Concurrent Engineering

The importance of speed in product development cannot be overemphasized. To succeed in highly competitive markets, companies must churn out new products quickly. Nearly every industry is focused on reducing product development cycles. Whereas automakers once took as many as eight years to develop new models, most are now striving to do it within a year. Rapid product development demands the involvement and cooperation of many different functional groups within an organization, such as marketing, engineering, and manufacturing. Unfortunately, one of the most significant barriers to efficient product development is poor intra-organizational cooperation.

In many firms product development is accomplished in a serial fashion, as suggested in Figure 7.1. In the early stages of development, design engineers dominate the process. Later, the prototype is transferred to manufacturing for production. Finally, marketing and sales personnel are brought into the process. This approach has several disadvantages. First, product development time is long. Second, up to 90 percent of manufacturing costs may be committed before manufacturing engineers have any input to the design. Third, the final product may not be the best one for market conditions at the time of introduction.

Concurrent engineering is a process in which all major functions involved with bringing a product to market are continuously involved with product development from conception through sales. Such an approach not only helps achieve trouble-free introduction of products and services, but also results in improved quality, lower costs, and shorter product development cycles. Concurrent engineering involves multifunctional teams, usually consisting of 4 to 20 members and including every specialty in the company. The functions of such teams are to perform and coordinate the activities in the product development process simultaneously, rather than sequentially. For example, Boeing A&T has more than 100 integrated product teams (IPTs) that oversee the design, production, and delivery of the C-17 aircraft's more than 125,000 parts and supporting services. Developing a unique approach, AT&T established nine expert breakthrough teams—called Achieving Process Excellence Teams—that identify process improvements for developing and deploying products faster in the market. They establish standards, procedures, and training for cross-functional communication that prevents problems from occurring. At The Ritz-Carlton Hotel Company, customized hotel products and services, such as meetings and banquet events, receive the full attention of local hotel cross-functional teams. These teams involve all internal and external suppliers, verify production and delivery capabilities before each event, critique samples, and assess results.

Companies such as Apple and Jawbone (a producer of Bluetooth earpieces)—both on *Fast Company* magazine's list of the worlds 50 Most Innovative Companies—exploit concurrent engineering to achieve a competitive advantage.[5] Typical benefits of concurrent engineering include 30 to 70 percent less development time, 65 to 90 percent fewer engineering changes, 20 to 90 percent less time to market, 200 to 600 percent improvement in quality, 20 to 110 percent improvement in white collar productivity, and 20 to 120 percent higher return on assets.[6]

Design for Six Sigma

Design for Six Sigma (DFSS) represents a structured approach to product development and a set of tools and methodologies for ensuring that goods and services will meet customer needs and achieve performance objectives, and that the processes used to make and

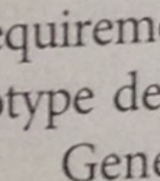
deliver them achieve high levels of quality. DFSS helps designers and engineers better translate customer requirements into design concepts, concepts into detailed designs, and detailed designs into well-manufactured goods or efficient services. Through good communication and early involvement in the product development process, this approach leads to reduced costs, better quality, and a better focus on the customer. DFSS is a complementary approach to Six Sigma methods for process improvement, which we will learn about in Chapter 9. Most tools used in DFSS have been around for some time; its uniqueness lies in the manner in which they are integrated into a formal methodology, driven by the Six Sigma philosophy, and with clear business objectives in mind.

DFSS consists of four principal activities:[7]

1. *Concept Development:* Concept development focuses on creating and developing a product idea and determining its functionality based upon customer requirements, technological capabilities, and economic realities.
2. *Detailed Design:* Detailed design focuses on developing specific requirements and design parameters such as specifications and tolerances to ensure that the product fulfills the functional requirements of the concept.
3. *Design Optimization:* Design optimization seeks to refine designs to identify and eliminate potential failures, achieve high reliability, and ensure that it can be easily manufactured, assembled, or delivered in an environmentally-responsible manner.
4. *Design Verification:* Design verification ensures that the quality level and reliability requirements of the product are achieved.

These activities are often incorporated into a process, known as **DMADV**, which stands for *define, measure, analyze, design,* and *verify. Define* focuses on identifying and understanding the market need or opportunity. *Measure* gathers the voice of the customer, identifies the vital characteristics that are most important to customers, and outlines the functional requirements of the product that will meet customer needs. *Analyze* is focused on concept development from engineering and aesthetic perspectives. This often includes the creation of drawings, virtual models, or simulations to develop and understand the functional characteristic of the product. *Design* focuses on developing detailed specifications, purchasing requirements, and so on, so that the concept can be produced. Finally, *Verify* involves prototype development, testing, and implementation planning for production.

General Electric was an early adopter of DFSS. For example, back in its 1998 annual report, GE stated that "Every new product and service in the future will be DFSS.... They were, in essence, designed by the customer, using all of the critical-to-quality performance features (CTQs) the customer wanted in the product and then subjecting these CTQs to the rigorous statistical Design for Six Sigma Process." One of the early applications of DFSS was at GE's Medical Systems Division. The Lightspeed Computed Tomography (CT) System was the first GE product to be completely designed and developed using DFSS. Lightspeed allows doctors to capture multiple images of a patient's anatomy simultaneously at a speed six times faster than traditional scanners. As a result, productivity doubled while the images had much higher quality.[8]



QUALITYSPOTLIGHT

John Deere

John Deere Power Systems, headquartered in Waterloo, Iowa, designs and manufactures engines that meet stringent customer and regulatory standards. The company adopted DFSS in 2006 to help build its competitive position. In 2011, the Environmental Protection Agency (EPA) mandated extensive engine emission reductions, requiring them to