Designing Engineering Data Management System in Research and Development Company

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***Abstract*— In the Global Era, Management Information System has become inseparable part of the company. One of the Management Information System that has been considered important in a company is Engineering Data Management System (EDMS). The role of Engineering Data Management System is to store data as well as providing a user friendly access to the data, as long as the product lifecycle appropriates with the control rules defined before. This study took a case in XYZ Company on designing Engineering Data Management System using Windchill PLM (Product Life Management) to optimize the business process. XYZ Company is a private company that works in research engineering and manufacture. This study brought out new concept using Engineering Data Management System and explains the role of EDMS in XYZ Company's business process.**

Keywords*— *Engineering data management system, Windchill, Product Life Management

I. INTRODUCTION

Managing and sharing design information is the most crucial part in collaboration on Engineering Projects. The Designers and CAD (Computer aided design) Engineers need the appropriate CAD tools to create design and the correct Engineering Data Management System to manage and share the information about the design to the stakeholders. More than 80% technical change occurs because the part cannot be produced or assembled [1]. The failure on designing mostly caused by lack of communication between both design team and manufacture team. Improving the product quality and minimize the production cost are the ways to overcome the problem. Nowadays, many industries have switched to use engineering systems that can work together or collaborative engineering [2]. XYZ is a private company that works in research and manufacturing engineering which was established in 2013. In processing the work, every engineer cannot avoid the jobs related to CAD model design. XYZ Company has approximately 70 engineers who have many different backgrounds from various fields, especially from mechanics, whose main task is making CAD model design. One of the main obstacles that often occurs for every engineer is the difficulty in determining which design will be done the last. Besides, the level of difficulty in designing the product may push the engineers to work on the design alternately. Sometimes, this can cause tracing the last updated design difficult.

Table 1. Constraints and Difficulties in CAD used at XYZ Company

Obstacles	Difficulty	Effect
Sharing Information	Medium	Took times
Traceability	Hard	Hard to find a design
Collaboration	Hard	Alternately
Reporting	Medium	Manually
Status	Hard	Manually

XYZ company, which has background as a company that move in research & development field, has process characteristics that still tentative-, like the existing enterprise companies. At R&D companies, design-revision (either update or downdate) still occurs very often. This can cause mal production or the production results are not compatible with the others and cannot be assembled. Table 1 shows the difficulties experienced by the XYZ company with the use of CAD tools, can be observed in traceability process, collaboration, and the design status itself still experiencing difficulties. The current business processes can push the XYZ Company to perform its process manually, start from the design-process tracking, using flash-disk to collaborate between teams, as well as updating the design-status manually. Because of those, XYZ Company use Engineering Data Management System (EDMS) to resolve the problems in managing the product development needs, start from the design until the product assembled successfully based on the product-design. This study examines how designing engineering data management system tackling the problem on collaborative engineering, traceability design and design optimization in XYZ Company.

II. LITERATURE REVIEW

A. Basic Concept

- EDMS

According to[3], Engineering Data Management (EDM) is a set of techniques and tools for managing, controlling, and distributing all product-related data during the product lifecycle. Engineering Data Management (EDM) has been developed to reduce the new product development cycle while maintaining the old data controls and distribute them automatically to the stakeholders when they need it. With development which could shorten product development process and automatic data controlling, EDMS could be implemented in XYZ Company in its business development. [4] Explains the fundamental role of the engineering data management system (EDMS) is to support the storage of technical documentation and various processes related to product design, manufacturing, assembly, inspection, testing and maintenance of the entire lifecycle.

Table 2 the value-adding functions and services of configuration management and EDMS According to [4]

	Conceptualization	Execution	Exploitation
Configuration management	• *Translates customer requirements into technical language* • *Manages version handling* • *maintains product coherence* • *controls specification and design changes*	• *Ensures product's manufacturability* • *disseminates technical information between vendors and project teams* • *controls specification and design changes*	• *Supports operational and maintenance activities of the system* • *provides a base of learning for future* • *summaries specification and design changes*
Engineering data management system	• *archives design history* • *provides user interface to all product data* • *maintains design process status* • *supports dissemination of technical information*	• *provides continuous source of up-to-date product information* • *supports technical communication between project collaborators from bids to project closure*	• *provides data for an aftermath and learning from the design process* • *helps tracing solutions to maintenance and operational problems*
Main contribution of EDMS	⇒ support and coordination of engineering work/ Information/data flow ⇒ quality of design	⇒ mediation between customer, production and design ⇒ quality of manufacturing	⇒ maintain operational period and establishes learning process ⇒ lifetime support

- PLM

According to [5], the scope and definition of PLM is to expand and meet the demands of the network of industry partners that are increasingly become more complex and spread globally, tied together by common business objectives. PLM is a collaborative backbone that allows people throughout the company to work together more efficiently.

PLM is the activity of managing company products throughout their lifecycle in the most efficient way. By doing this management, companies are allowed to take control of their products. The PLM concept was activated by PLM solution, which is a combination of business processes, methods, engineering applications (i.e. CAD, CAM and CAE) and data management system. Data management systems provide support for a combination of electronic data domes, document management, product structure management, process and project management, and component classification [6].

B. Related Model

A study conducted by [7] introduced the main concepts of Collaborative Engineering as a methodology, procedure, and new tools for designing and developing airplanes (i.e. Airbus Military). Airbus's design and other aircraft industries that used the Concurrent Technology technique were successful in the past few decades ago. The introduction of PLM to new methodologies, procedures, and tools, especially in the industrialization field, and Airbus' aim to reduce the time-to-market conducted by Airbus to engineering to perform various things in different ways.

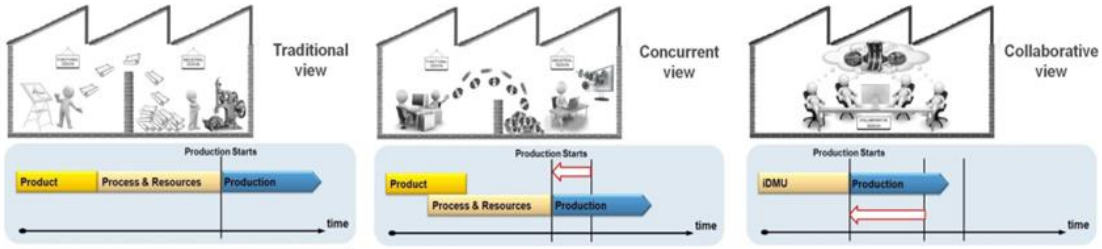

Figure 1. Transformation Traditional view to Collaborative view

Figure 1 explain about how the change happened from traditional view to collaborative view could shorten production starts. To break the boundary between functional design and industrial design and to make the design process with a unique team with unique results, iDMU is the goal of Collaborative Engineering. Hence, XYZ Company uses an engineering data management system to manage the needs of product development. This study aims to analyze the Engineering Data Management design by using Windchill PLM in helping the product development process at XYZ Company.

III. PROPOSED CONCEPTUAL MODEL

A. Existing Process vs Proposed Process

On the proposed concept, this study added engineering data management system using windchill PLM on the existing process, then it will support the collaborative engineering process. The process of collaborative engineering will able to optimize business processes that had been existed before. The current business processes can push the XYZ Company to perform its process manually, start from the design-process tracking, using flash-disk to collaborate between teams, as well as updating the design-status manually. Collaborative design is implemented in XYZ Company to resolve its problems so all the process can be done automatically. Figure 2 have shown comparison between existing processes and the proposed process, all processes are carried out with the support of Windchill PLM.

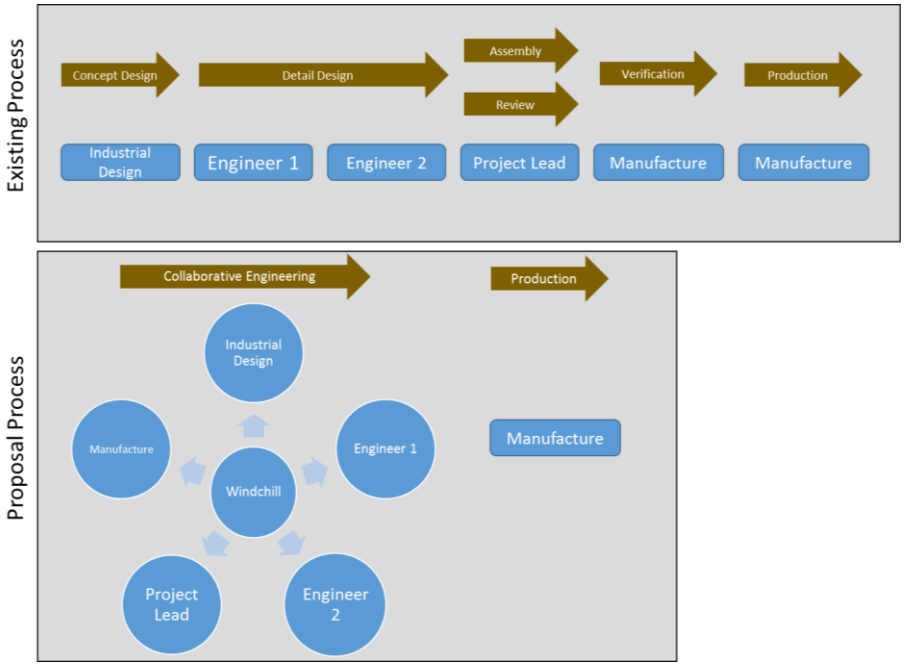

Figure 2.Existing Process VS Proposed Process

Starting from the Industrial Design department to make concept designs, after the industrial design work is finished, the system will be reviewed and approved by project leads under considerations, then the data will be stored on the server, then the project lead will divide the task to the Engineer team to do design detail for each part simultaneously which will be controlled by status, update, and system report. The final result of the design detail is that the design will be assembled and reviewed by project leads which will then be confirmed in the manufacturing section to be produced. All forms of processing will be recorded by Windchill PLM, which makes it easy for users to track down the designs when there is an error, and

makes it easier to make reports for each process. In this Collaborative design, the proposed process is proposed to optimize the work processes that exist in the XYZ Company.

B. EDMS Architechtur

XYZ company will apply engineering data management system using Windchill PLM based on web server, for the access it will be supported by email and media notification to the users, so we could see figure 3 which is the design architect of the EDMS for XYZ company.

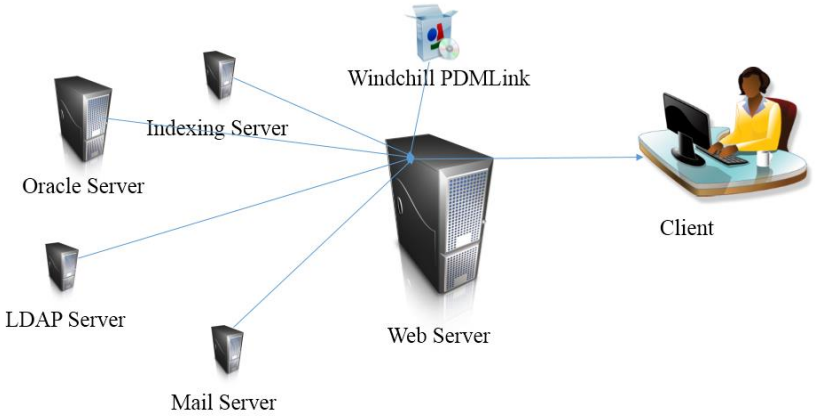

Figure 3.EDMS Architecture

1. Windchill Server:

   Is a program where all data management and business processes are carried out in general, divided into several sub-components:

   - Method server: child process where all the execution processes take place.
   - Background method server: child process that manages server methods, for example for running a server method that crashes when processing documents. For one windchill instance, there is only 1 background method server.

2. Database server: By default, this server is a place to store all objects, both cad etc., user or organization data, and also business processes or workflows. The database used is oracle or sqlserver.
3. http server: even though the server method of the wind-chill starting from version 10 already has an embed web server (tomcat), the webserver is considered less for the windchill context which is also designed for cluster scenarios.
4. Ldap server: briefly, this server is an identity server to set up anyone who has authority (authorization and/or authentication). By default, Windchill uses OpenDS. However, it can also use Microsoft Windows' active directory.

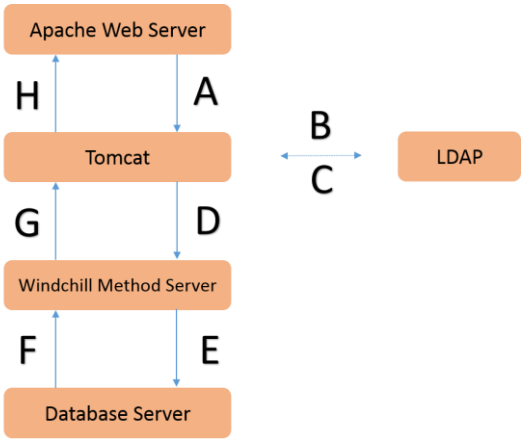

Figure 4.Data Processing flow

- -(a) A request from the client (can browser) come to the webserver endpoint (http: // server / Windchill / path /certain), if the endpoint is known by apache and leads to the windchill, it will be forwarded to the tomcat and will be continued to the server method. Else, if it fails, the process (h) will contain an error message.
- (b) The request that are forwarded from Apache, Tomcat will consult with LAP regarding authorization and authentication from the request.

- (c) The request that are forwarded from Apache, Tomcat will consult with LAP regarding authorization and authentication from the request.
- (d) The request received from the tomcat will be processed, depending on the type, it will be forwarded to the database or not. For example for resources such as is or css, then process (g) will be executed and return the requested file. As for, for example, a list of users, the process (e) will be executed.
- (e) Method server sends queries to the database based on requests from clients.
- (f) The results of query execution suppose an error occurs, then (f) contains an error. If there is no error, the results of the query will be returned to the server for processing.
- (g) Regardless the result of the process (f), windchill will send it on tomcat
- (h) And finally, Apache answers requests from clients in accordance with the processing results.

C. Collaborative Engineering Step

In designing EDMS based on collaborative engineering, based on this step:

- Identification
  In this phase, this research includes identification, background, and problems in XYZ Company, until current business model in this present time.

- Development
  In this phase, this phase tries to create new design of business model to resolve xyz company problems using collaborative engineering.

- Implementation & Analysis
  In this phase is the implementation in XYZ Company and doing the analysis, is the new business model could resolve the problems in XYZ Company.

- Evaluation
  Evaluation phase is the phase to fix from the implementation and analysis which is expected according to the problem which is appear in the company.

IV. RESULT AND CONCLUSIONS

This study summarizes how the implementation of EDMS could interbreed the existing business processes. Windchill PLM is used for implementing collaborative engineering for each existing process. The EDMS would tackle the obstacles that exist in the XYZ Company regarding work in collaboration, design traceability, and design optimization. The Windchill PLM design architecture framework has also been neatly arranged, so by the combination of new systems and introduction to users, EDMS will be able to help XYZ Company in optimizing the company's business processes.

V. FUTURE WORK

For the time being, this research is currently running until development phase, and need to be implemented in XYZ Company which is based on research and development to see the result of the design system collaborative and could get data. After collecting data in implementation phase, next will be analyzed whether the implementation of the collaborative engineering could resolve the problem appear and proceed to the evaluation phase to get the improvement for the next research. Due to company background, policies must be reviewed to ensure the affect workflow. In general, Human Resource development also needs to be done to support the way EDMS has been designed

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