Improving Time To Market in Consumer Products

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Consumer Products, an AT&T business unit, provides communications products, such as telephones and answering systems, to the residence and very small business market. Since 1987, Consumer Products has been trying to reduce its time to market by more than 50 percent. It has made significant progress, though it is still short of its goals. The experience of Consumer Products illustrates that competitive benchmarking and focusing on reducing the time needed to realize new products can drive significant process improvement. Furthermore, with a faster process in place, Consumer Products has begun to focus on a broader set of external customer needs to drive future improvements.

Introduction

Time to market can be viewed as a measure associated with the product realization process (PRP). PRP is defined as "the way in which AT&T moves from technology in the laboratories to products in the hands of customers."[1] By that definition, PRP could include technology planning, transferring research results to development, and inventing new manufacturing processes. Rather than grapple with these activities, the Consumer Products business unit has concentrated its attention on one aspect of product realization: the new product development cycle.

A product development cycle encompasses defining, developing, and introducing a single new product. *Cycle time* is defined as the interval from the start of product definition until that product is available for purchase by consumers.

This paper will describe CP's efforts to improve new product development and cycle time. It will first describe the circumstances in 1987 that caused CP to undertake these efforts, especially benchmarking competitors to help identify the process changes required in AT&T's operation. The changes instituted in 1988, and the results achieved through 1990, will then be summarized. Finally, the paper will review recent efforts to broaden Consumer Products' focus beyond average cycle time. These efforts have included applying the tools of quality function deployment (QFD) and statistical process control (SPC) that allow customer feedback to drive the next round of product improvements.

New Product Development in 1987

In 1987, Consumer Products was enjoying the results of business initiatives that began with AT&T's divestiture in 1984. Revenues, profits, and market share were up, largely because of a redesigned product line, a new manufacturing plant in Singapore, and a restructured, more efficient business operation. The restructuring was based on newly-created SBUs (Strategic Business Units): cross-functional teams with members from all the functional organizations (e.g., product management, manufacturing, development), with the authority to operate each product line as a profit center.

In 1987, the new product development cycle was spoken of as having a soft front end, unstable middle, and hard back end. Let us define what we mean by "soft," "unstable," and "hard." In the front end of the cycle, developers struggled for months to reach agreement on the features, functions, and style for the proposed product. Many the people on the product development team were inexperienced; the information they needed, such as market research on consumer style preference was unavailable; and many approvals from the functional organizations were required. We were trying to predict exactly what customers wanted long before the date the product would be available. Because of those uncertainties, it made sense to avoid getting locked into specific features, style, or operating procedures. Once product design began, we knew that new information on the customers' needs and style preferences would be available, as would information on the competition's products. Therefore, we created a soft front end, i.e., one that could accommodate changes in requirements.

The changes in requirements resulting from the front end were a primary cause of the instability in the middle of the process. The resulting instability would delay the introduction date because of unanticipated extra development work.

But changes in requirements were not the only source of instability. There was turnover among team members: this slowed down development while the new personnel were brought up to speed. Sometimes those new people would generate more changes.

Another source of instability was that each product development cycle, instead of deriving from an existing—and therefore reusable—design, often represented a completely new design. Product plans typically called for many new elements—e.g., a speakerphone circuit—to be developed as part of the larger development cycle. Invention is inherently unpredictable, and any difficulties or delays in developing these new elements rippled through the project. Each perturbation further delayed the introduction date.

The flexibility ended when manufacturing—the hard back end—had to begin. Often, the factory where the product would be made was identified only after the design was complete. Even when the factory was identified earlier in the development cycle, there was little chance for input from its manufacturing personnel. Product developers reacted to objections from the factory when manufacturing finally reviewed the design. The development team had limited flexibility to incorporate comments because they usually were received too late in the cycle. So activities began based on the best available compromises. These compromises often raised costs and delayed product introduction.

Panel 1. Acronyms in This Paper

CP	Consumer Products (AT&T Division)
PRP	product realization process
QFD	quality function deployment
SBU	strategic business unit
SPC	statistical process control

Often, development, manufacturing, and product management first blamed each other for the problems, then returned to the unstable middle to rework the design. In other cases, projects were stopped because the delays made our product too late to market compared to what competitors offered in terms of features and cost. CP had the worst of all possible worlds. We took a long time at every step of the process to get things exactly right. But we never succeeded, and frequent changes had to be made.

Thus, the three largest Consumer Products SBUs, using the development cycle described above, introduced fewer than 10 models in 1987. Consumer Products and its competitors introduce their new U. S. models at the two Consumer Electronics Shows held each year. Despite success in the marketplace with what it had, an obvious problem confronted CP at each show: AT&T's competitors were introducing more models than it was. One Japanese competitor brought out 30 new models in 1987. Worst of all, if CP saw an exciting new feature on a competitor's phone, it could take it two years to offer the same feature because it had to pass through an extended and unwieldy product development cycle.

Benchmarking the Development Process

Consumer Products began to investigate the reasons behind this performance gap in product introductions. One possible reason was that AT&T's competitors were investing more of their resources to develop and introduce new products than it was. However, financial analysis showed that Consumer Products was spending a higher percentage of revenues on development than its competitors were for comparable products. If the competition was not spending more, then they had to be spending more efficiently. With the help of an outside consultant, CP obtained benchmark data on our industry's product development cycle.

The benchmarking results showed that competitors' design cycles were between 40 and 75 percent

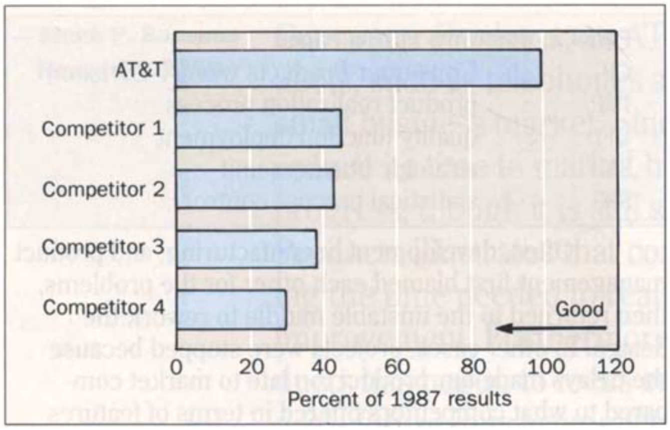

Figure 1. Graph presenting benchmark data on the consumer electronics industry product development cycle. Note that industry design cycles for the baseline year, 1987, were between 40 percent and 75 percent shorter than AT&T's. These shorter cycles allowed competitors to bring to market product lines with more up-to-date features, and more quickly.

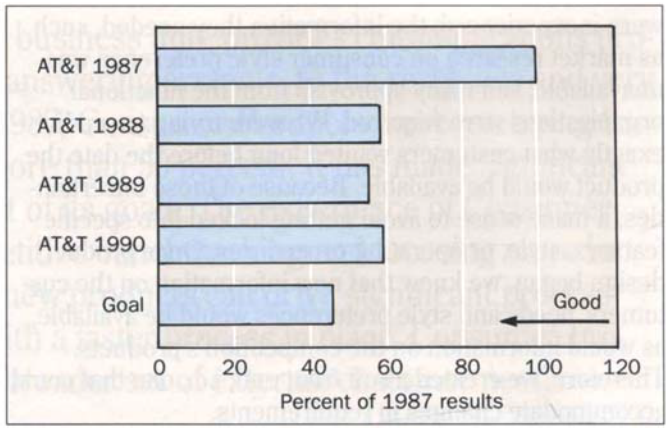

Figure 2. Representation of the drop in product development time based on a focus on time to market. An improvement of approximately 40 percent has been achieved over the 1987 cycle time average.

shorter than AT&T's (Figure 1). These shorter cycle times allowed the competition to gain experience more quickly and develop product lines with more up-to-date features. Not only was competition faster, but it also was more productive in terms of the new models designed by each engineer each year. Except for one company that designed 20 percent more different products per engineer, the others produced at least 4 times as many. A few companies produced more than 20 times more products per engineer than AT&T.

These results were enlightening, but what we learned about development processes was even more useful. Our competitors took far less time to define the product being developed, and once their team agreed on a product specification, changes were not permitted. The teams themselves were more experienced, had more autonomy, and were not changed during the project. Most of all, they took support processes—such as market research or technical testing—out of the critical path, i.e., the sequence of events that determines the product introduction date. They relied on established capabilities or platforms to avoid invention in the development process. These findings led Consumer Products to reengineer its new product development process to greatly reduce cycle time.

Changing the Development Process

The strategy for improving our development cycle was to adopt *time* as the critical element. Our objective was now to reengineer PRP for minimal cycle time, and all facets of PRP were to be tuned to this common goal. With this strategy, CP believed it could make changes that would help AT&T retain market leadership and raise productivity to new highs.

CP's senior management for product management, development, and manufacturing, worked together to make the changes. They set a goal of reducing cycle time by 50 percent from team formation ("kick-off") to product release to external customers.

The development cycle was redefined into three phases:

- *Definition phase.* The team defines the common goals to which they commit. These commitments are documented in a "freeze specification" that describes the product features, cost, and schedule to reach full production. Team members from each functional area sign the specification as a gesture of their commitment to it. This specification, as the name suggests, cannot be changed. If there is a need to change it, e.g. to account for a shift in customer need that would alter the product features, the project would be terminated.
- *Development phase.* Design engineers work closely with manufacturing engineers to complete the design. The most effective product comes from concurrent

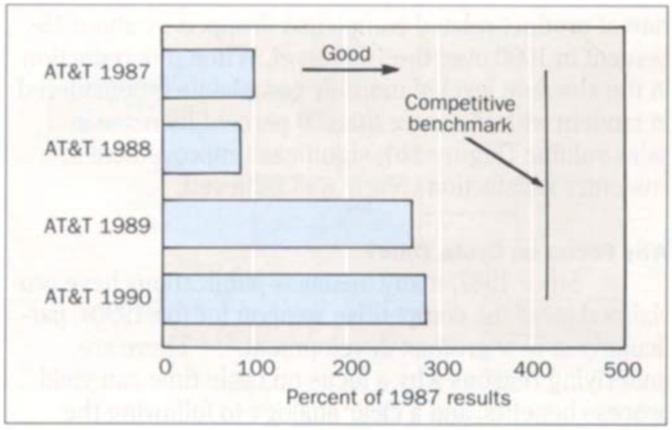

Figure 3. Graph representing the improvement in new product introductions per year. Note that the reengineered process shows an improvement of over 200 percent in annual product introductions from the 1987 baseline.

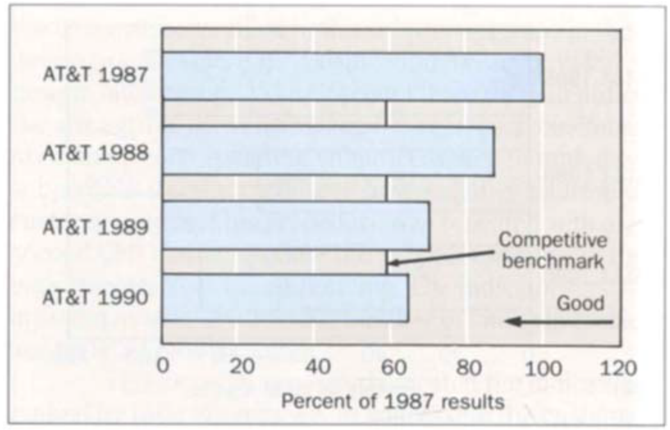

Figure 4. Representation of the design engineering expense-to-revenue ratio. A reduction of approximately 33 percent has been achieved in the 1990 R&D expense to revenue ratio over the 1987 level.

engineering between design and manufacturing.

- *Production phase.* In the final phase, the factory begins to manufacture the product in small quantities and then increases production to higher volumes. Manufacturing engineers and design engineers work closely to quickly move the product into production. The product now becomes available to our customers.

After the PRP cycle, the product development team can move to an improvement phase to optimize the design and to incorporate enhancements discovered during the cycle. Changes to the product during the improvement phase can be made during production, thereby avoiding interruptions to the product flow.

Fundamental to the reengineering is the concept of product development teams. These teams, formed when the project is launched, are composed of people from product management, development, and manufacturing. All the functions limit reassigning people, thereby creating team members who can bring their experience with the product family as background for the team's work. They are supported by people who are not full-time members of the development team, but who provide services to many teams.

Throughout the development cycle, dialogue among the cross-functional members of the product realization teams strengthens the information flow and help the team make decisions that consider the trade-offs across functions. This communication allows previously sequential activities, such as ordering parts, to take place concurrently with design activities. At times during the project, the demands for cross-functional team communication are so intense that team members from dispersed geographical locations assemble in one place. For example, factory representatives are present for the freeze specification, and designers go to the factory for production start-up.

To accelerate product development, platforms—or previously established capabilities—are provided to support the development teams' work. Platform plans are developed that anticipate the needs of the team in both product- and process-related areas. For example, process platforms for rapid modeling support the teams' prototyping needs; circuit platforms support their need for proven manufacturable designs.

Results of the Process Changes

Because the strategy for improving PRP was based on reducing time to market, it is appropriate that we first examine the results achieved in this area. Figure 2 shows that cycle time dropped significantly in response to the changes. In the figure, 1987 results are established as the baseline of 100 percent. An improvement of about 40 percent has been achieved over the 1987 cycle time average.

Figures 3 and 4 show two measures of productivity improvement. Figure 3 illustrates the annual

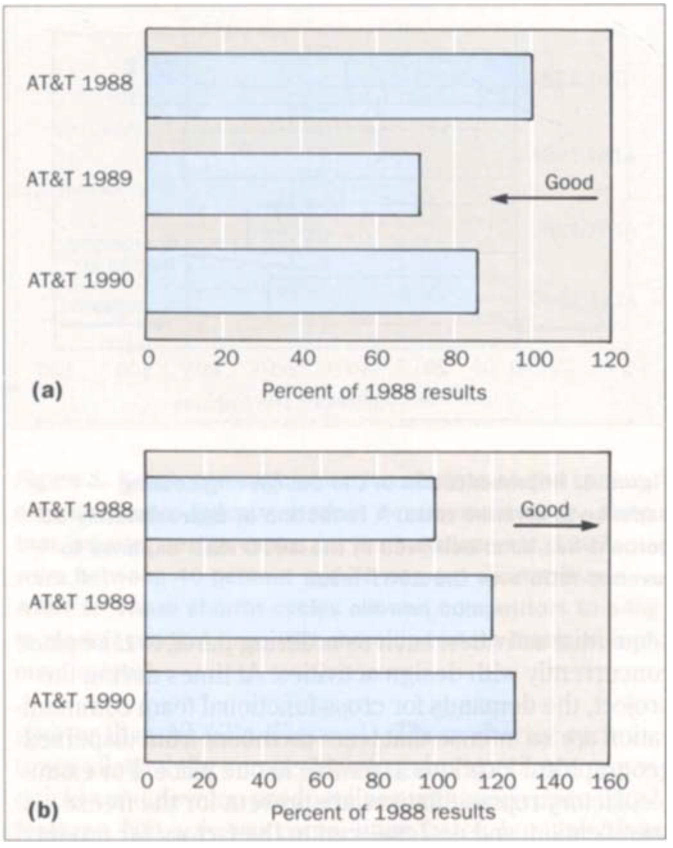

Figure 5. (a) Representation of the average monthly complaint letters for product related matters. The monthly average rate of product complaints dropped approximately 15 percent in 1990 over the 1988 level. (b) Representation of customer satisfaction measured in terms of increased sales, showing an increase of over 20 percent, using the 1988 baseline year.

improvement in new product introductions, and shows that reengineering has produced an improvement of over 200 percent in annual product introductions from the 1987 baseline. The design engineering expense to revenue ratio appears in Figure 4. A 33 percent reduction from the 1987 level has been achieved in the 1990 R&D expense-to-revenue ratio.

During this period, AT&T's market share grew, indicating that its products were meeting customer needs. Figure 5a, representing average monthly product complaint letters, shows further evidence of increased customer satisfaction. It shows that the monthly average rate of product-related complaints dropped by about 15 percent in 1990 over the 1988 level. When this reduction in the absolute level of monthly complaints is considered in tandem with the more than 20 percent increase in sales volume (Figure 5b), significant improvement in customer satisfaction clearly was achieved.

Why Focus on Cycle Time?

Since 1987, many business publications have proclaimed *speed* the competitive weapon for the 1990s, particularly in new product development.[2-7] There are underlying reasons why a focus on cycle time can yield process benefits, and a clear analogy to following the just-in-time (JIT) philosophy in a factory.

Although JIT can be viewed simply as a way to reduce inventory, its real value is in uncovering process problems. As work in the process inventory is reduced, there are no buffers in the factory to maintain production when there are difficulties. Quality problems are uncovered quickly, and the production process must be constantly improved. White collar processes, such as new product development, have no physical inventory, but frequently require lengthy approvals and time-consuming mandatory meetings. There is no way to achieve significant reductions in cycle time by doing each step just a little faster. The steps themselves must be reexamined and non-value added activities removed from the critical path.

Perhaps the best example of applying the lessons learned from manufacturing to other processes can be found by examining Toyota's "lean production" system.[8] Consumer Products applied these lessons by significantly reducing its cycle time. The goal of reducing cycle time by 50 percent forced CP to confront the issues of design team completeness and stability, lengthy management approvals and lack of frozen specifications in our old process.

Continuing the Progress

Clearly CP's focus on cycle time improved the product realization process significantly. However, the average cycle time did not continue to progress toward the competitive benchmark. Applying statistical process control techniques to cycle time data showed that the variation in cycle time across products was not decreasing. These factors show that further work was needed to install a method for continuous improvement. CP was

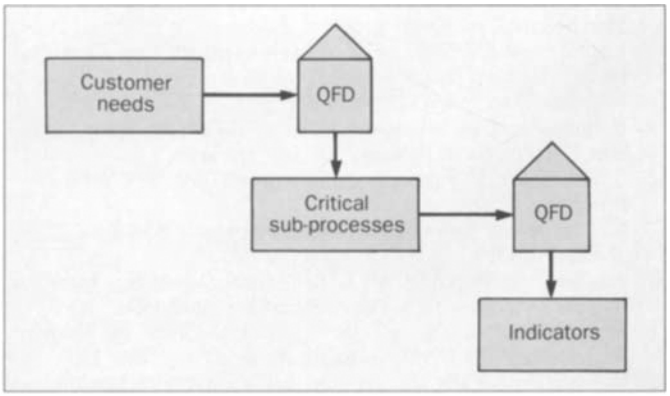

Figure 6. A representation of Quality Function Deployment (QFD) techniques that translate customer needs to critical process indicators. Data from customer surveys provided the relative importance of each need. Critical sub-process steps that make up the development cycle are then ranked in terms of how they address customer needs. A second QFD matrix relates the sub-process steps to the measurement indicators, including system test results, number of late deliverables, and product return rates.

more competitive in cycle time, and began to question whether it should focus only on closing the remaining gap. The decision was that the foundation for driving continuous improvement would be a balanced set of indicators for stockholder, customer, and people satisfaction. All three constituencies are, in some sense, "customers" of the development process. For example, AT&T's stockholders may have the perspective that cost and efficiency are paramount. For them, cycle time would be the key metric. According to Consumer Products' surveys, the retailers who sell our product care not about cycle time but about product returns, competitive features, and having a wide variety of products to sell. Similarly, the end-users of our products cite ease of use and product quality as most important to them. Rather than continue to focus on cycle time, CP decided to use all its information to develop the measures important to all "customers" of the development process.

Quality function deployment (QFD) techniques were applied to translate customer needs to critical process indicators (Figure 6). Data from customer surveys outlined the relative importance of each need. (Examples of these needs are trouble-free performance, ease of use, and high-quality sound transmission.) Across the top of the QFD matrix we filled in the subprocess steps in the development cycle, e.g., specification freeze, physical design, and testing. A development team then identified the strength of the relationship between each customer need and a corresponding subprocess step to rank the subprocess steps according to how well they address the customer needs. This procedure was repeated with a second QFD matrix to relate the subprocess steps to the indicators used as measurements. The indicators included system test results, number of late deliverables, and product return rates.

This two-step process delineated the indicators, ranked by their importance, in addressing the customer needs. We also established a process that permits revision of these rankings as customer needs change. Operational definitions for the indicators clearly specify the measurement technique required. Data from the measurements is displayed and analyzed using statistical process control techniques. We are confident that improvement of these indicators address the needs of all process "customers," i.e., stockholders, end-users, and CP people.

Summary

In a sense, Consumer Products is in the middle of its third round of improvements in its new product development cycle. The first round was represented by our turnaround during 1984-1987, when the entire product line was redesigned to be more competitive in features and cost. We did this by using task forces with virtually no attention to process. But beginning in 1987, we began to work within a framework that recognized the process itself. The number of products we introduced, as well as competitive benchmarks from other manufacturers, instigated the change. We used cycle time reduction as the focus for our efforts. Starting in 1990, we took a more comprehensive view of using customer input to drive our improvements and started to use the more sophisticated tools of SPC and QFD. In each case, our approach has been appropriate to our circumstances. As CP has matured as a business, its process for process improvement has matured as well.

We must include some cautionary notes to others considering a similar effort. Although the efforts have yielded significant benefits, the changes have not been easy. The required platforms were not always in place to support the development teams. CP's outstanding results attest to the commitment and dedication of the team members. Based on surveys of their attitudes, team members feel greater satisfaction because of their increased authority in the new process. Decisions are now made at lower levels in the organization. However, team members feel less positive about how well we use leading edge technology relative to our competitors because of the strategy of building on existing platforms.

The cultural changes associated with reengineering a process cannot be minimized. Consumer Products had several advantages in this regard. It had an established management structure, including the SBUs. The Consumer Electronics Shows provided semi-annual benchmarks that could not be refuted because of their clear feedback on competitors' products and capabilities. Most of all, since 1987 CP has invested extensively in training and communications to change its culture. It has created a set of shared values and a passion to be the best for its customers, owners, and people throughout the organization.

For those considering a similar effort, Michael McGrath has, from our perspective, the right advice: "Companies are inhibited by the lack of a clear product development process or high-performance culture. For those companies, the best solution is to start at the beginning by redefining the process and changing the culture."[9]

Acknowledgments

Processes are more than abstract flow charts. They represent the concerted efforts of many people working toward a common goal. The improvements described in this paper would have been impossible without the commitment, dedication, and skill of thousands of Consumer Products people.

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