

The Implementation of EDMS of "A" company

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요약 본 논문은 전자문서관리시스템의 정의와 배경 및 제조 산업의 실제 고객 프로젝트를 사례로서 소개한다. 전자문서관리시스템은 문서관리, 워크플로우, 이미징 그리고 콜드를 중요 요소로 포함하며 SAP, PDM 및 KMS와 같은 첨단 기술들과 상호 연계되어야 한다. 문서를 관리하는 것은 성공적 비즈니스의 중요한 요소가 되고 있다. 현장에서 사용중인 전자문서의 수는 급속히 증가하고 있으며, 이는 종래의 IT시스템이 전자문서화의 이점을 충분히 살리는데 있어 어려움이 되고 있다. "A" 회사는 그룹웨어의 기반 위에 문서관리와 워크플로우를 구축하였다. 그 결과 모든 스펙과 도면들을 LMS를 이용하여 쉽게 저장하고 접근할 수 있도록 하였다. 또한 ECN/DCN 프로세스의 사이클타임을 1-2주 또는 그 이상 걸리던 것을 1-2일로 단축할 수 있었다. 문서를 관리하거나 작업 프로세스를 담당하였던 잉여 인력들은 보다 생산적인 곳으로 재배치될 수 있었고 경쟁력의 강화를 통해 곧 매출의 증가가 기대된다. "A" 회사는 지금부터 많은 유/무형의 이익을 얻게 될 것으로 기대된다.

Abstract This paper is to introduce the definition and background of EDMS and present real customer project in manufacturing industry as reference. EDMS has DM, Workflow, Imaging and COLD as key components and should be interconnected with many advanced technology, such as SAP, PDM and KMS. Managing and controlling documents is an important part of business success. The number of electronic documents in use in the workplace is escalating rapidly, making it difficult for conventional IT systems to take full advantage of the benefits of digital documentation. "A" company implemented DM and Workflow based on groupware. So, all of SPECS and drawings could be easily stored and accessed via LMS. Also, the cycletime of ECN/DCN process could be reduced to one or two days from one or two weeks more. The overhead resources from the managing documents and involving with work process could be re-deployed to the more productive positions and the increasing of revenue is expected soon because of the competitiveness. "A" company is expected to have more benefits, that is, lots of tangible and intangible benefits from now on.

1. Introduction

At least a tenth of your organization's revenues - perhaps much more - is spent on creating, managing and distributing documents. The explosion in desktop computing has helped to fuel a dramatic growth in the production of business documents. Many people - from customer service operative and other front-line staff right up to senior management - spend more of their day working with business documents. Managing those documents is a critical business function - a

necessary (but not sufficient) condition for business success.

Moreover, document management can, if done correctly, lead to competitive advantage.

Organizations are doubling the number of documents they have generated every two years or so. Not just paper trails, such as orders and invoices, but e-mails, spreadsheets, presentations and more.

However, these documents can be difficult to find and share, hard to organize and impossible to keep under control. Document management software system help with these problems, leading to:

- better customer service

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- higher profit margins
- better operational efficiencies
- reduced costs.

So, document management is not (just) about tidier offices or improved filing rooms. It is about exploiting your business to avoid critical failures or, even better, to make more money.

Examples where use of document management systems has proved to be of significant benefit include cross-industry applications such as:

- regulatory compliance support, such as approval for new drugs or financial instruments, or ISO 9000 registration
- accounting, such as linking documents (such as correspondence, orders received, credit notes and despatch documents) with the accounts.
- customer service, for example, call center systems support.

Examples of use in specific vertical industries includes:

- finance, such as handling loan applications, insurance claims processing, or contract generation for settlement for financial instruments such as swaps and derivatives
- manufacturing, including handling engineering and maintenance documents, product data management(PDM), tracking revisions and different versions for different products and markets, or preparation and maintenance of standard operating procedures on process chemical plants
- government applications, such as benefits provision and tracking

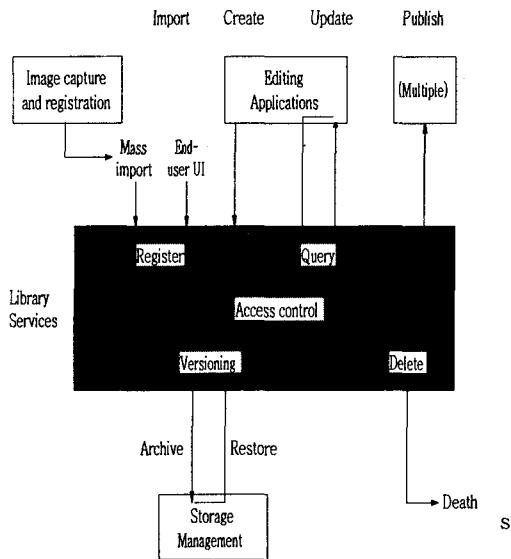
- transportation and distribution, with its plethora of despatch and tracking documents
- query - to permit users to search for documents based on information about the document, including document content, attributes or even structure, without knowing where on the system the document is located
- control over access to documents, or parts of documents by a security/authorization system
- deletion/removal when documents are finally declared redundant.

The goal of this paper is to introduce the EDMS(Electronic Document Management System) and its use of manufacturing industry("A" company).

This paper is organized as follows. Section 2 shows what EDMS is. Section 3 introduces the brief overview of EDMS project of "A" company. Section 4 presents three components of this project, which are LMS(Library Management System), ECN/DCN(Engineering Change Notice/Design Change Notice) and TMS(Technical Information Management System). Conclusion with benefits of EDMS is given in section 5.

2. What is EDMS ?

The use of business documents is in transition. Many business documents are created and stored electronically. However, many are still received and stored as paper, or saved as images on microfilm or laser disks. A business document contains information from multiple sources (including other documents); it may hold images and other media as well as text and numbers; a photographic image of a document may be necessary for it to fulfil its purpose. Examples include scanned-in documents, faxes, electronic forms,



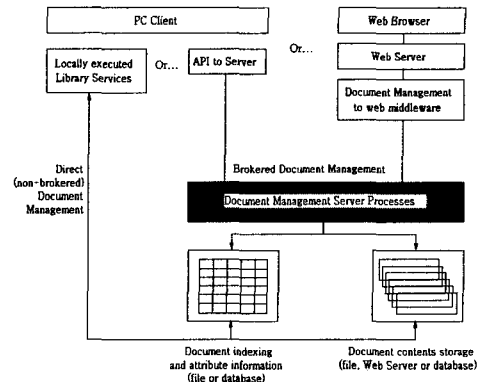
<Figure 1> The Document lifecycle

preadsheets, mainframe-generated reports, voice messages, electronic data interchange(EDI) records, and web documents.

Today's document management systems recognize the importance of documents as process intermediaries and process outputs. They manage document change. Many documents change as they are created and prepared for publication. Critical documents undergo review and approval processes. Many documents continue to change over their lifetime following first publication as Figure 1.

A document management system's functional organization is implemented and partitioned in different ways by different vendors. Figure 2 shows the basic architecture of EDMS and is a very high-level view - each of the boxes can contain a large number of components interoperating in a number of different ways.

Document management systems can be the fundamental of a company's information management strategy. Whatever is considered the fundamental piece, EDMS will undoubtedly overlap and interact with a wide range of other information systems of various types. Figure 3 indicates the most likely interplay with other information technologies.

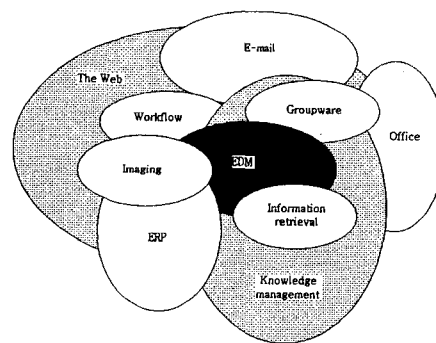


<Figure 2> EDM Systems :Basic architecture and choices

The EDMS performs many things by maintaining two sets of information - the content of the documents themselves, and information about each document: who produced it, when it was produced or changed (and what the change were), who can change it, what it contains and what other documents on. The information about the document is called meta-data.

A document management purchase may be an isolated solution to a particular business problem, or an enterprise-wide solution to assist with many business process.

However, even in the case of a point solution, it ought to fit with your platform strategy, your messaging (e-mail and groupware) strategy, and



<Figure 3> EDMS: interacting with a multiplicity of information technologies

possibly your business applications. How well a document management platform interoperates with, for instance, Lotus Notes or SAP, together with its capability to be used on its intranet, can determine its suitability.

Also, many document management applications must include, or integrate with:

- document image scanning, retrieval and display systems
- workflow (progress automation) systems
- COLD (computer output to laser disk) archival systems
- information retrieval tools.

Most document management systems offer integrated facilities for all of these, or integration with third-party specialist solutions offering these capabilities.

Document image capture and processing, workflow, information retrieval, integration with the application environment, capture and processing of computer-generated documents (such as invoices, statements and reports) - which is typically (but illogically) known as COLD (Computer Output to Laser Disk) - all play a part in the successful exploitation of document management technologies in an organizational context.

2.1 Groupware and e-mail

Groupware and e-mail systems are being superseded by architectures that provide EDMS component-based applications on top of e-mail-based systems. These architectures provide ease of use and integration with corporate e-mail and also with the standard PC office automation products such as word processors, but their document repository capabilities may be limited.

2.2 Document image capture

Document image capture is relevant in situation where the document imperative is focused on documents produced outside the organization. These

arrive in paper form and need to be encompassed within the EDMS for control and exploitation, either as images or, in the case of forms processing, as images and extracted data form those forms. The EDMS has to offer facilities for taking in such documents, often in batch mode, and often from bureau or service operation. It needs to be able to handle these document in three ways:

- to place the documents in the appropriate position in the storage hierarchy
- to extract the metadata for classification and control
- to apply additional metadata appropriate to the application, and the use to which the documents are put

2.3 Workflow

Workflow comes into play where the documents within the EDM have to be generated, circulated or accessed in support of a business process. In this case, the workflow process acts as a 'virtual user' of the EDMS, using API or system calls to find documents, associate them with processes, check them out and in as necessary, and so on. As such, the EDMS has to be able to maintain integrity of security, while opening up its capabilities to the workflow processes. It is in the security mapping that most problem arise.

2.4 COLD

COLD is widely integrated with DM in applications where documents and data need to be closely associated with, such as accounts receivable/payable. COLD essentially provides 'print spool' files to the EDMS, which needs either to store and classify them as discrete entity, or series of entities, or to parse the data to effectively associate it with the relevant documents.

3. EMDS project in 'A' company

This project was performed during 7 months with 6 peoples. Before starting the EDMS project, "A" company already implemented groupware as

infrastructure of EDMS.

Software customers and end-user usually find it very difficult to express their real requirements. It is almost impossible to predict how a system will affect working practices, how it will interact with other systems and what user operations should be automated.

A function described in a specification may seem useful and well defined. However, when that function is used with others, users often find that their initial view was incorrect or incomplete. System prototypes allow users to experiment with requirements and to see how the system supports their work. Prototyping is therefore a means of requirements validation. Users discover requirements errors or omissions early in the software process.

For this project we adopted prototyping methodology. Because "A" company should have the common requirements from three countries, prototyping was essential tool for this project. Requirements gathering/analysis was performed during one and half months with satisfying results.

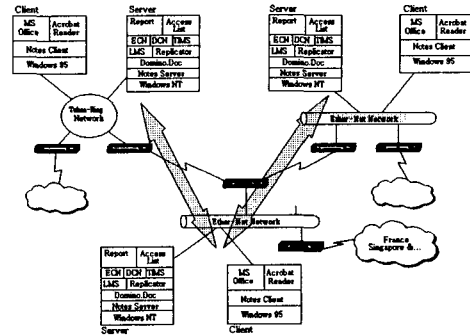
Coding and testing was performed during 3 months. In this stage three levels of test was performed such as Component testing(unit test, module test), Integration testing(sub-system test, system test), User testing(acceptance test). Each stage of test was executed based on test cases which were developed by developers and users.

User education is very important stage for the success of newly developed systems. Statistically 80 % of user complaint come from the misunderstanding of new systems. So, one and half months were used to educate the end users of three countries.

Based on the successful implementation of prototypes, testing and user education, this project was successfully finished within the planned periods.

Figure 4 shows the configuration diagram of this project, which includes servers, clients and networks.

Increasingly, organizations need to manage and share documents in a variety of formats among different users and groups. EDMS is the solution for organizing, managing, and storing all of its critical business documents, and for making them accessible inside and outside its organization. EDMS has three components:



<Figure 4> Configuration Diagram of "A" Company

(1) LMS (Library Management System) which is made from Lotus Domino.Doc and (2) Workflow system which has two parts - ECN (Engineering Change Notice) and DCN (Drawing Change Notice) and (3) TIMS (Technical Information Management System) for engineers. Each component will be explained in the next section.

4. Three components (LMS, ECN/DCN, TIMS)

4.1 About LMS

LMS(Library Management System) is the document management solution built for today's world of distributed, network-based computing.

Designed to meet the ubiquitous "network demands" for an efficient way of managing the integrity of collaborative work, LMS provides full document management functionality. The intuitive desktop metaphor of file rooms, file cabinets, binders, and documents makes LMS extremely easy to use -- directly from Notes. LMS is based on Lotus Domino.Doc and has more powerful and convenient features. Features include:

- . Import Data tool to import text data generated spread sheet file
- . Ability to replicate the changes of binders and documents
- . Reports to summarize the total library information
- . Access List to view the library access history

- . Linkage to Workflow system, that is, ECN (Engineering Change Notice), DCN(Drawing Change Notice).

The library is the entry point into LMS library. It is the main menu from where the user navigates the storage system, perform searches, lists checked out documents, and accesses administrative functions like setting and changing the document definitions and attributes. LMS consists of 3 libraries as follows.

- . Spec Library : contains "A" company worldwide specification and customer specification
- . Source Drawing Library : Contains sketch drawings, engineer drawings and release drawings for design center engineers
- . Official Drawing Library : Contains sketch drawings and release drawings for general users except design center engineers

LMS has the following hierarchical architecture, that is, file room, binder and document.

4.1.1 File Rooms

The file room provides a way to logically group individual file cabinets to facilitate navigation. All file cabinets are contained in a file room. When new file cabinets are created, the associated file room is selected automatically.

A file room can be created and associated with the file cabinet by LMS administrator. All file rooms and all file cabinets are managed in Code Database by LMS administrator.

4.1.2 File Cabinets

LMS uses file cabinets to organize and manage binders and documents. File cabinets are Notes database files which reside on the Notes Domino server. When new file cabinet is created, LMS automatically creates two databases: one for storing binder definitions, and another for storing documents. User can choose to keep all of your documents in a single database, or you can store documents in multiple databases according to size thresholds you specify.

Because file cabinets are .NSF files, contained in the

file cabinet with the document content are the necessary Notes forms for entering information into a document; the views for accessing the information; and the application logic that automates the processes related to the document. When a file cabinet's content is secured and replicated, so are these elements. In this way, application logic, messaging, data, and application design elements are integrated into a single, unified architecture. LMS uses this architecture to provide a single, logical way to view, store, retrieve, manage, and distribute all the documents contained in LMS.

The LMS Administrator and the File Cabinet Manager can create and manage file cabinets. Only the LMS Administrator can delete file cabinets and enable the document threshold agent for storing documents in multiple file cabinets.

4.1.3 Binders

Binder, in the LMS, is a container within a file cabinet that is used to logically group related documents. A binder cannot be in more than one file cabinet.

Each binder has attributes that facilitate organization and retrieval. Attributes associated with every binder include: the title, type, author, creation date, modification date, and number of documents.

Access to binders is limited to authorized users. Access to documents within the binders is not limited by binder access. However, because the content of a binder is the set of documents it contains, a user must have Author/Editor access to both the binder and to the document in order to add documents to or remove them from the binder.

The check in/check out feature is used to modify binder security settings and attributes.

Access to a binder is limited to file cabinet access, but the access that defaults from the file cabinet can be changed by the binder manager. Depending on your access rights, you can add documents to and remove documents from a binder. Optionally, you can perform actions on a binder and on the documents contained within the binder. For example, you can check out a binder and, at the same time, check out all of the documents contained in the binder.

4.1.4 Documents and its Types

A document in LMS is the information that is being managed. It can be a data file like a word processed document or a drawing file or a Adobe Portable Document Format (PDF) file. Notes document that is given a descriptive title and saved into a binder within a file cabinet.

Access to document content and attributes are limited to authorized Authors, Readers, Editors, and Document Owners. Access Control defaults from the file cabinet or binder level and can be further restricted at the document level.

The check in/check out feature of Domino.Doc ensures that only one user can modify a document at a time. When the document is checked out, it is locked in EDMS Library and copied to the users local drive. When it is checked back in, it can be as a new document, a new version, or an update.

Document Types provide for filing more than just basic title information with a document, thus making it easier to find the document later. For each document type, appropriate extended attributes can be specified.

4.1.5 File Cabinet Security

Every file cabinet has a user list that defines who can access it and what tasks users can perform. Users with registered Notes IDs whose names and passwords are stored in the Notes Public Name and Address Book can be listed in the user list.

The file cabinet user list defines who can:

- Readers** these users can read and download documents, but they cannot create or edit documents stored in this file cabinet.
- Editors** these users can create ECN(Engineering Change Notice) or DCN(Drawing Change Notice) documents.
- Managers** these users can create documents and edit documents stored in this file cabinet, including those created by others thru check out/check in. Also they can modify the file cabinet's security and force document check in.

The file cabinet user list automatically applies to binders and documents contained in the file cabinet, but the creator can change access on a per binder or

document basis.

4.1.6 Binder Security

Every binder has a user list that defines who can access it and what tasks users can perform. The binder user list is limited to the file cabinet user list, but the binder Manager (creator) can change access on a per binder basis.

The binder user list defines the following users:

- Readers/Editors** these users can view the binder; they cannot change binder properties or add documents to or remove them from the binder.
All users who have at least Reader access to a binder have at least Reader access to all documents in the binder.
- Managers** these users can view and edit binder properties and profile information. They can add documents to the binder and, if they can edit document, they can remove the document from the binder. And They can modify the binder's security, delete the binder, and edit all documents in the binder.

4.1.7 Document Security

Every document has a user list that defines who can access it and what tasks users can perform. The document user list is limited to the binder user list, but the document Manager (creator) can change access on a per document basis.

The document user list defines the following users:

- Readers/Editors** these users can view the document; they cannot change document content or properties or move the document to a different binder.
All users who have at least reader access to the binder that contains the document are automatically given Reader access to the document. The list of document Readers cannot be modified.
- Managers** these users can view and edit document content, properties and profile information. And they can modify the document's security, and delete the document.

A user must have at least Editor access to the binder that contains the document in order to be a

document Manager. All Managers of the binder containing the document are automatically given Editor access to the document.

4.1.8 LMS Replicator

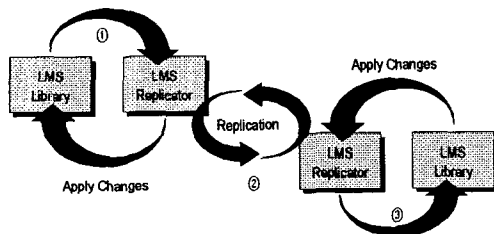
LMS replicator help ensure document integrity. When you check out and edit the document, the changed part should be applied to the remote site also. When the check in is processed, change log document is created by the LMS into the replicator database, so LMS can know the library changes thru this document.

LMS Replicators work on :

- when the document changes happen document creation, check in, delete
- when the binder changes happen binder creation, check in, delete

Following Figure 5 shows the replication process schematically:

- ① LMS makes the documents including the changes of binder/documents into the LMS replicator databases whenever creation, check ins or delete occur. The agent in LMS replicator database copies the changed document to the replicator referring to the change logging document in it.
- ② LMS replicator database is replicated periodically based on server connection document.
- ③ LMS replicator applies the changes of binder/documents into the LMS library.



<Figure 5> Replicator Diagram

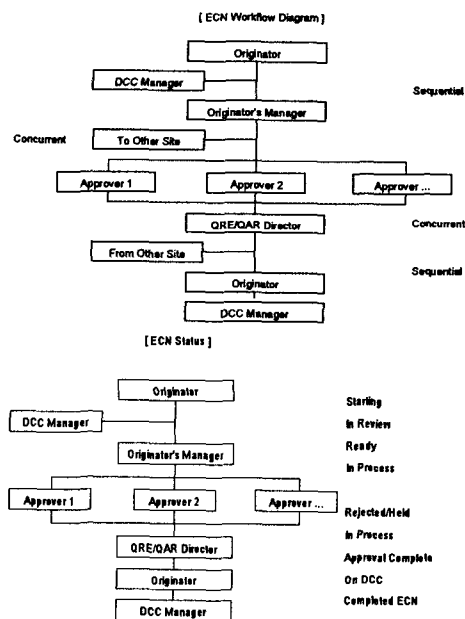
Processed documents are deleted by the agent in LMS replicator database.

4.2 About ECN

The originator requests ECN in order to make a

new SPEC or modify an existing SPEC. If it is for a new SPEC release, originator's DCC(Document Control Center) manager assigns the approval line, and if it is a released SPEC revision request, originator can get existing approval line based on the SPEC number. After originator's DCC manager completes reviewing the requested ECN, originator submit this ECN to his manager, and if the manager approves this ECN, it is sent to three sites in parallel.

If approval line is constructed with only one site, it is sent to that site only. If approval line is constructed with two sites, it is sent to those two sites in parallel. That is, the routing depends on the approval line. At this point, the important thing user should know is that the process is done in parallel before the submitted ECN comes back to the originator after all site's approvers approve it. Each site's approver can approve, reject, annotate, or comment.



<Figure 6> ECN Workflow/Status Diagram

If an approver approves the submitted ECN, he can also add some comments on the Lotus Notes mail. And all the approvers in the approval line can see these comments in their mail database or in ECN database.

If an approver rejects the submitted ECN, nobody in the approval line can proceed with the ECN procedure,

in which case, only the originator can restart the ECN. After each site's parallel approval is completed, the ECN comes back to the originator. At this point, originator modifies the attached SPEC according to the comments and annotations, and sends it to the originator's DCC manager. Originator's DCC manager reviews the approval completed ECN and an attached SPEC, and he puts the attached SPEC in the SPEC library, and release it.

Through the ECN process, the cycletime could be reduced and executives can monitor the progress of ECN's.

Figure 6 shows the ECN workflow diagram and ECN status.

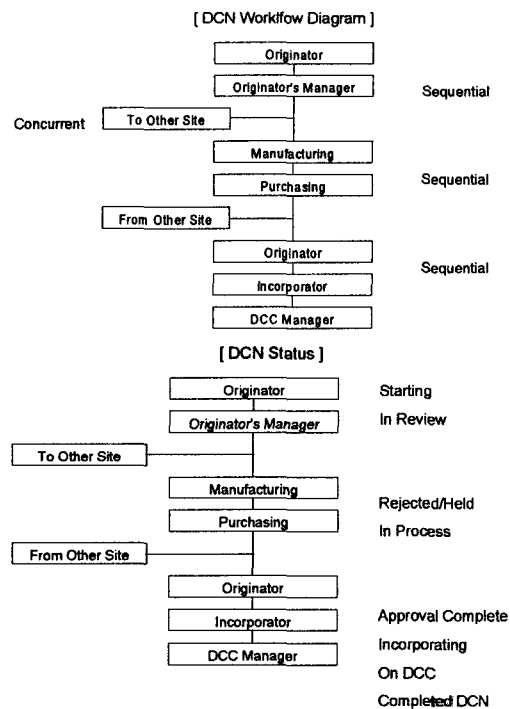
4.3 About DCN

The originator requests DCN in order to make a new drawing released form or engineering drawing or existing released drawing or modify released drawing. Originator can get existing approval line based on PDB package code, and also he can modify the approval line and he submit it to his manager. The manager can also modify the approval line and if he approves this DCN, it is sent to three sites in parallel. If approval line is constructed with only one site, it is sent to that site only.

If approval line is constructed with two sites in parallel, it is sent to those two sites in parallel. That is, the routing depend on the approval line.

The very important thing user should know is that the process is parallel among sites and it is serial within one site before submitted DCN comes back to the originator after all sites' approvers approve it. After each site's serial approval is completed, the DCN comes back to the originator. At this point, the originator can designate an incorporator by pressing the [Assign Incorporator].

An incorporator modifies the attached drawing according to the comments and annotations, and put them in the source drawing library and sends the DCN to the originator's DCC manager. Originator's DCC manager reviews the approval completed DCN and attached drawing, and he can put the attached drawing in the official drawing library, and release it. Figure 7 shows the DCN workflow diagram and DCN status.



<Figure 7> DCN Workflow/Status Diagram

4.4 About TIMS

TIMS is a electronic library for the Engineering Group. This library covers all the engineering-related reports, technical information, R&D activities and etc., but confidential documents should not be stored in TIMS. TIMS administrator will create File Rooms, Cabinets and Binders. Documents will be created by administrator in each Binder. General user can only read the documents which were created by the administrator. PDF file will be attached to each documents and user can read this file via Acrobat viewer. IF users want to print the attached PDF file, ask administrator by pushing "Print Request" button. And then, the Print Request mail will be delivered to each TIMS site administrator. All the settings related to printers should be completed before using this function. Some documents will be moved and saved at the archive databases after a certain period of time by administrator decision. User can easily search document including archive databases.

5. Conclusion

When seeking to exploit EDMS technology, companies should start by assessing the benefits that they wish to accrue, so that a realistic view of the likelihood of project success is determined at an early stage.

The expected benefits from the EDMS of "A" company can be summarized as follows.

Reduced overheads/cycletime

The most common approach to justifying expenditure on EDMS is one of reducing clerical overheads, and is largely a labor substitution argument, involving costs that are not specifically related to a specific product and are often fixed or extremely difficult to reduce. By installing systems that can automate manual processes and carry out back-office administrative tasks quicker and more accurately, EDMS can be justified by firing or re-deploying staff. The fund that would have been spent on their employment can be re-allocated to cover the costs of purchasing hardware, software and services to design and install a EDMS.

To meet customer's urgent change request, the reduction of cycletime of ECN/DCN process is very important for this company. Customers change their SPEC and drawing frequently. According to the change request, new SPEC and drawing should be applied to production line by the designated date. Under the paper based system, ECN/DCN process took one or two weeks more. But, EDMS could reduce the cycletime to one or two days.

Increased revenue

Although this benefit category is the most attractive and easiest to sanction, a realistic appraisal of the market shows that this is comparatively rare.

To get more orders from customers, "A" company should have good confidence from many customers in the system of managing documents and should reduce the cycletime of ECN/DCN process to meet customer's requirements.

Better management information

The most imprecise benefits of document

management fall into the category of better management information. This includes 'nice-to-have' information, such as general economic indicators in news papers. It extends to specific analysis of brand strength, customer perceptions, market penetration and competitors, which can be business-critical. "A" company can store and access lots of SPES's and drawings from customers efficiently.

Before implementing the first step of EDMS, "A" company installed Lotus Notes as groupware solution. Based on groupware, DM and workflow could be easily implemented. But, this is just starting point toward the complete EDMS in the near future. "A" company has plan to expand the scope of EDMS to handle COLD and video pictures soon. And then, this EDMS should be interconnected with the ERP, PDM and Knowledge Management System eventually. Also, they should have the IT vision with the short-term strategy.

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