

# Title: The Role of Communication in Concurrent Engineering

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## The Role of Communications in Concurrent Engineering

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#### INTRODUCTION

"Better quality", "lower prices" and "newer models" are the basic requirements of today's market place. Increasing competition forces companies to introduce numerous of improvements in the product development process to meet these requirements. Quality Function Deployment, Design for Manufacturability, Design for Assembly are just three of these tools. Some of the improvements have fundamentally changed the way products are developed and the way companies do business. The number of companies which are adopting these changes is quickly increasing and most of them realize that if they fail to keep up with these changes they may loose the competitiveness in the market.

Another one of these new tools-or principle-that the companies are implementing is Concurrent Engineering (CE). Since the 1980's it has been increasingly implemented by a wide range of companies. Since time to market is a critical success factor in new product development, companies are turning to concurrent engineering as a way to speed up product development, lessen the likelihood of having to make costly changes later in the process, and reduce time to market [2], [12], [16].

Concurrent engineering seeks to reduce the development time by eliminating the "throwing over the wall" nature of traditional serial approach through a better integration of activities and processes. Traditional approach contrasts intensively with the concurrent engineering and does not require lot of communication between each departments [4], [8]. On the other hand concurrent engineering is largely an organizational and managerial challenge to organize communication between the different parties involved, early design reviews by the development team and applying value engineering / quality function deployment [3]. This research paper will focus on the importance of communication in concurrent engineering and analyze what kind of problems are faced.

#### **CONCURRENT ENGINEERING**

The following definition of concurrent engineering suggested by the researchers at the Institute for Defense Analyses (IDA):

".... a systematic approach to the integrated, concurrent design of products and their related process, including manufacturing 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 ."[6]

Karim and Hauptman suggest that basic principals of concurrent engineering include common goals, complete visibility of design parameters, mutual consideration of all downstream decisions, overlapping problem-solving, harmony to resolve conflicts, teamwork, and continuos improvement. These principals stress the importance of collaboration, communication, cooperation and consensus [14]. It can be argued that without an effective communication mechanism it is almost impossible to accomplish these requirements of concurrent engineering.



Figure 1

Yasemin Turktekin EMGT 510 NPD Figure 1 represents the role of communication in CE. It is obvious that basic principals suggested by Karim and Hauptman are tied to each other by means of communication. The success of concurrent engineering depends on the level of integration and communication [7], [19]. Without detailed technical, market, political and financial information flow among the parties, it is unlikely that the new product will meet both customer needs and the expectation of others in the organization [5].

#### THE IMPORTANCE AND THE ROLE OF COMMUNICATION IN CE

In order to understand the concept of concurrent engineering, an important distinction must be made between information transfer versus knowledge sharing. Information transfer means simply the distribution of the information, which is adopted by the traditional approach, and it can be accomplished via either documents, electronic mail or just verbally. On the other hand sharing knowledge means effective communication and understanding the information [5].

An example to this effective communication is Boeing 777's development. Boeing stressed the importance of communication to produce a high quality design. This tremendous emphasis helped to avoid many problems to arise because of the complexity and the size of the project. It had more than 200 teams and approximately 100 suppliers involved in 777's design. Information sharing between product designers and key suppliers was frequent which was one of the key success factors of the development [13]. This approach has also been supported by Karim and Hauptman. They emphasize the importance of two-way communication which leads to information sharing. According to their literature search the communication and interactive feedback was found to be an essential determinant of success in R&D and product development teams [14]. On the other end of the spectrum, that is when the information is not readily available and shared. Hayes, Shaw and Tan stress the importance of communication in new product development by stating that the insufficient information and communication between phases are two reasons that cause long development cycle [8]. Most of the articles about management of CE highlight the importance of the effective communication among the involved parties early in the design stage [14], [10], [3]. These involved parties include customers and suppliers along with cross-functional team which mostly consists of design engineers, marketing, purchasing, manufacturing engineers [10].

Applying QFD can foster the communication with the customer as well as the success of the concurrent engineering. The well established communication with the customer can be considered as a means of feedback, which will help to evaluate the requirements and adjust changes on a timely basis [11]. Same trend has also been observed in the case studies that we have examined in the course. In all of the cases an effective means of communication has been established in order to bring the customer into product development phase.

Communication is a key element of teamwork, and it is extremely important to the successful implementation of concurrent engineering. The diversity of the parties involved can cause communication problems and prevent team cohesiveness. It can be very difficult to get team members to agree on team goals, problems, solutions and to reach a consensus [7],[16]. For example marketing people and engineers talk in different languages. As Filipczak indicates " Putting engineers and marketers in a room together to share ideas could be a recipe for disaster". He also adds that "The engineers are not people people, they are thing people and not very good at communicating" [4]. According to Liker, Sobek, Ward and Cristiano, the primary bottleneck for effective CE is in the ability of design engineers to communicate and make sound decisions [10]. This might be because that the design engineers don't realize that the information-sharing is a performance issue, it is not just they would rather do it or not based on their personal preferences [4].

Contrary to many people's view, concurrent engineering isn't technology driven. It's a people process [16]. Filipczak advocates that " The perfect concurrent engineering team would consist of one person who knows all the facts", so that there would be no communication and integration problems [4].

Members of the team must feel free to communicate with one another in an expedient and open manner. Harris and Koshy stress the importance of locating the members closely in order to improve the communication and to foster a group spirit [7]. However, in some situations scattered design and manufacturing locations, as a result of economics, mergers and historical factors are inevitable. When the members of a cross-functional product development team located in different part of the region or the world, their separation becomes a significant barrier to effective communication [18].

Griffin and Hauser advocate that there is a strong relationship between the level of communication and the distance among the team members. Moreover, they mention that the probability of that two people communicate at least once per week drops off rapidly with the physical distance between the offices, with the probability of communication less than 10% at office separations of 10 meters [1]. If the collocation is not a possible than the communication between remote teams should be supported with electronic network or commercial e-mails in order to expedite the transfer of information [7].

As mentioned earlier in order to getting the separate projects work concurrently communication among teams is the fundamental factor. So, in big projects having a fewer chain of command will lead more effective concurrency [4]. A concurrent engineering team relies heavily on person-to person communication within the project team. Lack of efficient and effective communication can lead to project failure. Product development projects' communication infrastructure consists of any system, equipment and software that facilitates the meaningful transfer of information relating to the project. It will determine the degree to which data from various disciplines can be meaningfully organized and accessed [9].

A system can be manual, interpersonal, or computerized. Interpersonal and manual systems are usually found in very small projects and organizations. It will usually take one of the form of conversations, memos, and meetings [9]. Depending on the size and the complexity of the project the means of communication may vary. As Swink, Sandvig and Mabert observed in their study, Some of the projects that they have studied focused on collocation and face-toface communication. The projects focusing on quality of design, had more formal presentations and design review meetings, on the other hand projects focusing on time used more informal communication [13].

### THE ROLE OF COMPUTERIZED TOOLS IN CE

Compared to the traditional (sequential) product development approach, concurrent engineering has much more information load. This requires and put emphasis on the information process capacity of the organization. Therefore, effective use of computer-based technologies may become a necessity for managing the concurrent engineering effort [6].

Computer-aided design, computer-aided engineering analysis, and database technologies not only can facilitate the design efforts of individuals, they can also promote standards and lead to synergies [6].Early implementers have found that concurrent engineering to be slow and inconvenient unless electronic data interchange/electronic graphics interchange (EDI/EGI) technology is used to achieve rapid, efficient and error free communication between disparate project members [20]. Many companies have been successful in using computerized design tools in order to over come the distance barrier. For example electronic design for manufacturing (EDFM) conference is one of the tools that AT&T uses to review their PCB designs at a distance. With this tool, both design and manufacturing sites get identical update. The EDFM software in use at both sites initiates the conference and manages the sending, receiving, and updating for changes. With the real time feedback and interactive nature of the conference, the team can quickly brainstorm and explore multiple design alternatives in rapid succession, avoiding many iterations and misinterpretations. Finally, the participants in this conference report that the dynamic communication through this tool raised the level of teamwork between design and manufacturing and also reduced the development time [18].

Through shared, computerized design tools and frequent communication via fax, electronic e-mail, tele-conferencing, and high-speed data links it is possible to achieve effective communication. Anderson suggests that many companies have the capabilities to build such networks but some of them lack the necessary open and cooperative work environment. Human resource development workshops in communication skills can help concurrent engineering teams create a favorable climate for network communication. The training should also address the technical aspects of the electronic communication [15] [16].

Information technology supports concurrent engineering, not the other way around. For concurrent engineering to be effective, designers and manufacturing or production engineers have to be able to share information. They should feel a sense of commonality [16].

Many companies like AT&T, Boeing, IBM, Digital Equipment Cooperation, Johnn Deere, and Grumman have stated that the using computerized tools has been very supportive to concurrent engineering [6]. High Tech information users must first consider what they have to say as well as how to say it to capture the attention of the recipient. Information must be perceived as relevant and accessible, and organized for digestibility [17].

The presentation and characteristics of information are also important factors to have an effective communication. For instance, computer graphics and supplemental audio-visual aids are found to be "critical" aspects of information interface. There is too much information that must be communicated to keep pace with new product development to allow for inefficiencies. Both marketing and engineering personnel must learn to package their information from the perspective of their counterpart to help ensure its efficient acquisition and utilization [17].

In the future, all these computer and communications developments are expected to eliminate the need to relocate people. On the contrary nothing has proved a complete substitute for face-to face communication [21].

### WHAT CAN BE DONE TO IMPROVE COMMUNICATION

Concurrent engineering is indeed designed to generate discussion and controversy before design decision are made [10], [9]. One of the ways to increase the amount of communication and coordination between design and manufacturing functions is to use liaison personnel to avoid any possible problem at the beginning. Liaison personnel are not members of any functional piece of an organization, but rather people who are capable and prepared to address issues that span functional organizational boundaries [17]. So that Team will have a center point to use as a means of communication.

Before implementing CE, communication structure needs to be reviewed and improved. It is also important that staff understand why CE is being adopted and that will evolve continuously and their collaboration is needed for the sake of success [11]. Management support is tremendously important, in order for concurrent engineering to work, management must encourage teamwork, improve communications, and organize for an integrated design phase [7].

As mentioned in previous sections, engineers are not very good at communicating. These talented people are first ones to resist to communicate, so hiring engineers fresh out of school might be a valuable way to avoid this problem. With the right training these engineers will learn how to and what to communicate from the beginning [4].

Contrary to people's view hierarchy is not an obstacle for effective communication, it is the walls between departments. If those can be flattened then communication will not need to travel to too many departments. Implementing concurrent engineering has built a new hierarchy in Boeing 777's development and was not an obstacle for the communication [4], [13].

In early stage of design phase going slowly and considering all possible alternatives may facilitate more effective communication. Along with this, developing a CAD database early in the design process can be a very useful means of communication which will create a common language between design and manufacturing engineers [10].

#### CONCLUSION

The importance of communication in concurrent engineering is obvious. In order to concurrent engineering be successful, team members must be free to communicate both good news and bad news; management must feel free to communicate openly about the overall business of the organization, the total strategy, and the company's competitive situation. The channels of communication must be open so that everyone in the organization sees the whole picture and not just a piece of it [5].

For concurrent engineering approach to be effective, there must exist a strong level of communication between all the involved parties. Distributed information sharing and collaborative/cooperative work are signs of effective communication and important techniques to maintain or exceed the current level of concurrent engineering.

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