

Rooting Out the Causes of Inefficient Product Creation

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In the decades ahead, successful companies will be those that can develop products with real customer value – and do so fast, consistently, and cost-effectively. Toward this end, most forward-thinking companies have taken initiatives to improve their product creation processes. Among their new tools and techniques have been simultaneous engineering, cross-functional program teams, milestone reviews, and product strategy boards. They have had four critical objectives:

- Reducing time-to-market
- Increasing customer satisfaction
- Reducing manufacturing cost
- Increasing the cost-efficiency of research, development, and engineering (RD&E)

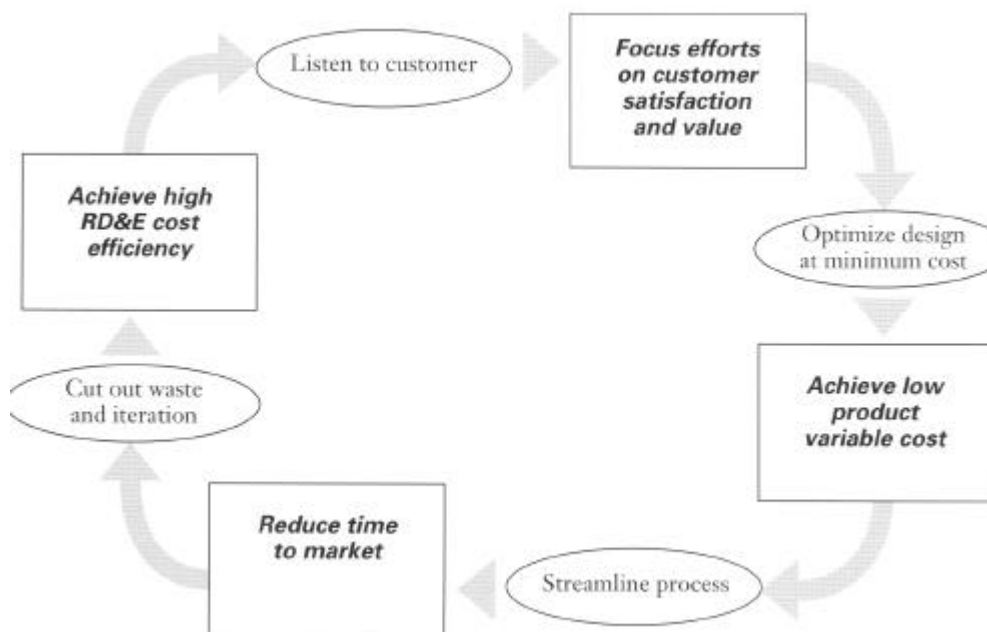
In theory, it should be possible to achieve all four objectives simultaneously. In practice, however, progress has been uneven and frustration levels high. Executives often feel that they must make tradeoffs among the four objectives. Increasing customer satisfaction seems to require longer development time and higher cost, whereas increasing speed seems to reduce cost-efficiency in RD&E.

The experience of a large European truck manufacturer typifies the issues involved. The manufacturer had recognized that its development process was not producing real customer value and satisfaction. The firm's management launched a major initiative to introduce the voice of the customer into the process. Eventually, the resulting product line met an enthusiastic response in the marketplace. However, the CEO confessed to us that the experience had been like mating elephants: „Lots of crashing and trumpeting, and it took nine years to see the results.“ The product development had endured endless iterations, with late-stage engineering changes to overcome problems in manufacture causing delays and RD&E budget overruns of \$50 million. The company had addressed one symptom, but at major cost to other performance measures. Why?

We believe that persistent problems in the four areas of lead time, customer value, product cost, and RD&E efficiency can be traced to the fact that often management has addressed the symptoms of problems rather than their root causes. Significantly, our work has revealed that the same underlying root causes often cause problems in all four areas. Accurate diagnosis of these root causes – and scalpel-like precision in operating on them – can stimulate renewed and lasting product creation vitality in what we call a *virtuous circle* of product creation (Exhibit 1).

Exhibit 1

Strategy/Process Correlation



Long Lead Times

Companies that are slow getting their products to market exhibit one or more of three general problems: lack of initial direction, multiple iterations (rework), or slowness in execution. But what are the root causes?

Lack of Initial Direction. Without a clear initial direction, a program goes through seemingly endless consideration and discussion before it finally gets under way. Even if the entire management team is convinced that something ought to be done in a particular market segment, there is often no consensus on what to do. Management may discuss the matter for months or even years while a more nimble competitor gets to market first.

One cause of this endless discussion is the absence of a clearly articulated product strategy. The product strategy should identify target markets for the company's products and services. It should also specify timing for the development of new products and balance the load on RD&E accordingly. Without such a frame of reference, firms tend to drift. Each decision to develop a specific product requires the management group to reconsider practically its whole strategy.

Another factor that makes it hard to establish an initial direction is the absence of a clear understanding of customer needs. Without a solid process for gauging customers' explicit and latent needs, a company can never be sure whether a particular program will improve its competitive position. Uncertainty leads to endless debate about the merits of the program, squandering precious time.

The third impediment to making initial project decisions has to do with complex and/or ineffective management structures. Some companies have as many as five overlapping management review committees that must evaluate and approve any decision. Such cumbersome structures inhibit product development in several ways, including slowing the initial decision process.

Multiple Iterations. Multiple iterations and rework are another major cause of slowness. Put simply, it takes longer to do something wrong several times than to do it right the first time.

When an organization finds itself going round and round the design spiral, certain process elements are likely to be broken. Often the market requirements and product specifications are incomplete or unclear. When the objectives of the product development program aren't firmly established at the beginning, executives from the various functions involved often demand rework later in the program.

Another common cause of rework is an inadequate milestone structure. Many companies use milestones designed around management reporting or budgetary requirements rather than specifying milestones directly related to the critical path of the project. Unless milestone events are pegged to key decisions, managers can't fully analyze the necessary tradeoffs. As a result, some aspect of the project is likely to need rework. An example of this type of milestone is the major financial review that occurs in the life of most projects. Many companies, in fact, never cancel a project once it reaches that review point, even though the project may fail the review and the time and energy expended thereafter could be better spent elsewhere.

Finally, many companies suffer from poor milestone discipline. Well-designed milestones have a fixed sequence and timing that must be respected. Too often, when a delay in one area of a program puts a milestone review in jeopardy, executives take one of two very dangerous courses of action: They either delay the review without changing the product's eventual launch or allow the review to take place without meeting all the requirements. The former course lengthens lead times, while the latter leads to extensive rework. Familiar examples include managers making go-ahead decisions before all the prototype testing has been completed or signing off on factory-readiness before final tooling is available. Too often, the final design must be changed and the work redone.

Slowness in Execution. A third important contributor to long development cycles is pervasive slowness of execution, both within functions and across them.

We have found that some delay can be caused by having inadequate tools, such as CAD/CAM and MIS support, at the functional level. More often, however, the slowness has to do with the ineffective use of human resources. Staff may be assigned to the wrong projects or to too many projects.

Or there may be simply no sense of urgency. It's hard to remain keenly competitive when the atmosphere in RD&E is too relaxed.

In our experience, the most important cause of slowness in an otherwise efficient organization is often an excessive number of poorly coordinated hand-offs throughout the process. Marketing research hands off the project to marketing, which gives it to advanced engineering, which drops it at the prototype shop, which hands it off to the line engineering organization, which passes it along – eventually – to manufacturing engineering, which dumps it at the plant. Although a number of companies are introducing cross-functional teams and simultaneous engineering concepts, many are still struggling with how to manage the hand-offs. In many

companies we work with, the issue of how to manage the interface between marketing and the technical functions is the most pressing concern.

Low Customer Satisfaction

In our experience, low customer satisfaction results from flawed product concepts, lack of customer input through development, and a mismatch between customer-perceived value and product cost. Again, we must dig deeper to identify the root causes.

Flawed Product Concepts. One of the most common root causes of flawed product concepts is ignorance of the customer – the same root cause that, as we saw above, makes it difficult to get projects off the ground. Ignorance of the customer is even more damaging to customer satisfaction. Companies with unclear product strategies, uncertain identification of target group(s), and no understanding of customers' latent needs have no way of knowing whether their newly developed ideas will succeed. The last point is critical. Most truly revolutionary new products and services, such as automatic teller machines, Post-It notes, and the personal computer, came out of understanding latent needs.

Very often, companies that do a wonderful job of defining requirements nonetheless produce only lackluster products because their efforts simply do not strike a chord with customers. These companies lack the ability to see inside the customer's head and discover latent needs and desires that the customer is unaware of.

Lack of Customer Input. Another major problem is the exclusion of the voice of the customer from the development process. We have found this problem even in companies that spend a great deal of effort and resources trying to understand the customer. Often, such companies have few mechanisms in place to actually use that understanding to refine and test the product as it is developed.

In some firms, Marketing „owns“ the customer's viewpoint, which it shares with the rest of the organization only indirectly, insisting on acting as a conduit. Too often, internal politics and rivalries distort the customer input.

Because latent needs and future preferences are so highly subjective, it is essential for every function to participate directly in gathering and interpreting them. When Marketing tries to limit access to customers or raw market research data, the effect is usually to drive Engineering off on its own. For example, one executive vice president of engineering for an automotive company told the authors that he knew what the customer wanted better than the customer himself – and far better than Marketing, which could not see beyond the next quarter's sales forecast.

The other root cause that cuts the customer's voice out of the process is an inadequate milestone structure. If the program plan does not explicitly require a number of checkpoints along the way, the customer will often be forgotten in the race to meet time, performance, and cost targets.

Mismatches Between Value and Cost. All development projects make tradeoffs between customer-perceived value and cost. These tradeoffs normally involve Marketing, Engineering, Manufacturing, Finance, and Environmental Protection. When the process of evaluating tradeoffs becomes subjective rather than objective, decisions deteriorate and customer satisfaction ultimately suffers.

Ineffective program management is one root cause of a breakdown in the objectivity of tradeoff analysis. If the program manager lacks the leadership qualities and consensus-building skills required, the team's ability to analyze the facts gets muddled with mutual suspicion and rivalry, increasing the subjective nature of the analysis.

Lack of analytical tools can also make tradeoff analysis subjective. Effective tools are available for establishing the customer value of specific performance characteristics and features. For example, the quality function deployment (QFD) approach offers an objective, analytical way to identify and resolve tradeoffs.

Another root cause is a lack of mutual knowledge or respect among the various functions involved. Many companies rely on highly functional organizations in which there is little direct contact across functions and therefore little opportunity to develop understanding. When a lack of contact is combined with a confrontational atmosphere, emotional drivers begin to dominate and objectivity is lost.

Finally, complex or ineffective management structures can prevent decisions from happening at the appropriate levels. Too often, a conflict over tradeoffs within a program team is referred up to the department manager's program management committee. That committee sends the issue to the VP-level new products committee, which in turn refers the issue to the CEO – probably the least-qualified person, to understand the different points of *view* and make a rational tradeoff decision. One industrial equipment manufacturer had six different management committees reviewing almost every aspect of new product development.

High Product Variable Cost

In our experience, the first-level causes of high product variable cost are wrong make-or-buy decisions, technology creep, and difficulty of manufacture.

Wrong Make-or-Buy Decisions. Management has been struggling with the make-or-buy decision for many years. While we do not recommend outsourcing as a cure for all evils, in many cases uncompetitively high variable costs can be directly attributed to a failure to take advantage of low-cost suppliers.

Because of the specialized nature of their products, high-technology companies often develop vertically integrated design and manufacturing systems. As their industries mature, however, such firms often fail to recognize when to begin outsourcing commodity components and decreasing their vertical integration. Sizable investments in engineering and manufacturing facilities often keep firms from going outside and drive up their product variable cost.

The „not-invented-here“ syndrome also taints the make-or-buy decision process by coloring judgment about suppliers' capabilities, particularly if the company has made significant investments in the development effort.

Finally, incomplete or blurry specifications add to the problem. If it is unclear what a product or component must do, it's hard to outsource it.

Technology Creep. Many companies involved in technology-focused market segments suffer from what is sometimes called technology creep. Engineers and executives are dazzled by the beauty and power of what their technology can do. But unless that technology adds value – as perceived by the customer – it will very likely add cost without commanding a higher price.

The root causes of technology creep are the lack of a mechanism to bring the voice of the customer into the development process and the lack of formal, objective analysis of tradeoffs between value and cost.

Difficulty of Manufacture. In order to keep variable costs down, products must be designed to take advantage of the company's manufacturing base. Poor performance in design for manufacturing is often caused by a few basic root causes.

First is a lack of early manufacturing input. Researchers have found that as much of 80 percent of a product's variable cost is determined in the first few months of the development process. It is essential for the manufacturing function to play an active and informed role during that period. Poor communication between Manufacturing and Engineering also can exacerbate the problem, especially if the functions are far apart either physically or culturally. Finally, complex/ineffective management structures, as discussed above, often get in the way of resolving issues early on, resulting in expensive design fixes and suboptimal solutions.

High RD&E Expense

It's a familiar management refrain: The cost of RD&E just keeps going up, while the flow of exciting new products and services slows to a mere trickle. Often the root causes of this dilemma lie within the product development process. The key issues we have found are that engineers are working on too many projects, there is too high a failure rate, and resources – both human and physical – are being used inefficiently.

Too Many Projects. The single biggest cause of RD&E inefficiency is having too many projects running at one time. Stephen Wheelright has shown that for maximum efficiency, engineers should work on only two projects simultaneously, and the same logic applies to engineering managers and the various services that support product development.

One of the key root causes of having too many projects is an unclear product strategy, as we have discussed. Another is the lack of a restrictive project-screening process. Programs need to be screened out as they progress, so that only the very best go into actual product development. In some companies, however, it is very difficult to kill unsuccessful projects along the way. Keeping them alive is a direct cause of RD&E inefficiency. Finally, complex management structures result in a lack of crispness in decision-making, as discussed above.

Too Many Project Failures. Unsuccessful programs that are eventually dead-ended, as well as products and services that are launched but then show poor market performance, consume RD&E resources. The lower the success rate, the higher the cost of RD&E to the corporation.

The root cause of failure to accomplish specified objectives normally lies as much in the process of specifying those objectives as in program implementation. If the process of developing specifications does not take into account factors such as technology risk, it is likely that the programs will fail.

In our experience, programs fail in the marketplace either because the product in service does not achieve high customer satisfaction or because the lead time was so long that the market changed during the course of the project. The root causes of both poor customer satisfaction and long time to market have been discussed above.

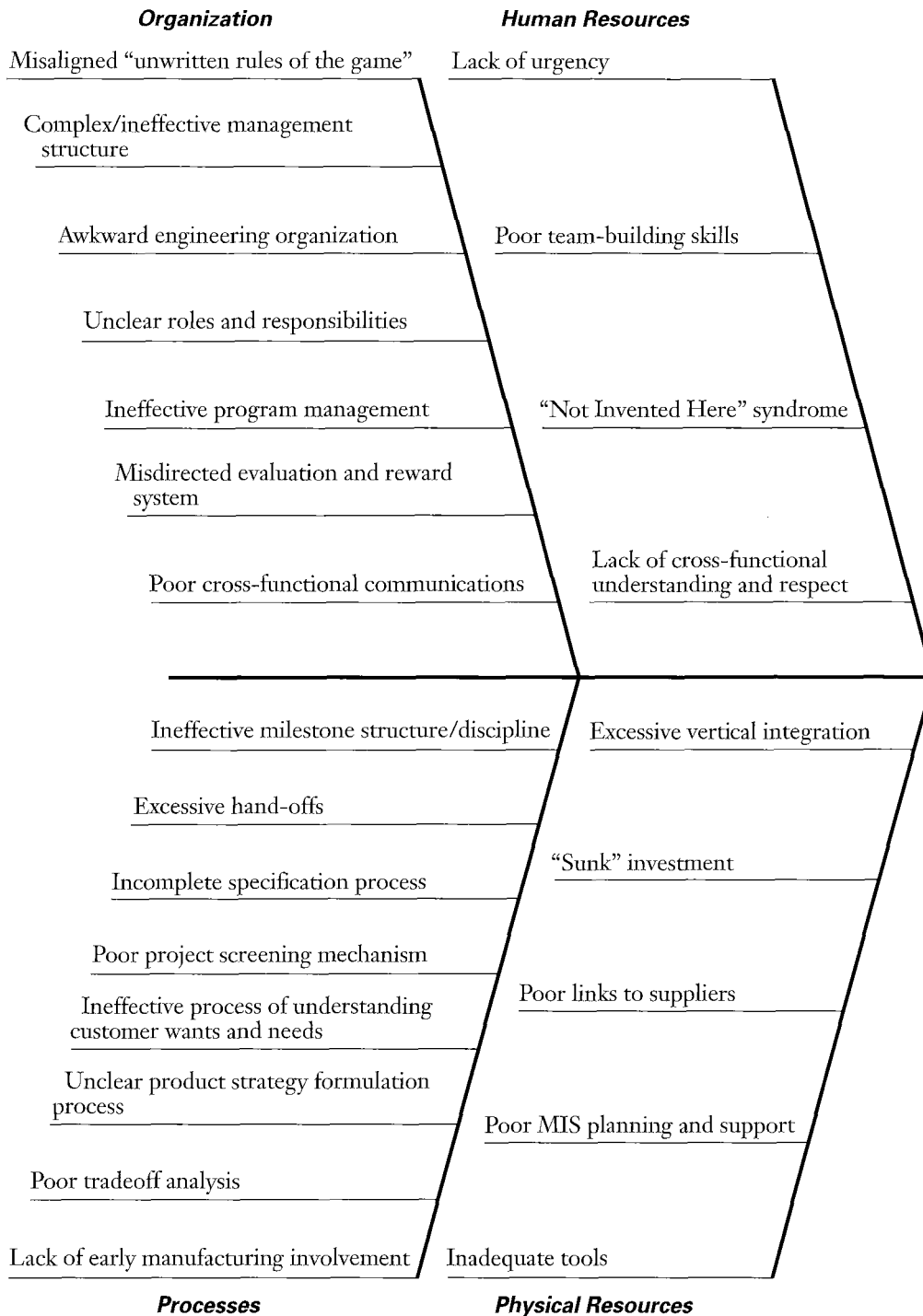
Inefficient Use of Human Resources. Common root causes of inefficiency in the use of human resources are awkward organizational models, unclear roles and responsibilities, the absence of team skills, and misdirected evaluation and reward systems. Root causes of the inefficient use of infrastructure include poor MIS planning and support, mismatched CAD/CAM facilities, and outdated testing equipment.

Addressing the Common Root Causes

Consolidating the results of the analyses above reveals a common set of root causes, arrayed in Exhibit 2 under the headings organization, resources (human and physical), and processes. By identifying and fixing the most important of these root causes, a company can enter into the product creation process virtuous circle.

Exhibit 2

The Root Causes of Inefficient Product Creation

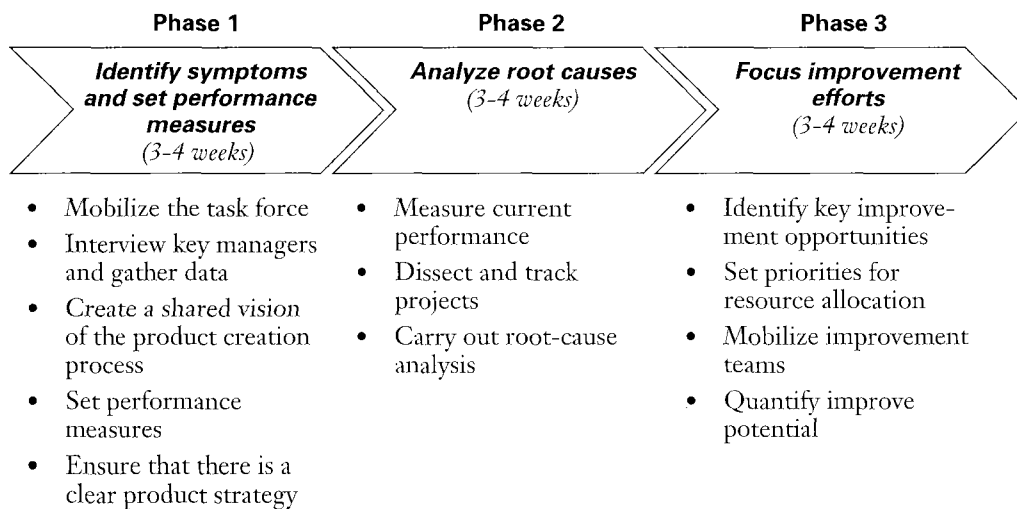


To set the improvement agenda, we have helped a number of leading companies undertake customized versions of due *health check* outlined in Exhibit 3. The objectives of the first phase are to identify the symptoms and set relevant performance measures.

The task force for this job should include representatives from all the key functions involved in creating new products. The task force should work with senior management to establish a shared vision of the importance of products to the business, as well as a clearly articulated product strategy. The group should then identify the main symptoms and set target performance levels against key measures. These performance measures need to include both output measures (e.g., time to market, product renewal rate, time to break-even) and process measures (e.g., number of design changes, level of rework, lead time variance against plan).

Exhibit 3

The Product Creation Process Health Check



In phase 2, the company measures its current performance and carries out a root cause analysis. It is useful to select for analysis a number of representative projects at different stages of development (one recently completed, some in process) and with varying success rates (some „problem children,“ some „star projects“). The projects selected should all be of significant size, with the necessary project information readily available. The task force should review project documentation and conduct interviews with key project team members and „customers.“ The objective of this phase is to develop a clear statement of the most important root causes of the symptoms.

In the final phase of the health check, the company identifies the most promising improvement opportunities in terms of both potential impact and „do-ability,“ sets resource allocation priorities, and mobilizes improvement teams. A first task for these teams – as in all product and process development work – is to establish clear improvement objectives and to prepare detailed program plans, i.e., to „plan superbly, then run like hell.“

A company that has a clear improvement agenda focused on the most important root causes can realistically hope to achieve simultaneous gains in all four objectives: shortening lead times, raising customer satisfaction, reducing product cost, and boosting RD&E cost-efficiency.

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