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Managing the Development and Introduction of New Products and Manufacturing Processes February 26-27, 1997

Managing Product Development Teams: A Global Perspective

Robert A. Shiffler
Technical Manager
Caterpillar, Inc.

Background

Caterpillar Inc. manufactures construction and mining equipment and diesel engines. In 1996, the company's total sales revenues and profits were $16.5 billion and $1.4 billion respectively. The company has over 57,000 employees. Caterpillar's headquarters are in Peoria, Illinois. It has four facilities worldwide; Aurora, Illinois; Gosselies, Belgium; Sagami, and Piracicaba. Each of these facilities serves different parts of the world. For example the Aurora facility serves North and South America, Australia and the Far East while the Gosselies facility serves Europe, Africa and the Middle East.

Implementation

Caterpillar's main customers are international contractors. The company has to deal with different cultures worldwide, each of which may have varying needs, therefore the product development process requires a lot of coordination between teams. When the company's worldwide growth began to increase in 1990 it had to make a transition from general decision-making to divisional decision-making. To reach that objective, it used two different sets of teams in their New Product Introduction (NPI) process. The NPI teams basically focus on customer needs, while the Competitive Advantage Teams look for commonality in the design and approach of the products and utilize these commonalties to gain worldwide competitive advantage.

NPI teams: There are four core NPI teams in total, corresponding to the number of worldwide facilities that the company has. These are multi-functional in nature and are responsible for determining the customer requirements, product strategy, financial targets and overall program management and communication through the NPI process. The teams have representatives from departments such as marketing, product design, business resources and finance. Each of the NPI teams also has sub-teams whose leaders are members of the NPI teams. When an NPI core team makes a decision, the leaders go back to their sub-teams and implement this decision. These leaders are also in charge of gathering information about their own markets and providing the related NPI core team with this information. For example, the sub-team in Belgium gathers data about customer needs in Europe and the leaders carry that information to their NPI core team. All four core NPI teams meet on a weekly basis.

Competitive Advantage Teams: These teams are in charge of determining product design, project design, product cost and capital and technological requirements and are responsible for giving feedback to the NPI teams. They include representatives from business resources, procurement, product design, operations and suppliers. The company has one competitive advantage team corresponding to each of the following subjects:

1. Assembly, Test and Paint
2. Electrical/Electronic
3. Engine Installation
4. Hydraulics
5. Light Structures
6. Operator Modules
7. Powertrain

8. Structures
9. Transmission

Each of these teams has sub-teams in four different facilities. They get together on a monthly basis and try to develop one set of tools that can be used in all of the facilities around the world. They also monitor costs throughout the development process.

Results

NPI Process: The NPI process was designed to look at all aspects of the business such as product design, process design, logistics plan, marketing plan, pricing plan and servicing tools. The process requires full commitment from both NPI and competitive advantage teams. It consists of four phases. The strategy phase focuses on marketing research and customer interviews. The most important aspect of this phase is that the company has to anticipate where the business is going and what kind of products its customers will be using in the next decade. This is because the company's long-term success depends on the success of its customers.

In the concept phase, the teams start to develop a definition on the program. They formulate the plans and targets for each area of that project. In the development phase, the NPI and Competitive Advantage teams act concurrently to prepare the literature for implementation. Once the literature is prepared the initial production phase begins.

Winwriter 150C: Product Development Process

James Howes
Program Manager
Lexmark International

Background

Originally, Lexmark was a division of IBM, which manufactured printers, typewriters, keyboards and supplies. In 1991, IBM sold this division because the business was not strategic to the other divisions in the company. Lexmark became a separate, new company, which is located mainly in Lexington, Kentucky. It consists of three divisions; Consumer Printers, Business Printers and Imaging Products. Its overall market share was 4.5% in the U.S. and a little over 7% worldwide about halfway through 1996.

Implementation

After splitting from IBM, the company had to go through some changes in terms of relationships between departments such as manufacturing, product development and marketing. Originally these departments were all at hierarchically different levels and did not communicate well with each other until the production process got very close to an end. In 1991, Lexmark developed a new vision statement and strategy which consisted of focusing on personal printers and retail customers. The aim of the vision statement was to be known for reliability, flexibility, responsiveness, innovative products and services. The underlying theme was a clear customer focus.

The second step was to form cross-functional teams that had representatives from all departments such as development engineering, manufacturing, marketing, finance, etc. This eliminated the communication problems that the departments had before 1991. Since then, these cross-functional teams have been getting together at least once a week during the product development process. The decision-making process usually depended on which department was most closely related to the issue being discussed. For example, if the issue was related to marketing, representatives from the marketing department generally made the decisions and the cross-functional team tried to reach consensus on that decision.

Lexmark's process innovation consisted of intensive customer contact, cross-functional teams and a new product development process. To be able to involve the customer in the development process, Lexmark began to use tools such as phone and mail surveys, technical support feedback and in-store surveys. The company also developed a product development process that consisted of six steps. These steps were as follows:

(1) Strategy: The marketing department or customers develop a new product idea.

(2) Project Proposal: The management team determines which ideas are credible and approves the initial funding and schedule for those product ideas that seem feasible. A team that will undertake the project is assembled.

(3) Business Investment Commitment: This critical phase is where the ultimate decision about whether or not the project is to be undertaken is

made. Once the funding and schedule are approved, the project is ready to move on to the next phase.

(4) Exception review: The team reviews the changes that were made to the project through the earlier phases, if there were any.

(5) Announcement, Readiness: The team makes decisions about product positioning and pricing.

(6) Post Announcement: Various departments provide feedback about the status of the manufacturing process and recommend any changes. For example, if inventory is growing in the warehouse, the recommendation would be that manufacturing cut back production. The company also makes MRP decisions according to the feedback received in this phase.

Results

After implementing the process innovation, Lexmark's Winwriter 150c received a four star rating by *Business Week* for its high quality and was put in exhibition in the American Museum of Design. The actual cost of the product was 22% below initial estimates and it was priced $100 below its competition. The demand for the product exceeded supply, although Lexmark increased production by six times the initial level.

Integrated Electronic Product Data Management

Raymond H. Alstadt
Vice President
Product Research & Development
QMS, Inc.

Background

QMS Inc. is a print systems manufacturer with headquarters located in Mobile, Alabama. It is a recognized technology leader in the field of printing solutions and a full-service provider. The company has been public since 1983 and has been listed on the NYSE since 1986. It currently has 800 employees worldwide and recorded a revenue of $150 million in the last fiscal year.

In 1990, the company had a number of major problems in its product development processes.

The Manual Document Control Systems were fragmented and redundant, product release procedures were not well defined or misunderstood, there was miscommunication or, in some cases, no communication between departments. The computer and network infrastructure utilized in the company was fragmented and there were no hardware or software standards, which made information flow difficult and inefficient.

Implementation

After recognition of all of these problems, the management prepared a directive which identified its major business objective as reducing product development time through process improvements and improving product predictability, quality, cost and marketing time. This could be achieved through a loop system that included auditing, documentation, process consistency and training. The major aspect of that system was that feedback between these steps should occur, processes should be reviewed, and changes should be implemented when appropriate. This required an electronicization of all processes.

In order to implement this strategy, the company had to start with some very basic concepts. First of all, it required a complete infrastructure with a consistent network and hardware throughout the organization. Everybody involved in the development process had to understand product document and process management needs. However that was difficult to achieve due to the inconsistency of documents. Therefore, the company selected Sherpa Corporation as a partner for the process which was called Product Data Management (PDM). PDM consisted of modeling of processes electronically to manage the creation and modification of documents, and conversion of the existing hard copy documents to electronic format. This would provide the company with much facility to review and sign-off documents electronically, eliminating paperwork.

The company began implementation by creating a corporate information model. It established a web page together with intranet web pages for each department including the personnel. Establishment of the first e-mail system in the company eliminated the utilization of memos as a means of communication, which had required stacks of paper. The company also based its engineering systems on UNIX servers. Although the business system is currently on VAX/VMS, it is migrating towards UNIX.

The implementation of PDM was completely parallel to the requirements of the ISO process, such as secure and easily accessible documentation, a common method for controlling, and changing the documentation and integration with product design and control. ISO documents such as Manufacturing Procedures and Instructions, Quality System Documents, Customer Technical Assurance Procedures, Materials Planning Procedure and Sales Administration were all taken under PDM control.

Results

Before the implementation of PDM, the company did not have any software or hardware platform standards. There was very loose control over engineering documents and processes and the networks were fragmented. There was no e-mail system, internet or intranet web sites. The company did not have a document imaging capability and the paper processes were fragmented. Most important of all is that the company did not have an ISO 9002 certification.

After the implementation of PDM, QMS was able to transition into a company that had efficient management of engineering documents, a reliable and well managed global network, a very efficient internet presence together with a cross-communicable UNIX e-mail and cc:mail, consistent electronic processes replacing the paperwork, and ISO 9002 certification.

Product Development Process At Symbol Technologies

Paul Severino
Director of Manufacturing Engineering
Symbol Technologies, Inc.

Background

Symbol Technologies, Inc. manufactures bar-code scanners, portable shopping systems and wireless LANs. It has been a leader in the bar-code industry for 25 years. The company had a strong patent position on point-and-shoot hand-held laser scanners. However, some of those patents were coming to an end, which required the company to lower its prices and, therefore, squeeze its profit margins. The erosion of profit margins required that the company optimize its operations.

Implementation

Basically the company implemented a new product development process that consisted of six steps; (1) Concept Development, (2) Concept Refinement, (3) Development Planning, (4) Time and Implementation, (5) Design Qualification, and (6) Initial Production.

(1) Concept Development: In this first step of product development, the marketing department developed the initial ideas. General managers of the divisions related to the product being developed reviewed those ideas. The purpose of this step was to find out which ideas fit best for the company and were the most feasible. Before going to the next phase, division general managers and the marketing department had to come to an agreement on which ideas would be rejected and which ones would be passed on to the next step.

(2) Concept Refinement: In this phase, the sales and marketing and R&D departments worked with Advanced Development Associates, industrial designers and product architects, on the Mini-QFD process. This was a prioritization of the requirements that the customers of the specific product being developed might have. Also, at this time, the division formed a core team which would work full-time through the rest of the phases of the product development process.

(3) Development Planning: The basic purpose of this phase was to understand what the product was, to prepare a product requirements document and a systems definition document. In order to do that, the core team estimated the total costs and budget requirements and how long the process would take. To proceed to the next phase, the core team had to obtain senior management's approval on the documents that they prepared.

(4) Time and Implementation: This was the step that had the most intense workload. The core team and extended team, which included a finance representative, a customer service representative and anybody else who would possibly be associated with the product, worked together on a document. The document showed the goals that had been set in the earlier phases and to what extent those goals were accomplished. The document also showed issues such as manufacturing and finance that needed to be resolved in the following steps of the development process.

(5) Design Qualification: The core team was still fully involved in this phase together with an

operations team and a quality team. Production requirements were validated and the first set of tool parts was prepared.

(6) Initial Production: This step involved the introduction of full-volume production. Materials were ordered according to a Materials Requirement Plan. Manufactured products were released and ready to be ordered by the customers. The criterion for exit from this phase was proof that the product could be developed with at least a 98% yield.

Results

The success of this new product development strategy was illustrated by a new laser diode hand-held bar-code reader. The major priorities of this product were determined to be high scan performance, breakthrough ergonomics and quick marketing time. All of these requirements were achieved through the utilization of the six-step process.

During the concept refinement period, the program manager began weekly meetings with the prospective members of the core team which would consist of one associate per discipline. The marketing department conducted an international survey on hand-held bar code scanners to determine the optimum visual and functional perceptions, such as shape, size and trigger location. According to the results of the survey, customers most preferred gun-shaped scanners. The team also developed aggressive manufacturability goals.

The development planning period included the final composition of the core team which consisted of two software engineers, three mechanical engineers, two manufacturing representatives and a marketing representative. The members of the core team then were moved from their functional organizations to a co-located setting in order to focus solely on the product.

In less than three months, the team was able to finalize the technical approach and the manufacturability study, prepare product cost, program schedule and budget commitments and select the microprocessor that would be used.