

IMPLEMENTING THE PRODUCT DATA MANAGEMENT INTO ENTERPRISES: Five Case Studies

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ABSTRACT

In recent years, enterprises are facing the impact from the Financial Tsunami, factories moved outward, high production cost, shorter product life cycle, larger customization and global fierce competition. In order to survive, enterprises have to circulate all kind of information within the enterprise and supply chain to leverage the operation. This article presented five case studies including Hewlett-Packard, Ericsson, NEC, OKI, and Acer. We hope that sharing those five cases to promote the PDM applications into more companies.

Keywords: *Product Data Management (PDM), Enterprise Resource Planning (ERP), Implementation*

1. INTRODUCTION

In recent years, enterprises are facing the impact from the Financial Tsunami, factories moved outward, high production cost, shorter product life cycle, larger customization and global fierce competition. In order to survive, enterprises have to circulate all kind of information within the enterprise and supply chain to leverage the operation. Therefore, excellent information management will be the first step to maintain the competition advantage. Within the product life cycle, the challenges of design engineering change included the data integration, control, management, retrieval of development, design, manufacture, marketing, customer service, etc. Product Data Management (PDM) system is the tool for the purpose of managing the related information.

Fries (1995) proposed that nine critical steps for successful implementation of Product Data Management systems in a company required careful planning and analysis. The nine steps includes identify needs, gain support, analyze requirements, justify the cost, select vendor, design the system, plan the implementation, ensure success, and maintain the system.

This article presented five case studies including Hewlett-Packard, Ericsson, NEC, OKI, and Acer. We hope that sharing those five cases to improve the PDM application into more companies.

2. FIVE CASE STUDIES OF PDM

In order to search for valuable and worthy information, the selecting principle of the successful cases will be based on those who related to be electronic enterprise. Therefore, the selected cases included Compaq, HP,

Ericsson, NEC, OKI, and Acer. These Cases will be analyzed by the way as the following issues. Firstly, the enterprise acknowledges the requirement to implement the PDM system. Secondly, describe their business requirement. Thirdly, select the vender who will supply the system and after service. Finally, solve their encountered problem.

(1) Hewlett-Packard

This case describes the way HP implemented a secured and reliable product data vault in the factory at South Queens Ferry in Scotland [9]. Hewlett-Packard is a supplier and seller of 3C products such as personal computers and notebooks. According to the annual report from the website at 2000, the revenue was around 48.8 billion US dollars. With total 88,500 employees around the world, there are 250 sale points, supply points and agent relations in 120 countries around the world. Besides, there are many factories in many countries. Here, HP designs and manufactures radio frequency (RF) test instruments and telecommunication testing equipment, such as signal generators, communication test sets, modulation analyzer, measuring receivers, audio sources and analyzers, and transceiver test system. Typically, each consists of PCA (printed circuit assemblies), power supplies, and a control panel contained within a metal or plastic casing. Until recently, HP manufactured some of its own PCA, but an increasing proportion of these now are bought from outside suppliers. Typically PCA has 100 to 2,000 components. The strategic requirement is to manage electronic data at good manner, so that all the product data can be transferred speedily from the design location to manufacture factory.

The key management problems at South Queens Ferry increase quickly because the company produces many different kinds of products. The characteristics are high complexity, small lot size of production, customized products, short product life cycle, necessary of transferring designs among international manufacturing plants and design locations. Especially, the adoption of paper-based information encountered multiple copies while the old way of storing and transferring various file types is difficult to manage and control. Many issues were forcing HP to make the change. Issues are a need for secure data, to share data with other HP plants and with suppliers, to increase use of contractors, to share manufacturing resources, to reduce time-to-market, to re-use parts and design data, changing design environment, employment transfer frequently among projects.

The company formed a PDM user group, with champions from marketing, R&D, finance, purchasing, procurement department, manufacturing engineering, and IT. The group first looked at information flows, feed back loops and noted the owner of data sets and documents. The group also built tables to connect the data sets with their owners and users, and this focused attention on key processes, tasks, and the life cycle phases of data. It found much redundant data and lots of duplication of effort. Another serious issue is most engineers self-storing their own data which utilize the resource of company, but the company needed to move the control of source data away from individual engineers. The PDM group recognized, however, this would not happen overnight, hence aiming to major problem to provide the solution. The company particularly wanted to smooth over information flow from R&D to manufacturing, and feedback from manufacturing to R&D. A specific objective was to improve links between CAD and printed circuit board assembly. With a major data problem and a willingness to do something about it, HP had a solution ready by 1993. It was a PDM system owned by HP. Therefore, the group recommended HP to implement the WorkManager at South Queens Ferry for a pilot run. WorkManager offers the concept of the packet which combining master documents, reference copies, forms and notes, and markup into the single entity of the data packet, which can be routed serially or concurrently according to the routing list.

An immediate advantage is that WorkManager was integrated with HP's own MCAD system for mechanical design, and with Mentor Graphics framework which consists of many parts of HP used for PCB design. Other advantages are as followings. Such as: time to transfer engineering change information from R&D to factory, or vice versa, fell from 7 days to 1 day; time to review a document also decreased dramatically as on-line reviewing; an electronic approval from now automates process of ordering prototype parts; the form is simultaneously routed to everyone who reviews and approves the parts purchasing, and streamlining the process.

HP's initial objective was to ensure availability of information at the point of use. Accordingly, the loading of data has received more priority than the routing of electronic work packages among users. Obviously, HP had invested substantial resources in producing design data. It can't take any risks of losing data and the impact of a loss on its customers which could be huge. So the company saw an investment in data management as a necessity rather than a choice that has to be justified using cost benefit methods. However, the strategic benefit is being able to transfer product data among many sites worldwide that is likewise an overriding factor. There

are features of WorkManager PDM system in the future, such as storing a wider range of data objectives particularly to load and store the software for its test and measurement products, the other one is improving the process management of information over the product life cycle. Besides, HP use 9000 A-Class server to mate with many software packages such as Co/Creator, EDS, Unigraphics, PTC, SDRC/Metaphase which provide the solution not for the internal usage but also for sales. After the real experience, WorkManager was up-graded to be Admin Flow/ Change Engine, then up-graded again to be the Process Manager to meet the market requirement. Currently, it was using by Ericsson, Sumitomo Life, British Telecom, Samsung etc.

(2) *Ericsson*

This case describes the way Ericsson Diax A/S Denmark implemented WorkManager PDM system from HP [10]. Ericsson is a telecommunication equipment manufacturer in Denmark. According to annual report from the website of Ericsson, the revenue in year 2000 was around 270 billion SEK (currency of Denmark). Ericsson has 105,000 employees and is active in 140 countries around the world. It combines expertise in switching, radio and network technology, and is one of the leading companies in the field of telecommunications. Ericsson Diax A/S had implemented PDM system to manage all product information through this integrated system to control documentation, hardware, software, product structures and versions, change request and activities. Diax was merged by Ericsson and was renamed to be Ericsson Diax A/S in 1995. The company has developed two main products: Switching System and Wireless Access System. Most employees of the company are engineers and more than half of the staffs are dedicated to R&D. To implement a PDM system to manage and control the document properly in applying for ISO 9001 certification; hence, every engineer will be the user of PDM system.

Diax has test facilities and a small manufacturing facility, but much of the latter is engaged in building prototypes only. Most manufacturing is done by other Ericsson companies or by external suppliers. Diax does undertake some assembly work, as well as equipment setup, checking, delivery, customer instruction and support. Accordingly, the company generates and maintains design of mechanical and electronic hardware, software, documentation, and customer training materials. Along with new products and increasing customers as long as the growth of sales, it was clear that managing all data has becoming a burden and it would constrict its development without proper infrastructure facilities. Several reasons for managing problem include : product development is dynamic sale job, the company size was growing rapidly, there was a strong desire to minimize the administration function, telecommunication systems and services have been in a state of rapid development and expansion, the company's product was complex, low volume, with lot of versions and every customer had different needs, specifically, the company needed a tool that can handle alter management, support searching for and browsing information.

In 1992, Diax formed a small cross-functional PDM steering group. It began searching for a solution and the group examined in detail PDM system from Sherpa, Digital Equipment and Lotus Notes. By 1993, Diax was interested in applying for ISO 9001 certification, which highlighted a need for proper document management and control. At last, it studied the WorkManager system offered by HP (now CoCreate), and a visit was made to a WorkManager customer site in England. It is designed to handle the details of product development cycle and enhance the flow of a data by enterprises, this is primarily provided through WorkManager's packet paradigm of operations. In 1997, Diax implemented version 2.5 of WorkManager on a HP 9000 series server. Therefore, Diax control all the electronic documents, software, hardware configuration, activity and change activity by using the WorkManager. Benefits: It enables the company to conform to ISO 9001, and quick and easy to search/access/reuse information, speed up the product development, provide data security, improve data retrieval correctly and completely, and input fewer resources consumed in the product administration.

Staff numbers and PDM users in Diax continue to expand, but the emphasis has switched to increasing the PDM's functionality. The company needs a HTML interface for WorkManager, to allow its production line and some user in external partner companies to browse more easily. An interface is needed to its parent company's change management system. Also they are thinking of building a data warehouse for sales, marketing, and financial information - all linked to PDM. Overall, this company feels it has built valuable experience with the kind of PDM system that suits its workload and corporate culture best.

(3) *NEC*

This case describes the way that NEC MCD Japan implemented Obbligato PDM system [3][7]. The major product of NEC includes computer, communication equipment, electronic parts, software, internet and solutions. The revenue of year 2000 is around 40 billion US dollars. NEC has 34,000 employees and operates by 310

subsidiaries, departments, and branch offices around the world. NEC MCD (Mobile Communications Division) is a worldwide supplier of mobile phones, pagers, and telecommunication infrastructure equipment.

The R&D department of mobile communication is distributed all over Japan. The R&D department works closely with remote subsidiaries that takes care manufacture and much of the design and engineering takes place. However, there are many R&D departments locate in the whole world. The organization structure creates a working environment of geographic distribution. The major objective of NEC MCD is seeking to maximize productivity by sharing resources across the world. For new product development, it is critical that product data is well organized and easily accessible by Japanese and English user to facilitate remote collaboration.

To improve its efficiency across this distributed working environment, NEC MCD implemented the Obligato PDM solution in 1996. The major function of Obligato PDM is to share both product management and information. It is a product by using a concept of Engineering Chain Management to improve the product competence and business efficiency.

In today's competitive worldwide market, organizations need to be able to leverage remote resources as efficiently as local ones. Obligato PDM software enables NEC MCD to reuse design data, to share data for concurrent engineering, and to reduce the need for paper drawings and forms. It allows non-engineering departments to access product data in the early of the product lifecycle, and it eliminates manual data entry for procurement and maintenance. Obligato also tracks and controls engineering changes and provides security levels so that only the authorized users can access or change documents. Another Obligato PDM user, Anritsu Corporation, is a worldwide provider of advanced networking equipment and measurement instruments. The company selected NEC Systems Obligato II PDM software in 1998. Like NEC MCD, Anritsu sought NEC is not just a PDM vendor, but a partner that could help it re-engineer business processes to make better use of existing data and facilitate collaboration. Anritsu anticipates significant benefits from its Obligato II implementation, including a targeted return on investment of 430 million yen (approximately \$3.5 million US) per year. These savings are expected to result from shortened design cycles, improved product design, better customer satisfaction, reduced costs, and increased data availability.

From the above information, we may find out some critical factors from the successful implementation of the Obligato PDM system at NEC MCD and Anritsu include the followings. For example, acknowledged the requirement to change the PDM system, improved old work flow completely, took care major problems, made the objective to be the solution provider, implemented the PDM system from the famous vendor, hired the consulting personnel from software department or consulting company, integrated and kept the old product data, had considered the integration with other IT system at the beginning, using the internet and the IT technology, reinforcing the training and two way communication, conducted a pilot run at small scale, specified the plan with stages and then carried out the plan step by step, gaining the control right of the product data from the engineer.

(4) OKI

This case describes the way that OKI of Japan implemented PDM system from SDRC [4][8]. The major products of OKI are information processor, communication and electronic parts. The revenue of year 2000 was around 6.7 billion US dollars. OKI has 8,200 employees and operates by many subsidiaries, departments, and branch offices around the world.

OKI commands top market share in ATM devices in Japan, despite pressure of fierce competitors as NEC and Fujitsu. In order to maintain market leadership, OKI has to re-engineering the process completely and implement a new IT technology to reduce the design/engineering and manufacturing cycle times and the IT cost. Hence, OKI needed an integrated PDM system that provides an interface to ERP also.

For the PDM component, OKI evaluated WorkManager, Matrix, IBM, Sherpa, ComputerVision, Metaphase and other packages. Since the package from Metaphase provides more features and more suitable for large-scale implementation. At last, OKI selected the PDM system from Metaphase put together with the data base server of HP 9000 workstation series, a full-time team of software and design engineering determined requirements, developing and implementation schedules, and a working pilot system deployment. From there, it took one year to release the system. Benefits : a sharp drop in design process, an increase in design reusability, much better use of common parts, a reduction in drawing search and acquisition time, a reduction of check in or check out time for drawing and a reduction of IT maintain cost. OKI created another benefit, learned from the implementation

and accumulated the know-how. Keeping on to the partner of Metaphase and Baan, afterward, OKI provided the solution to other company in Japan. In the future, OKI plans to enlarge PDM vision into a knowledge system for the 21st century.

(5) *Acer*

This case describes the way that Acer of Taiwan implemented EPIS/PDM system and its benefits [2]. Acer is a cross country enterprise bases in Taiwan. It is a leading global player in the Internet technology, computing, communications and other electronics technology arenas. Over 25-year history, Acer has embraced four pillars, such as human nature is basically good, customer is No. 1, put knowledge to work for the company, be pragmatic and accountable. Acer recently implemented a new organizational structure focus on its role in Internet-enabling technology. The revenue of year 2000 was around 8 billion US dollars. Acer has 35,000 employees to take active business and operation in over 40 countries.

Acer's Internet Organization is a response to the understanding in the Internet Era, and the company is operating in an arena with no competitors, only partners - partners that rely on each other's experience, expertise and competencies in order to enhance competence. A diversification balanced in different areas of IT, and yet focused in each of these areas at the same time. Acer's five business groups were established as part of Internet Organization. An advanced collaboration system will be a necessity. The strategic objective is by means of global unified product life cycle management to concurrent the enterprise's operations. The tactical objectives are the reduction of product development cycle time, best design quality for competitiveness, product cost minimization for profit maximization.

In 1998, Acer setup a product information application center to take responsibility to implement Enterprise Product Information System/PDM system. Linking business vision to EPIS/PDM system, this is to deploy the project management, engineer change management, product configuration management, component information management and engineer document management. The strategic of EPIS/PDM solution started from market research and the voice from the customer, then the product generation process and order fulfillment process, the last one is customer service process. The flow of software system will be: CAD→PDM→ERP. Within the flow, PDM system provides summary of BOM, option & variants, drawing & spec., engineering change order & engineering change number, target cost to ERP system. ERP system feeds back procurement price, ECR, supplier information, actual cost to PDM system. The project manager will be in the center supported by quality control advisers and project steering committee. Under the project manager, there are three groups. The analysis & design group is responsible for solution architecture & infrastructure design, business process plan & modeling, system design. The application development group is responsible for component information management, product configuration management, engineering document management, engineering change control, system integration. The system support group is responsible for system administration and database administration. This project took 25 months to implement. Strength after implementation: The design data flow in different IT system without manual intervention, manage products with product configuration which can be fit the needs BTC contract, centralized data control but available locally, enriched design data, the electronic work flow environment for design area. Area of improvement : Key in once at a time, data consistence, data reusable & shareable through IT, visual GUI, review and re-build legacy data to avoid legacy data error. The business process is the most important thing and must tightly couple with the IT/IS, uses the consultant, customer centric and keeps the theory in mind, must have concept of management with event-driven concept, leverage the power of steering committee/owner, must be cross function team driver, well understand the culture and pay more effort on buy-in, uncompromising management support and ownership, willingness to change, must have a business architecture to synchronize all the information & products flow architecture.

3. DISCUSSION

PDM and Enterprise Resource Planning (ERP) system are both the backbone of the information system of the enterprise by integrating the complicated flows. Many enterprises treated them as the solution to increase the operating efficiency, to pursue the order. Many enterprise have been implemented this system, but some still can't reach the perceived objectives. Therefore, the successful key factors to implement the PDM system will be worth to study. From the result to infer the effect of compete advantage after the implementation of PDM system, and the conclusion can be the reference for the high rank managers to implement PDM system afterward Product Data Management System.

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