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CONCURRENT ENGINEERING FOR PROCESS IMPROVEMENT OF PRODUCT

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Abstract

Nowadays the competition among companies is so compelling that they should not only be on the top of technology in the area, but also run their business according to life-long models. The emphasis on the product post-sale life is common for these models. It embodies team values of cooperation, trust, and sharing in such a manner that decision making proceeds with large intervals of parallel working by all life-cycle perspectives early in the process, synchronized by comparatively brief exchanges to produce consensus. The various elements of product life cycle like manufacturability, assimilability, testability, serviceability, reliability, quality, cost, disposability, user requirements etc. are incorporated during the product design and development phase. CE is designing and validating a total product, its manufacturing process, and its maintenance process, all at the same time.

Keywords: *Lead time, Manufacturing methods, Concurrent design of products.*

Introduction

CE is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life-cycle from conception through disposal, including quality, cost, schedule and user requirements. CE is a systematic approach to integrated product development that emphasizes the response to customer expectations. Concurrent Engineering is a systematic/management technique used for product development, which provides an integrated approach to the design of products and their related processes from concept to disposal.

Need of Concurrent Engineering

There are many reasons that have influenced the need of CE, like:

Lead-Time: One of the prime motivations for concurrent engineering approach is the desire to decrease or shorten the product development time or lead time. It is fully recognized that addressing all the problems of product life cycle in the design phase shortens the product lead-time. These days, for some products, average product lifetime is less than the average product development time. Therefore, for a company to survive and remain competitive, it has to decrease the product development time maintaining the high quality and low cost.

New Manufacturing Methods/Technology Push: New manufacturing processes are being developed continuously. Newer methods may bring down the costs, production time and even may improve the quality. But, such knowledge is often with the production engineer and not the design engineer. Therefore, to make the optimum use of newer manufacturing methods, close cooperation between design, production, and R&D departments is essential.

More Demanding Customers: These days, customers are becoming increasingly more demanding. Low costs and good quality they take for granted and then they demand products, which are more closely targeted to their needs. Companies, hence, have to be not only effective but also

innovative too to fulfill the demand of customized products.

Basic Principles in CE:

- Start all tasks as early as possible.
- Utilize all relevant information as early as possible.
- Work structuring: Systematically structure the work or work environment so that each task can be performed independently of each other either by a human being or a machine or a computer.
- Everyone participates in defining the objectives of their work.
- Operational understanding is achieved for all relevant information as team will work better if they know what other members are doing, e.g. what constraints a team member would encounter when certain parameters will be changed.
- A strong commitment is made to adhere to the decisions taken earlier.
- Decisions are made in a single trade-off space.
- Decisions are robust, overcoming a natural tendency to resort to quick, novel decisions.
- Trust among teammates. Trusting members, if they agree to accept responsibility for a task, prefer to work together rather than in isolation. This will also lead to better teamwork affinity.
- The team strives for consensus.

Planning for Concurrent Engineering Implementation

- A top-down design approach based on a comprehensive system engineering process: This feature requires top management support for successful implementation of CE. Neither pure participative nor pure authoritative approach is compatible. What is best for CE is the assignment of clear management responsibility with participation from other responsible managers and peers representing the various disciplines of product life cycle. All are involved in the decision making to allow consensus building.
- Cross-functional or Multidisciplinary teams: Team members should be picked up from across the life cycle of product development and process development as well as from important suppliers, customers and ancillary units. The team members should be selected to ensure a balance of characteristics appropriate for the tasks and goals the team has to meet. The same team cannot tackle every task successfully, so choose teams to reflect the demands and requirements placed on them for the particular task.
- Continuous improvement: This requires focus from the top management. This requires a design trading system as well as easy access to the library of lessons learned from previous product development programs and also from the lessons learned from earlier life-cycle phases. What is essential for this is an automated configuration management and control system with shared computer knowledge bases.
- Human minds cannot practically work simultaneously on multiple tasks. Work should be structured properly and layout a computing environment that allows shared information database with open access to all the participants in the organization or product development team.
- Team should be formed as early as possible in the design phase and be continued along the life cycle phases of design, manufacturing & support. Special training should be provided and incentives should be planned for members who continue with the team.

Design for Manufacturing

Customer's needs and product specifications are useful for guiding the concept phase of product development; however, during the later development activities, teams often have difficulty linking needs

and specifications to the specific design issues they face. For this reason, many teams practice **design for manufacturing**, which is of primary importance because it directly addresses manufacturing costs.

Integrating Mechanisms

Integrating mechanisms are practices, policies and procedures facilitating concurrent engineering: these can be developed and/or exacted by any level from top management level to team leaders depending upon the type of organizational structure, type of management and the practices, policies and procedures concerned. In the integrating mechanism, all the interested departments must "sign-off" their approval of the design. It is a potentially weak form of the cooperation since the approval is needed at the end of the design and as such there is no mechanism to ensure that the departments will be contacted in the early phase of the design. By the time a department is contacted for its approval many decisions may already be irreversible and the ability to change may be limited. Nevertheless this potentially useful mechanism to create cross-functional information flow and cooperation is a logical method of resolving various conflicts of interest by making all departments a party to the final decision.

Changing the Design Process

In order to implement a design for manufacturing program firms must be willing to undergo change. These required changes involve tailoring the design and development process and the traditional organizational structuring to fit the principles of DFM. Sequential processes must be integrated into concurrent design processes. Distinct departmental barriers must be broken down and departmental collaboration must be embraced. Employees must be led away from individualism and trained to be team players. Designers must be educated on manufacturing operations and all employees must be aware of how the choice that they make affects operations later in the development process. In order for all of these changes to occur there must also be a strong commitment from upper management.

Use of Intelligent CAD Systems and Other Computer Technology in DFM

Computer technology has revolutionized the design and development process over the last decade. The increased use of CAD systems and the technological advances in expert system applications has provided designers with the tools to make DFM that much easier. Many designs may be modeled and analyzed on CAD systems thereby enabling design problems that would normally not be discovered until later in the design process, to be discovered in the modeling phase. Computer modifications are much easier and dramatically less costly than design modifications at latter phases in the product development process. Artificial intelligence is also beginning to be integrated into many CAD systems. This can provide the designer with expert information on manufacturing limitations and operations as well as information on many other aspects of the development process while he is designing a component. This will enable the designer to develop designs which are manufacturable from the start.

Potential Advantages Of Using Design For Manufacturability

- Faster time to market which results in increased market share.
- Lower manufacturing and production costs.
- Improved quality of resulting end products.
- Increased positioning in a highly competitive world market.
- Increased accuracy in predicting and meeting project plans, schedules, timelines, and Budgets.
- Simpler product structures.
- Reduced parts count.
- Increased efficiency and performance.
- Higher reliability in the product development process.
- Reduced defect rates.
- Increased effectiveness in transferring technology.
- Increased customer satisfaction.

Design for Quality

In the recent years, quality of manufactured goods in the globalized market has received centralized attention. The three factors recognized to be crucial for profitability of a new product are quality, cost and development time. In the midst of this scenario, it can

be conclusively said that the rival companies that do not incorporate quality at the design level itself must forcibly resort to the following painful alternatives:

- Utilize extensive testing and screening facilities in order to supply customers with products of comparable quality
- Selling goods of lesser quality

Benefits and Future scope

Concurrent Engineering has been the focus of many industrial organizations for new product development, due to the ability of the cross-functional team to reduce the total time to design and manufacture or time to market. This reduction in the time to market is a major source of competitive advantage in the manufacturing environment we have today. Use of concurrent engineering should improve the performance of the organization in general but certain human and organizational characteristics may affect the degree to which improvement is felt in the organization.

In today's competitive manufacturing environment design for manufacturability has proven to be a successful tool in the design and development process. When DFM is successfully implemented the results can be better quality, higher productivity, reduced time to market, reduced material usage and considerable cost saving to name a few. However, successful implementation of DFM is not a trivial process. It requires dedication, commitment, and radical organizational changes. Even though many manufacturers now utilize some form of DFM there is a vast difference between the companies that have successful DFM processes and those that do not. There are several reasons for failure or ineffective DFM process.

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