

---

# The Power of Product Integrity

Kim B. Clark and Takahiro Fujimoto



Harvard Business Review

No. 90603

# The Power of Product Integrity

Kim B. Clark and Takahiro Fujimoto

Some companies consistently develop products that succeed with customers. Other companies often fall short. What differentiates them is integrity. Every product reflects the organization and the development process that created it. Companies that consistently develop successful products—products with integrity—are themselves coherent and integrated. Moreover, this coherence is distinguishable not just at the level of structure and strategy but also, and more important, at the level of day-to-day work and individual understanding. Companies with organizational integrity possess a source of competitive advantage that rivals cannot easily match.

The primacy of integrity, in products and organizations alike, begins with the role new products play in industrial competition and with the difficulty of competing on performance or price alone. New products have always fascinated and excited customers, of course. Henry Ford's Model A made front-page news after near-riots erupted outside dealers' showrooms. But today, in industries ranging from cars and computers to jet engines and industrial controls, new

products are the focal point of competition. Developing high-quality products faster, more efficiently, and more effectively tops the competitive agenda for senior managers around the world.

Three familiar forces explain why product development has become so important. In the last two decades, intense international competition, rapid technological advances, and sophisticated, demanding customers have made "good enough" unsatisfactory in more and more consumer and industrial markets. Yet the very same forces are also making product integrity harder and harder to achieve.

Consider what happened when Mazda and Honda each introduced four-wheel steering to the Japanese auto market in 1987. Although the two steering systems used different technologies—Mazda's was based on electronic control, while Honda's was mechanical—they were equally sophisticated, economical, and reliable. Ten years earlier, both versions probably would have met with success. No longer. A majority of Honda's customers chose to install four-wheel steering in their new cars; Mazda's system sold poorly and was widely regarded as a failure.

Why did consumers respond so differently? Product integrity. Honda put its four-wheel steering system into the Prelude, a two-door coupe with a sporty, progressive image that matched consumers' ideas about the technology. The product's concept and the new component fit together seamlessly; the car sent a coherent message to its potential purchasers. In contrast, Mazda introduced its four-wheel steering

---

*Kim B. Clark is the Harry E. Figgie, Jr. Professor of Business Administration at the Harvard Business School. His most recent article in HBR was "What Strategy Can Do for Technology" (November–December 1989). Takahiro Fujimoto is assistant professor of business administration at Tokyo University. Their new book, Product Development Performance, will be published in early 1991 by the Harvard Business School Press.*

*Author's note: We gratefully acknowledge the help of Nobuhiko Kawamoto, CEO of Honda Motor Company, and Tateomi Miyoshi, large product leader for the Honda Accord.*

system in the 626, a five-door hatchback that consumers associated with safety and dependability. The result was a mismatch between the car's conservative, family image and its racy steering system. Too sophisticated to be swayed by technology alone (as might have been the case a decade before), Mazda's potential customers saw no reason to buy a car that did not satisfy their expectations in every respect, including "feel." (Mazda's new advertising slogan, "It just feels right," suggests the company's managers took this lesson to heart.)

Product integrity is much broader than basic functionality or technical performance. Customers who have accumulated experience with a product expect new models to balance basic functions and economy with more subtle characteristics. Consumers expect new products to harmonize with their values and lifestyles. Industrial customers expect them to mesh with existing components in a work system or a production process. The extent to which a new product achieves this balance is a measure of its integrity. (One of integrity's primary metrics is market share, which reflects how well a product attracts and satisfies customers over time.)

Product integrity has both an internal and an external dimension. Internal integrity refers to the consistency between a product's function and its structure: the parts fit smoothly, the components match and work well together, the layout maximizes the available space. Organizationally, internal integrity is achieved mainly through cross-functional coordination within the company and with suppliers. Efforts to enhance internal integrity through this kind of coordination have become standard practice among product developers in recent years.

External integrity refers to the consistency between a product's performance and customers' expectations. In turbulent markets like those in which Honda and Mazda were competing, external integrity is critical to a new product's competitiveness. Yet for the most part, external integrity is an underexploited opportunity. Companies assign responsibility for anticipating what customers will want to one or more functional groups (the product planners in marketing, for example, or the testers in product engineering). But they give little or no attention to integrating a clear sense of customer expectations into the work of the product development organization as a whole.

Of course, there are exceptions. In a six-year study of new product development (see the insert "Focus on Development"), we found a handful of companies that consistently created products with integrity. What set these companies apart was their seamless pattern of organization and management. The way

## Focus on Development

What are the sources of superior performance in product development? What accounts for the wide differences in performance among companies in the same industry? To answer those questions, we studied 29 major development projects in 20 automobile companies around the world. (Three companies are headquartered in the United States, eight in Japan, and nine in Europe.) The projects ranged from micro-mini cars and small vans to large luxury sedans, with suggested retail prices from \$4,300 to more than \$40,000. Our research methods included structured and unstructured interviews, questionnaires, and statistical analysis. Throughout the study, we strove to develop a consistent set of data (including both measures of performance and patterns of organization and management) so that we could identify the constants among projects that differed greatly in scope and complexity.

We chose to concentrate on the automobile industry because it is a microcosm of the new industrial competition. In 1970, a handful of auto companies competed on a global scale with products for every market segment; today more than 20 do. Customers have grown more discerning, sophisticated, and demanding. The number of models has multiplied, even as growth has slowed, and technology is evermore complex and diverse. In 1970, for example, the traditional V-8 engine with 3-speed automatic transmission and rear-wheel drive was the technology of choice for 80% of the cars produced in the United States. By the early 1980s, consumers could choose among 34 alternative configurations. In this environment, fast, efficient, effective product development has become the focal point of competition and managerial action.

people did their jobs, the way decisions were made, the way suppliers were integrated into the company's own efforts—everything cohered and supported company strategy. If keeping the product line fresh and varied was a goal, speed and flexibility were apparent at every step in the development process, as were the habits and assumptions that accustom people and organizations to being flexible and to solving problems quickly. For example, product plans relied on large numbers of parts from suppliers who focused on meeting tight schedules and high quality standards even when designs changed late in the day. Product and process engineers jointly developed body panels and the dies to make them through informal,

intense interactions that cut out unnecessary mistakes and solved problems on the spot. Production people built high-quality prototypes that tested the design against the realities of commercial production early in the game and so eliminated expensive delays and rework later on.

The examples we draw on in this article all come from the auto industry. We chose to look at a single industry worldwide so that we could identify the factors that separate outstanding performers from competitors making similar products for similar markets around the globe. But our basic findings apply to businesses as diverse as semiconductors, soup, and commercial construction. Wherever managers face a turbulent, intensely competitive market, product integrity—and the capacity to create it—can provide a sustainable competitive advantage.

## The Power of a Product Concept

Products are tangible objects—things you can see, touch, and use. Yet the process of developing new products depends as much on the flow of information as it does on the flow of materials. Consider how a new product starts and ends.

Before a customer unpacks a new laptop computer or sets up a high-speed packaging machine, and long before a new car rolls off the showroom floor, the product (or some early version of it) begins as an idea. Next, that idea is embodied in progressively more detailed and concrete forms: ideas turn into designs, designs into drawings, drawings into blueprints, blueprints into prototypes, and so on until a finished product emerges from the factory. When it is finally in customers' hands, the product is converted into information once again.

If this last statement sounds odd, think about what actually happens when a potential buyer test-drives a new car. Seated behind the wheel, the customer receives a barrage of messages about the vehicle's performance. Some of these messages are delivered directly by the car: the feel of the acceleration, the responsiveness of the steering system, the noise of the engine, the heft of a door. Others come indirectly: the look on people's faces as the car goes by, comments from passengers, the driver's recollection of the car's advertising campaign. All these messages influence the customer's evaluation, which will largely depend on how he or she interprets them. In essence, the customer is consuming the product *experience*, not the physical product itself.

Developing this experience—and the car that will embody it—begins with the creation of a product

concept. A powerful product concept specifies how the new car's basic functions, structures, and messages will attract and satisfy its target customers. In sum, it defines the character of the product from a customer's perspective.

The phrase "pocket rocket," for example, captures the basic concept for a sporty version of a subcompact car. Small, light, and fast, a pocket rocket should also have quick, responsive handling and an aggressive design. While the car should sell at a premium compared with the base model, it should still be affordable. And the driving experience should be fun: quick at the getaway, nimble in the turns, and very fast on the straightaways. Many other design and engineering details would need definition, of course, for the car to achieve its objectives. But the basic concept of an affordable and fun-to-drive pocket rocket would be critical in guiding and focusing creative ideas and decisions.

By definition, product concepts are elusive and equivocal. So it is not surprising that when key project participants are asked to relate the concept for a new vehicle, four divergent notions of value emerge. Those for whom the product concept means *what the product does* will couch their description in terms of performance and technical functions. Others, for whom the concept means *what the product is*, will describe the car's packaging, configuration, and main component technologies. Others, for whom product concept is synonymous with whom the product serves, will describe target customers. Still others, reflecting their interpretation of the concept as *what the product means to customers*, will respond thematically, describing the car's character, personality, image, and feel.

The most powerful product concepts include all these dimensions. They are often presented as images or metaphors (like pocket rocket) that can evoke many different aspects of the new product's message without compromising its essential meaning. Honda Motor is one of the few auto companies that make the generation of a strong product concept the first step in their development process.

When Honda's engineers began to design the third-generation (or 1986) Accord in the early 1980s, they did not start with a sketch of a car. The engineers started with a concept—"man maximum, machine minimum"—that captured in a short, evocative phrase the way they wanted customers to feel about the car. The concept and the car have been remarkably successful: since 1982, the Accord has been one of the best-selling cars in the United States; in 1989, it was the top-selling car. Yet when it was time to design the 1990 Accord, Honda listened to the market, not to its own success. Market trends were indi-

cating a shift away from sporty sedans toward family models. To satisfy future customers' expectations—and to reposition the Accord, moving it up-market just a bit—the 1990 model would have to send a new set of product messages.

As the first step in developing an integrated product concept, the Accord's project manager (the term Honda uses is "large product leader") led a series of small group discussions involving close to 100 people in all. These early brainstorming sessions involved people from many parts of the organization, including body engineering, chassis engineering, interior design, and exterior design. In line with Honda tradition, the groups developed two competing concepts in parallel. The subject of the discussions was abstract: what would be expected of a family sedan in the 1990s. Participants talked frequently about "adult taste" and "fashionability" and eventually came to a consensus on the message the new model would deliver to customers—"an adult sense of reliability." The ideal family car would allow the driver to transport family and friends with confidence, whatever the weather or road conditions; passengers would always feel safe and secure.

This message was still too abstract to guide the product and process engineers who would later be making concrete choices about the new Accord's specifications, parts, and manufacturing processes. So the next step was finding an image that would personify the car's message to consumers. The image the product leader and his team emerged with was "a rugby player in a business suit." It evoked rugged, physical contact, sportsmanship, and gentlemanly behavior—disparate qualities the new car would have to convey. The image was also concrete enough to translate clearly into design details. The decision to replace the old Accord's retractable headlamps with headlights made with a pioneering technology developed by Honda's supplier, Stanley, is a good example. To the designers and engineers, the new lights' totally transparent cover glass symbolized the will of a rugby player looking into the future calmly, with clear eyes.

The next and last step in creating the Accord's product concept was to break down the rugby player image into specific attributes the new car would have to possess. Five sets of key words captured what the product leader envisioned: "open-minded," "friendly communication," "tough spirit," "stress-free," and "love forever." Individually and as a whole, these key words reinforced the car's message to consumers. "Tough spirit" in a car, for example, meant maneuverability, power, and sure handling in extreme driving conditions, while "love forever" translated into long-term reliability and customer satisfaction. Throughout the course of the project, these phrases

provided a kind of shorthand to help people make coherent design and hardware choices in the face of competing demands. Moreover, they were a powerful spur to innovation.

Consider this small slice of the process. To approximate the rugby player's reliability and composure ("stress-free"), the engineers had to eliminate all unnecessary stress from the car. In technical terms, this meant improving the car's NVH, or noise, vibration, and harshness characteristics. That, in turn, depended on reducing the "three gangs of noise," engine noise, wind noise, and road noise.

To reduce engine noise, the product engineers chose a newly developed balance shaft that rotated twice as fast as the engine and offset its vibration. The shaft made the Accord's compact 4-cylinder engine as quiet as a V-6 and conserved space in the process. But since the shaft was effective only when the engine was turning over reasonably quickly, the product engineers also had to design a new electrically controlled engine mount to minimize vibration when the engine was idling.

Moreover, once the engine was quieter, other sources of noise became apparent. The engineers learned that the floor was amplifying noise from the engine, as was the roof, which resonated with the engine's vibration and created unpleasant, low-frequency booming sounds. To solve these problems, the engineers inserted paper honeycomb structures 12 to 13 millimeters thick in the roof lining—a solution that also improved the roof's structural rigidity and contributed to the car's tough spirit. They also redesigned the body floor, creating a new sandwich structure of asphalt and sheet steel, which similarly strengthened the body shell.

Multiply this example hundreds of times over and it is clear why a strong product concept is so important. At its core, the development process is a complex system for solving problems and making decisions. Product concepts like those developed at Honda give people a clear framework for finding solutions and making decisions that complement one another and ultimately contribute to product integrity.

## Organizing for Integrity

When cars were designed and developed by a handful of engineers working under the direction of a Henry Ford, a Gottlieb Daimler, or a Kiichiro Toyoda, organization was not an issue. What mattered were the engineers' skills, the group's chemistry, and the master's guidance. These are still vital to product integrity; but the organizational challenge has be-

come immeasurably more complex. Developing a new car involves hundreds (if not thousands) of people working on specialized pieces of the project in many different locations for months or even years at a time. Whether their efforts have integrity—whether the car performs superbly and delights customers—will depend on how the company organizes development and the nature of the leadership it creates.

Efforts to organize development effectively are rooted in the search for solutions to two basic problems. One is designing, building, and testing the product's parts and subsystems so that every element achieves a high level of performance. In a car, this means that the brakes hold on wet or icy roads, the suspension gives a smooth ride on rough roads, the car corners well on sharp turns, and so on. Because performance at this level is driven by expertise and deep understanding, some specialization, both for individuals and for the organization, is essential. Yet specialization is a double-edged sword. By complicating communication and coordination across the organization, it complicates the second problem that development organizations face: achieving product integrity.

When markets were relatively stable, product life cycles long, and customers concerned most with technical performance, companies could achieve product integrity through strong functional organizations. Managers could commit whatever resources and time it took to make products that worked well, and external integrity (matching the product to customer expectations) was simply a by-product of those efforts. But as competition intensified and customers' needs and wants grew harder to predict, integration became an explicit goal for most product developers. By the late 1980s, even the most resolutely functional development organizations had established formal mechanisms such as coordination committees, engineering liaisons, project managers, matrix structures, and cross-functional teams to improve product development.

Structural mechanisms like these are only a small part of achieving product integrity, however. At best—when they are reinforced and supported by the behaviors, attitudes, and skills of people in every part of the development organization—they speed problem solving and improve the quality of the solutions. But by design, they are focused inward; they do not address integrity's external dimension. So unless the company makes a deliberate effort to integrate customers into the development process, it is likely to create products that are fresh, technologically advanced, and provide good value but that often fall short with sophisticated consumers.

For this reason, external integration is the single

most important task for new product development. It represents a conscious organizational effort to enhance the external integrity of the development process by matching the philosophy and details of product design to the expectations of target customers. Generating a distinctive product concept that anticipates future customers' needs and wants is the first step in external integration. Infusing this concept into drawings, plans, detailed designs, and, ultimately, the product itself is the substance of its ongoing work.

To get some sense of how thorough (and hard) this infusion process actually is, consider a few of the conflicts Honda faced during the planning stage for the third-generation Accord.

The vehicle's product concept (man maximum, machine minimum) included maximum space and visibility for the occupants, minimum space for the car's mechanisms, a wide, low body for aesthetics, superb handling and stability, and superior economy in operation. To convey a feeling of spaciousness, the design called for a low engine hood and a larger-than-usual front window. Both features increased the driver's visibility and sense of interaction with the outside world. But the window size also meant that the cabin would get uncomfortably hot on sunny days unless the car had a big air conditioner—as well as a powerful engine to run it.

A large engine—the obvious solution—was precluded by the decision to keep the hood low, since the only suspension system that would work was an expensive, double-wishbone construction that narrowed the engine chamber. And in any case, the engineers wanted the engine to be light so that the car would handle sharply.

The height of the hood became a battlefield, with body, engine, and chassis engineers warring over millimeters. What made the conflict constructive—it ultimately led to the development of a new engine that was both compact and powerful—was the fact that all the combatants understood what the Accord had to achieve. Guided by the large product leader, who saw every argument as an opportunity to reinforce the car's basic concept, the engineers could see their work through future customers' eyes.

As Honda's experience indicates, external integration extends deeply into the development organization, and it involves much more than being "market oriented" or "customer driven." It begins with customers, to be sure, since the best concept developers invariably supplement the cooked information they get from marketing specialists with raw data they gather themselves. But strong product concepts also include a healthy measure of what we call "market imagination": they encompass what customers say they want and what the concept's creators *imagine*

customers will want three or more years into the future. Remembering that customers know only existing products and existing technologies, they avoid the trap of being too close to customers—and designing products that will be out-of-date before they are even manufactured.

Interestingly, companies that are heavily driven by market data tend to slip on external integrity. As a rule, these companies have well-equipped marketing organizations with great expertise in formal research, and they are adept at using data from focus groups, product clinics, and the like to develop customer profiles. But these methods rarely lead to distinctive product concepts. In fact, to the extent that they limit or suppress the imaginations of product designers, they can actually harm a new product's future competitiveness.

How auto companies organize for external integration—and how much power they invest in their integrators—varies greatly. Some companies create an explicit role for an “external integrator” and assign it to people in a few functional units (testers in engineering, for example, and product planners in marketing). Others assign all their external integrators to a single specialized unit, which may be independent or organized by product. Similarly, the work of concept creation and concept realization may be broken up among different groups in the development organization or consolidated under one leader, as it is at Honda.

We have already seen how advantageous consolidating responsibility can be for enhancing external integration. This approach is equally successful in achieving internal integrity.

One of the thorniest issues in creating a strong product concept is when (and how) to involve functional specialists other than those who make up the product development team. As we saw with the Accord, the product concept has clear repercussions for every aspect of the development process, from design and layout to cost and manufacturability. So on the one hand, front-loading input and information from specialists downstream is highly desirable. On the other hand, broad downstream involvement can easily jeopardize the distinctiveness and clarity of a product concept if (as often happens) negotiations and battles among powerful functions lead to political compromises and patchwork solutions.

The fact that working-level engineers were involved in the concept stage of the Accord's development was essential to its product integrity. Faced with tough choices about the car's front end, the engineers had not only a clear concept to guide them but also one they felt they owned. Moreover,

their solution—the new engine—enhanced the Accord's internal integrity by raising its level of technical performance. At the same time, internal demands and functional constraints never compromised the Accord's basic concept. Like many of the other product managers we spoke with, the Accord's product leader knew that democracy without clear concept leadership is the archenemy of distinctive products.

There are other ways to balance downstream expertise with strong concept leadership, of course. (One of Honda's rivals also makes early cross-functional negotiations an important part of its new product development work, for example, but gives a small group of concept creators and assistants six months or so to establish the concept first, before the negotiations begin.) The important point is that integrity depends on striking a balance between the two. Companies that trade off one for the other sacrifice both product and organizational integrity. Those that place sole responsibility for the product concept with a specialized unit (often one within marketing) end up with lots of last-minute design and engineering changes. Conversely, companies that initiate senior-level, cross-functional negotiations at the very start of every project usually find themselves with undistinguished products.

The integration that leads to product integrity does not surface in organization charts alone, nor is it synonymous with the creation of cross-functional teams, the implementation of “design for manufacturing,” or any other useful organizational formula for overhauling development work. Ironically, efforts to increase integration can even undermine it if the integrating mechanisms are misconstrued or if the organization is unprepared for the change. At one U.S. auto company, we found a very coherent cross-functional project team with great spirit and purpose. But the team was made up solely of liaisons and included none of the working engineers actually responsible for drawings and prototypes. So for the most part, engineers ignored the team, whose existence only masked the lack of true integration.

What distinguishes outstanding product developers is the consistency between their formal structures and the informal organization that accomplishes the real work of development. In the case of the Honda Accord, we have seen some important characteristics of such consistency: the company's preference for firsthand information and direct (sometimes conflict-full) discussion; the way specialists are respected but never deified; the constant stream of early, informal communication (even at the risk of creating confusion or inefficiencies in the

short run); and, most important, the primacy of strong concept leadership.

## Integrity's Champion: The Heavyweight Product Manager

The key to product integrity is leadership. Product managers in companies whose products consistently succeed accomplish two things without fail. They focus the whole development organization on customer satisfaction. And they devise processes (both formal and informal) for creating powerful product concepts and infusing them into the details of production and design. In our lexicon, they are "heavyweight" product managers, and they differ significantly from their lighter weight counterparts in other companies.

During the 1980s, product managers began to appear at more and more of the world's auto companies. In most cases, the title means relatively little. The position adds another box to the organization chart, but the organization's basic structure is still heavily functional. Product managers in these companies coordinate development activities through liaison representatives from each of the engineering departments. They have no direct access to working-level engineers, no contact with marketing, and no concept responsibility. Their positions have less status and power than the functional managers' do, and they have little influence outside of product engineering (and only limited influence within it). Their job is to collect information on the status of work, to help functional groups resolve conflicts, and to facilitate completion of the project's overall goals. They do not actually impair a product's integrity, but neither can they contribute much to it.

The contrast with the heavyweight's job could not be more striking. In a few auto companies, product managers play a role that simply does not exist in other automakers' development organizations. Like the Accord's large product leader, they are deeply involved in creating a strong product concept. Then, as the concept's guardians, they keep the concept alive and infuse it into every aspect of the new product's design. As one heavyweight product manager told us, "We listen to process engineers. We listen to plant managers. But we make the final decisions. Above all, we cannot make any compromise on the concept. The concept is the soul of the vehicle; we cannot sell it."

Guardianship like this is crucial because the product concept can get lost so easily in the complexity of actually designing, planning, and building a new

car. The problems that preoccupied the Accord's product engineers were often almost imperceptibly small: a three-millimeter gap between the window glass and the body; the tiny chips on the car's sills that come from stones kicked up on the road; a minuscule gap between the hood and the body. But problems like these are the stuff of product integrity: all the magic is in the details.

Keeping track of those details, however, is no easy matter. Nor is it easy to keep the product concept fresh and clear in many people's minds during the months (and years) that development consumes. For that reason, heavyweight product managers must be a little like evangelists, with the product concept as their Bible and the work of exhorting, preaching, and reminding as their mission. To paraphrase an assistant product manager in one of the heavyweight organizations, subtle nuances such as the car's taste and character have to be built into the design by fine-tuning. They cannot be expressed completely in planning documents, no matter how detailed those may be. So the product manager has to interact continuously with the engineers to communicate his intentions and to refresh and reinforce their understanding of the product concept.

As concept guardians, heavyweight product managers draw on both personal credibility and expertise and the organizational clout that comes with the job. Themselves engineers by training, heavyweight product managers have a broad knowledge of the product and process engineering required to develop an entire vehicle. Years of experience with their companies give their words weight and increase their influence with people over whom they have no formal authority.

Product planners and engineers working on the detailed design of specific parts typically fall into this category. Yet as we have seen, the substance of their work is vital to a new car's integrity. To track design decisions and ensure that the concept is being translated accurately, heavyweight managers communicate daily with the functional engineering departments. They also intervene directly when decisions about parts or components that are particularly problematic or central to the product concept are being made. From a functional point of view, this is clearly a breach of organizational etiquette. But in practice, this intervention is usually readily accepted, in part because it is backed by tradition but mostly because of the product manager's credibility. When heavyweights visit bench-level engineers, they come to discuss substantive issues and their input is usually welcome. They are not making courtesy calls or engaging in morale-building exercises.

Organizationally, the heavyweight manager effec-



tively functions as the product's general manager. In addition to concept-related duties, the responsibilities that come with the job include: coordinating production and sales as well as engineering; coordinating the entire project from concept to market; signing off on specification, cost-target, layout, and major component choices; and maintaining direct contact with existing and potential customers. Some of this work occurs through liaison representatives (although the liaisons themselves are "heavier" than they are in the lightweight organizations since they also serve as local project leaders within their functional groups). But there is no mistaking the heavyweights' clout: engineering departments typically report to them (which ones depends on the internal linkages the company wishes to emphasize). Heavyweights are also well supplied with formal procedures like design review and control of prototype scheduling that give them leverage throughout the organization.

Still, probably the best measure of a product manager's weight is the amount of time that formal meetings and paperwork consume. Lightweight product managers are much like high-level clerks. They spend most of the day reading memos, writing reports, and going to meetings. Heavyweights, in contrast, are invariably "out"—with engineers, plant people, dealers, and customers. "This job can't be done without wearing out my shoes," one experienced manager commented. "Since I'm asking other engineers for favors, I shouldn't ask them to come to me. I have to go and talk to them."

What lies behind "product managers in motion" is the central role that information plays in bringing new products to life. Take the heavyweight's interaction with customers. Talented product managers spend hours watching people on the street, observing styles, and listening to conversations. Department stores, sports arenas, museums, and discotheques are all part of their "market research" beat.

Heavyweight product managers are equally active in their relations with the test engineers. Like the product manager, test engineers stand in for the customer. When they evaluate a suspension system or test-drive a new car, they are rehearsing the experience the future customer will consume. To do this successfully, in ways that will ensure product integrity, the test engineers must know what to look for. In other words, they must be crystal clear on the product concept.

Heavyweight product managers make sure this clarity exists. They often test-drive vehicles and talk about their experiences with the test engineers. Many can and do evaluate the car's performance on the test track and show up almost daily during critical tests. They also seize every opportunity to build

good communication channels and deepen their ties with younger engineers. One product manager said he welcomed disagreements among the test engineers because they gave him a good reason to go out to the proving ground and talk about product concepts with younger people with whom he would not otherwise interact.

If we reverse direction to look at how heavyweight product managers promote internal integrity, the same kind of behavior and activities come to the fore. Direct contact with product engineers and testers, for example, not only reinforces the product concept but also strengthens the links between functions, speeds up decision making and problem solving, and makes it easier to coordinate work flows. In fact, almost everything a product manager does to infuse the concept into the details makes the organization itself work better and faster. The reason is the strong customer orientation that the product concept—and product manager—convey.

The product manager's job touches every part of the new product process. Indeed, heavyweight product managers have to be "multilingual," fluent in the languages of customers, marketers, engineers, and designers. On one side, this means being able to translate an evocative concept like the pocket rocket into specific targets like "maximum speed 250 kilometers per hour" and "drag coefficient less than 0.3" that detail-oriented engineers can easily grasp. On the other side, it means being able to assess and communicate what a "0.3 drag coefficient" will mean to customers. (The fact that the translation process from customer to engineer is generally harder than that from engineer to customer explains why engineering tends to be the heavyweight product managers' native tongue.)

Because development organizations are continually involved in changing one form of information into another, face-to-face conversations and informal relationships are their life's blood. Heavyweight managers understand this and act on it. Aware that product concepts cannot be communicated in written documents alone (any more than the feel and sensibility of a new car can be captured in words alone), they travel constantly—telling stories, coining phrases, and generally making sure that nothing important gets lost in translation.

## The Improvement Ethic

How a company develops new products says a great deal about what that company is and does. For most companies, the journey toward competing on integrity began during the 1980s. Quite possibly, it was

inaugurated with a commitment to total quality or to reducing the lead time for developing new products. Heavyweight product management constitutes the next step on that journey. Taking it leads down one of two paths.

Some companies introduce a heavyweight product management system modestly and incrementally. A typical progression might go like this: shift from a strictly functional setup to a lightweight system, with the integrator responsible only for product engineering; expand the product manager's sphere to include new tasks such as product planning or product-process coordination; then raise the product manager's rank, appoint people with strong reputations to the job, and assign them one project rather than a few to focus their attention and expand their influence. Senior managers that face deep resistance from their functional units often choose this path.

Other companies (particularly smaller players) take a faster, more direct route. One Japanese company leapt to a strong product manager system to introduce a new model. Backed by the widespread belief that the project might well determine the company's future, senior management created an unusually heavy product manager to run it. An executive vice president with many years of experience became the product manager, with department heads from engineering, production, and planning acting as his liaisons and as project leaders within their functional groups. With these changes, management sent a clear signal that the company could no longer survive in its traditional form.

The project succeeded, and today the product is seen as the company's turnaround effort, its reentry as a competitor after years of ineffectual products. The project itself became a model for subsequent changes (including the creation of a product manager office) in the regular development organization.

How a company changes its organization and the speed with which it moves will depend on its position and the competitive threat it faces. But all successful efforts have three common themes: a unifying driver, new blood, and institutional tenacity. (See the insert "The Case for Heavyweight Product Management," which describes Ford Motor Company's progress toward becoming a heavyweight organization.)

Just as engineers need a vision of the overall product to guide their efforts in developing a new car, the people involved in changing an organization need an objective that captures their imaginations. Where changes have taken hold, senior managers have linked them to competition and the drive for tangible advantage in the marketplace.

During the 1980s, the quest for faster development lead time was particularly powerful in driving such efforts. But lead time is not an end in itself. Rather, its pursuit leads people to do things that improve the system overall. In this respect, lead time is like inventory in a just-in-time manufacturing system: reducing work-in-process inventory is somewhat effective, but attacking the root causes of excess inventory truly changes the system.

Companies that successfully focus on lead time generally emphasize changes in internal integration. Product integrity can drive companies to higher performance. Managed well, the drive to create products that fire the imagination gives the implementation of a heavyweight system energy and direction.

Of the many change efforts we have seen, the most successful were led by new people. Some were new to the company, but most came from within the organization. Sometimes viewed as mavericks, they saw the potential for change where others saw more of the same. A company cannot change everyone. It can, however, create new leaders and empower people who are attuned to the new direction the company has to take. It can also find nontraditional ways to identify and develop heavyweight product managers for the future, such as apprenticeship systems.

Moving to a heavier product manager structure is a process of discovery—one the U.S. auto company with the ineffectual cross-functional team we described earlier knows very well. Like many others, that company has discovered that changes in organizational structure are important but insufficient. To create a true team, greater change—particularly in the behavior of traditionally powerful functional managers—is needed.

The journey to heavyweight product management is hard, surprisingly so for many managers. Those who succeed do so because they have tenacity. Outstanding companies understand that projects end but the journey doesn't. The challenge to learn from experience and continuously improve is always there.

Yet in company after company, the same problems crop up over and over. Why do most companies learn so little from their product development projects? The explanation is simple: at the end of every project, there is pressure to move on to the next. The cost of this tunnel vision is very high. Those few companies that work at continuous improvement achieve a significant competitive edge. Moving to a more effective development organization can be the basis for instilling an ethic of continuous improvement. Companies that compete on integrity exercise that ethic every day.

# The Case for Heavyweight Product Management

In the early 1980s, successful products filled the Ford Motor Company's scrapbooks but not its dealers' showrooms. Its cars were widely criticized. Quality was far below competitive standards. Market share was falling. In addition, the company's financial position was woe-ful, and layoffs were ongoing, among white-collar staff and factory workers alike. By the end of the decade, history was repeating itself: the Ford Explorer, introduced in the spring of 1990, may prove to be Ford's most successful product introduction ever. Despite the fact that it debuted in a down market, the four-door, four-wheel-drive sport-utility vehicle has sold phenomenally well. Rugged yet refined, the Explorer gets all the important details right, from exterior styling to the components and interior design.

Behind the Explorer lay a decade of changes in Ford's management, culture, and product development organization. The changes began in the dark days of the early 1980s with the emergence of new leaders in Ford's executive offices and in design studios. Their herald was the Taurus, introduced in 1985. Designed to be a family vehicle with the styling, handling, and ride of a sophisticated European sedan, the car offered a distinctive yet integrated package in which advanced aerodynamic styling was matched with a newly developed chassis with independent rear suspension and a front-wheel-drive layout. The car's interior, which minimized the chrome and wood paneling that were traditional in American roadsters, had a definite European flavor. So did the ride and the way the car handled: the steering was much more responsive, and the ride was tighter and firmer.

The development efforts that produced the Taurus set in motion profound changes within the Ford engineering, manufacturing, and marketing organizations. Traditionally, Ford's development efforts had been driven by very strong functional managers. In developing the Taurus, however, Ford turned to the "Team Taurus," whose core included principals from all the major functions and activities involved in the creation of the new car. The team was headed by Lew Veraldi, at the time in charge of large-car programs at Ford, and it served to coordinate and integrate the development program at the senior management level.

Team Taurus was the first step on a long path of organizational, attitudinal, and procedural change. As development of the Taurus went ahead, it became clear that integrated development required more than the

creation of a team and that there was more to achieving integrity than linking the functions under the direction of a single manager. So the next step in Ford's evolution was the development of the "concept to customer" process, or C to C.

The C to C process took shape during the mid-1980s, as Ford sought aggressively to cut lead time, improve quality, and continue to bring attractive products to market. Led by a handpicked group of engineers and product planners, the C to C project focused on devising a new architecture for product development: its members identified critical milestones, decision points, criteria for decision making, and patterns of responsibility and functional involvement. This architecture was then implemented step by step, in ongoing programs as well as in new efforts.

At about the same time, in 1987, Ford formalized the "program manager" structure that had evolved out of the Taurus experience. (Program manager is the term Ford uses for the position we call product manager.) As part of this structure, senior management affirmed the centrality of cross-functional teams working under the direction of a strong program manager. Moreover, cross-functional integration was reinforced at the operating level as well as at the strategy level. The change in marketing's role is a good example: instead of adding their input through reports and memoranda, marketing people (led by the program manager) meet directly with designers and engineers to discuss concept development and key decisions about features, layout, and components. Similarly, program managers have been given responsibility for critical functions like product planning and layout, where many of the integrative decisions are made.

In successive programs, Ford has refined its approach and pushed integration further and further. The strength of the program managers has also increased. The results are visible in the products Ford developed during the latter part of the 1980s—and in their sales. Beginning with the Taurus, Ford has scored impressive market successes with a number of its new cars: the Lincoln Continental, which expanded Lincoln's share of the luxury market; the Thunderbird Super Coupe, which compares favorably with European high-performance sedans; the Probe, the result of a joint development project with Mazda and which enthusiasts generally rate higher than Mazda's own effort, the MX6; and the sport-utility Explorer.