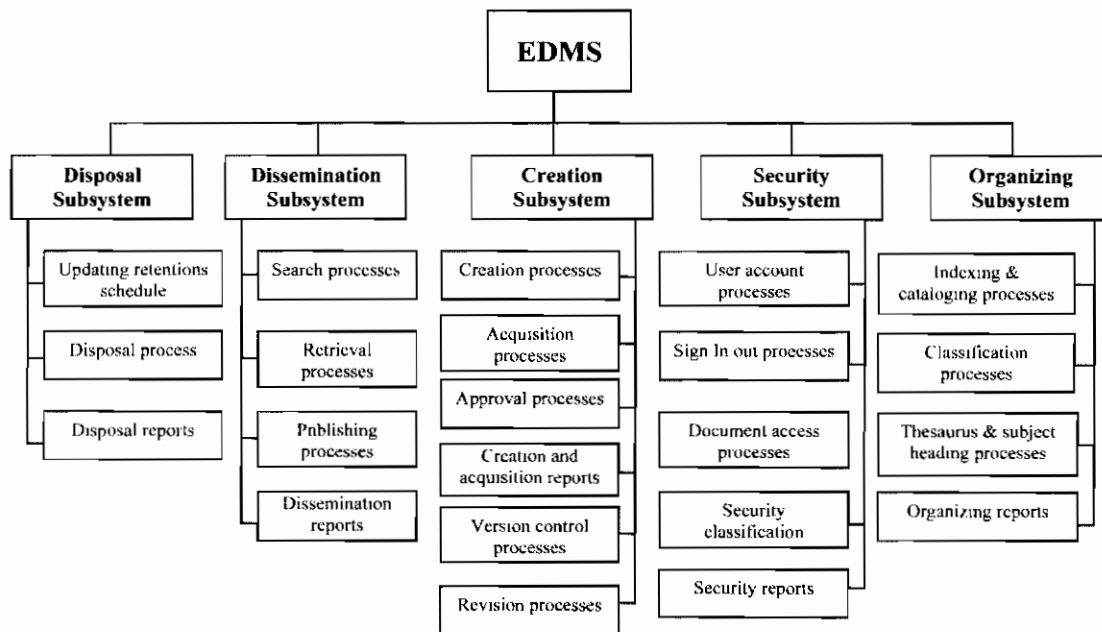


Figure 4: Functional decomposition of the new Electronic Document Management System.

CONCLUSIONS AND SUGGESTIONS

Document management is a general term for any system (manual or computerized) capable of managing the documents of an enterprise through their life cycle. In the ITVHE, which has been the context of this research, there is not any DM, formally. It means that there is not any written statement purpose referring to a DMS. However, with some inspections, one can find out that the duties of a DM are being executed more or less.

Based on the problem distinguished in the system, a new model was proposed. As it is evident in Figure 3 after functional decomposition of the new system, it will have five subsystems namely, creation and acquisition subsystem, organizing subsystem, security subsystem, dissemination subsystem and at last, but not least, disposal subsystem. The functional decomposition diagram shows that the functions or subsystems are further decomposed to events. The next part of the designations will be decomposing of events to procedures by a DFD. The most important consideration in designing and implementing an EDMS, though, is the redesign of procedures and business procedures.

Nevertheless, there are some requirements for the new system, among them some regulations, procedures, and organizational considerations.

SUGGESTIONS

The first and most important requirement in improving the situation of DMS in the institute is adding a new duty to the present system and developing a new organizational position for managing the DMS of the institute. The most suitable place for the position will be the department of Library and Information Services.

The new duty will be:

“Planning, launching, managing, maintaining and continuous upgrading of a document management system, computerized or not, for the institute within the framework of the Institute’s Integrated Information System (IIS).

The second major step supposed to be the preparation of a set of regulations for document management and correspondence in the institute. The president of the institute should approve the regulations and its execution must be mandatory for all.

The third step will be designing the physical model and implementation of the EDMS by the to-be-responsible person in the Department of Library and Information Services. At that time, however, a review of the present conceptual model will be crucial.

FUTURE RESEARCH OPPORTUNITIES

During the research, so many new questions have come to researcher’s mind. Each of the questions is, potentially, a new topic for research. The following topics are critical for further investigation by graduate students in Library and Information Science, Computer

Science or Management etc.

Designing a conceptual model of for information system (such as EDMS) using SSM and/or OOM.

Studying the major EDMS software packages available in the market and calculating their usability factor for the public and/or private sector.

Comparing the usability of different methodologies on designing an IS in the situation of public sector in Iran.

Studying the present role of the NATIONAL LIBRARY AND ARCHIVES in DM in public sector and suggesting a new model for taking a leading role in knowledge era.

Analyzing the rules and regulations related to document and DM or EDMS in Iran and comparing them to their counterparts in some the developed and developing countries.

ENDNOTES

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