CONCURRENT ENGINEERING (http://www.referenceforbusiness.com/management/Comp-De/Concurrent-Engineering.html)

Concurrent engineering is a method by which several teams within an organization work simultaneously to develop new products and services. By engaging in multiple aspects of development concurrently, the amount of time involved in getting a new product to the market is decreased significantly. In markets where customers value time compression, fast-cycle developers have a distinct advantage. Additionally, in many high-technology areas such as electronics and telecommunications, product-technology performance is continuously increasing and price levels are dropping almost daily. In such areas, a firm's ability to sustain its competitive edge largely depends on the timely introduction of new or improved products and technologies. More and more, the time parameter makes the difference between mere survival and substantial profit generation. Concurrent engineering is a key method for meeting this need of shortening a new product's time-to-market.

SEQUENTIAL NEW PRODUCT DEVELOPMENT

In the past, commercial success was practically guaranteed for companies that could design, develop, and manufacture high-quality products that satisfied real needs at competitive prices. However, beginning in the early 1990s this traditional formula radically changed as time-to-market became a vital component of commercial success. Studies have demonstrated that being a few months late to market is much worse than having a 50 percent cost overrun when these overruns are related to financial performance over the lifecycle of a new product or service. In other words, time has become a key driver of competitive success, from design and development to the actual launch of a new product or service.

Traditional project planning and execution has been marked by the definition of objectives and mile-stones. These goals are met through a progression of networked activities, some of which must be performed sequentially, others of which may be conducted in parallel. Planning techniques such as Program Evaluation and Review Technique (PERT), Graphical Evaluation and Review Technique (GERT), and Critical Path Method (CPM) have been used to support this sequencingof tasks and activities. However, until the beginning of the 1990s time compression was not a major issue in the new product development environment. In the planning and scheduling of tasks and activities, any time compression concerns were only implicitly present.

CONCURRENT NEW PRODUCT DEVELOPMENT

Because time has become a competitive weapon, time pressures have become central to the project-based new product development organization. These pressures have led to the explicit understanding that time compression is a driver of project (and subsequent business) performance. As a consequence, methods, techniques, and organizational approaches have been designed and developed that allow for time compression needs to be handled in a proper manner. All time-centered approaches have one principle in common: they attempt to maximize the number of major design or development tasks that are performed concurrently, thus the concept of concurrent engineering.

In a concurrent engineering environment, even if certain tasks cannot be completely executed at the same time, designers and developers are encouraged to achieve maximum overlap between otherwise sequential activities. In other words, concurrent engineering aims at achieving throughput time reductions by planning and executing design and development activities in parallel, or by striving for maximum overlap between activities that cannot be completely executed in parallel (for example, when one of the tasks or activities requires information to be partially generated during a previous task or activity).

Therefore, concurrent engineering is based on the premise that the parallel execution of major design components will decrease the throughput time of projects, thus reducing the time-to-market for new products and services.
Many companies have benefited from this same approach. Firms like Intel and Canon have been among the leaders in shortening their product development cycles through the implementation of concurrent engineering. However, this trend has not been limited to individual companies; complete industry sectors also have implemented concurrent engineering principles. At the beginning of the 1990s, the automotive industry pioneered many of the concurrent engineering concepts and their implementation. By early 2000s, many industries, including electronics and pharmaceuticals, were behaving in much the same manner.

IMPLEMENTING CONCURRENT ENGINEERING

In a concurrent engineering environment, teams of experts from different disciplines are formally encouraged to work together to ensure that design progresses smoothly and that all participants share the same, current information. The project and problem-solving methods and the technologies utilized make up the essential elements through which parallelism in new product design and development can be achieved. Following is a discussion of how each of these elements contributes to concurrent engineering implementation.

PROJECT METHODS.

Project methods based on team-work, milestone management, and target-oriented work definition and follow-up are paramount. These methods also must be supported by appropriate senior management commitment and incentive systems. Each team is granted a large degree of autonomy to solve design problems where and when they occur, without much hierarchical intervention. However management must ensure that the transfer of information between different activities or tasks is smooth and transparent. Also, the means of experimentation must allow the experts involved to rule out differences in interpretation on the functional and technical design parameters. In other words, for concurrent engineering to be successful, information and interpretation asymmetries between the experts involved must be avoided whenever possible.

PROBLEM-SOLVING METHODS.

During design and development projects, methods are utilized that foster and support smooth interdisciplinary problem definition and problem solving. Methodologies such as brainstorming open the boundaries of the team to allow for wider ranges of alternative design definitions and solutions to be considered. The use of methodologies like Quality Function Deployment (QFD) further aids experts from different disciplinary backgrounds to jointly define a product's functional and technical requirements. Activity flow chart methods such as IDEF3 allow for detailed planning and monitoring of the different parallel and overlapping activities involved in project execution. Failure Mode and Effects Analysis (FMEA) allows for a systematic investigation of the occurrence and impact of possible flaws in the new product design. The use of Design of Experiments (DOE) enables the systematic identification of critical product/process parameters that influence performance. These are just a few of the many supportive methods that can be used in a concurrent engineering environment. The sources listed at the end of this essay provide more detailed and exhaustive overviews on these and other methodologies supporting concurrent engineering.

TECHNOLOGIES

In concurrent engineering, design technologies are utilized that foster efficient cross-disciplinary analysis, experimentation, and representation of new product designs. Some examples of these technologies include: three-dimensional (3-D) computer-aided design (CAD) systems, rapid prototyping techniques, rapid tooling and rapid testing techniques, as well as techniques that enable the representation of product designs in a virtual context. These design technologies are important because of the key information they convey: their 3-D character allows the expert to interpret design features in a more effective and efficient way.

All of these technologies contribute to the reduction of interpretation asymmetries between the experts involved, as well as to fast-cycle design and development, because they allow for high-speed iterations of analysis and experimentation on both concepts and models of the product. Thus, they modify traditional project management approaches by allowing for more systematic and flexible experimentation and iteration to be included throughout the project's design and development process. In fact, the time and cost incurred by the development and construction of prototypes generally are reduced by factors of 2 to 5 when using digital (e.g., 3-D CAD) and physical (e.g., rapid prototyping) technologies. These tools have become an important enabling factor in the concurrent engineering environment. Without their implementation and further upgrading, concurrent engineering might never be able to realize its full potential in terms of design cost and lead-time optimization.

This brief overview has provided a summary of the why, what, and how involved in implementing a concurrent engineering philosophy for the development of new products, services, and processes. It has outlined how introducing overlap during the execution of innovation project tasks and activities has become vital because of competitive pressures that force new product developers to be more time-conscious.

However, a final caveat is warranted. Although concurrent engineering is an important method for handling the time pressures that occur during new product development, rushing products to the market can sometimes be a mistake. First, markets need time to develop. Numerous examples exist where a new product was too early for the market to absorb it or where product variety has reached limits beyond which the product choice decision becomes too complicated for customers. Second, more revolutionary new product development, which often is based on significant technological advances, typically requires longer time horizons to reach completion. Putting too much emphasis on time compression may blind an organization to this basic fact. Third, the conceptual development of new product ideas requires time or "slack." In a high-speed development organization, time-compression imperatives may undermine this need. Therefore, both managers and new product developers need to find a balance between the paradoxical needs for speed and slack in their organizations. Despite its efficiency, concurrent engineering will only prove to be effective when this balance is achieved through the experience and leadership of an organization's senior management.