INSIGHT

Aerospace & Defense

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When it really matters.

Engineering Performance Management:

Balancing Creativity and Discipline

The best engineering organizations, by design, encourage and support a culture of creativity and technical excellence. However, those necessary attributes sometimes contribute to teams' resistance to strict budgets and tight schedules. Engineers claim their work is necessarily nonrecurring and that therefore—unlike other, more-repetitive functions such as manufacturing and procurement—engineering requires creativity with limited constraints. In the quest to solve problems and deliver elegant designs, new program development efforts are often completed late, leading to large cost overruns, financial disappointment, and damage to corporate reputation.

In many industries—particularly aerospace and defense, high technology, and automotive design—labor may constitute up to 70% of overall new product development costs (Figure 1). In highly competitive markets with rigorous new product release schedules and high production volumes, getting the engineering completed on time, on budget, and with designs that meet customer requirements can make the difference between meeting financial targets or losing both market position and competitiveness.

Effective management of engineering teams' productivity is critical for companies with highly engineered products to succeed. Effective management is a fundamental requirement for strong performance, but companies sometimes fail to

Figure 1: General product development costs and cost drivers

	Cost element	Typical % of total cost	Major cost drivers	Potential product-development-cost impact	Time to realize savings
Total product development cost	Design labor[1]	60%–70%	Engineering productivity Design workload Labor rate	High	• Short to medium
	Overhead labor	10%–15%	Organizational structure (spans and layers) Overhead process efficiency Footprint	Medium	• Short to medium
	Information technology	10%–15%	Customer requirements[2] IT architecture Contract structure and management	Low	• Medium to long
	Miscellaneous indirect	5%–10%	Procurement process Usage/Expense control	Low	• Short to medium

1. Includes internal and outsourced design labor.
2. For non-original equipment manufacturers.

Source: AlixPartners

identify problems related to engineering team efficiency. Management discipline is vital to creating engineering performance improvements as well as to the execution of current plans. There are always opportunities to improve engineering organizations and functions through disciplined performance management.

Engineers can retain their cultures of creativity and technical excellence and still be effectively managed to tight schedules and budgets and deliver superior financial performance. Effective performance management follows three main approaches: (1) focusing the engineering organization on productive output, not activity for its own sake; (2) managing resources and workloads across multiple integrated efforts; (3) optimizing engineering costs.

Productive output: The difference between being busy and delivering results

Activity doesn't equal output. Although engineering activities can contain nonrecurring design elements that require creative solutions, they're defined by a process; and that process generates engineering teams' deliverables to the rest of the organization. Those deliverables include system architectures, system diagrams, specifications, 3-D models, and bills of material.

Engineering teams are extremely busy at most companies: often much of their workdays are spent in meetings, on the phone, and writing e-mails. All of that effort may provide a certain level of satisfaction that individual engineers have worked hard, offered their opinions, and lent their expertise across many different workstreams. And that may be satisfying to the engineers, but in many cases, those activities didn't advance a deliverable or generate a tangible contribution to the product design. When design uptime, design efficiency, and first-pass yield are taken into account, real engineering productivity may amount to only 20 to 30% of actual time spent on the actual task (Figure 2). It's possible to improve on that with rigorous analysis and by evaluating how time, effort, and staffing actually relate to productivity and costs. It's important to assess how engineers spend their days and to identify organizational changes—including structure, metrics, and standard processes—that could help them focus on deliverables, not just on activity. Often a big source of improvement is through the reduction of engineer multitasking. Focusing engineers on one deliverable at a time often greatly improves their productivity by reducing the churn from moving from task to task.

Get the most out of what you have

"Reduce, reuse, recycle" is a phrase usually associated with the environmental movement. It's also a rallying cry for those seeking to improve the performance of engineering teams engaged in product development activities. As design labor approaches 70% of product development costs, workload reduction and effective management of resources rank high among the essential elements of cost reduction efforts.

In engineering-centric organizations with multiple programs, companies often find themselves funding multiple development efforts when instead, significant elements of products' bills of material could be shared. But projects often get developed independently, in their own individual silos, designed to the specific tastes and preferences of the individual engineers on each project. Despite the obvious cost benefits of modifying and reusing designs and insisting on the use of common,

Figure 2: Design labor productivity

	Design labor productivity	= Design uptime	x Design efficiency	x First-pass yield
Typical performance	**20%-30%** !	40%-60%	Often not measured, typically less than 80%	Industry specific but often lower than 60%
World-class performance	60%-70%	75%-85%	Over 90%	Over 80 %
	Symptoms of poor productivity	• Uptime not measured • Lost-time reasons not well understood • Large batch releases, poor flow, and long waits • Too many and wasteful meetings, -email overload	• Analysis and design tasks not standardized • Hours per design output (e.g, drawing) neither defined nor tracked • No peer comparison by design discipline • Engineering multitasking creating churn	• Design started before requirements fully agreed on • Phasegate review criteria poorly observed • Rampant firefighting, little systematic effort toward prevention

Source: AlixPartners

off-the-shelf parts, many engineers prefer white-sheet design because it's more challenging and exciting than modifying the work of others.

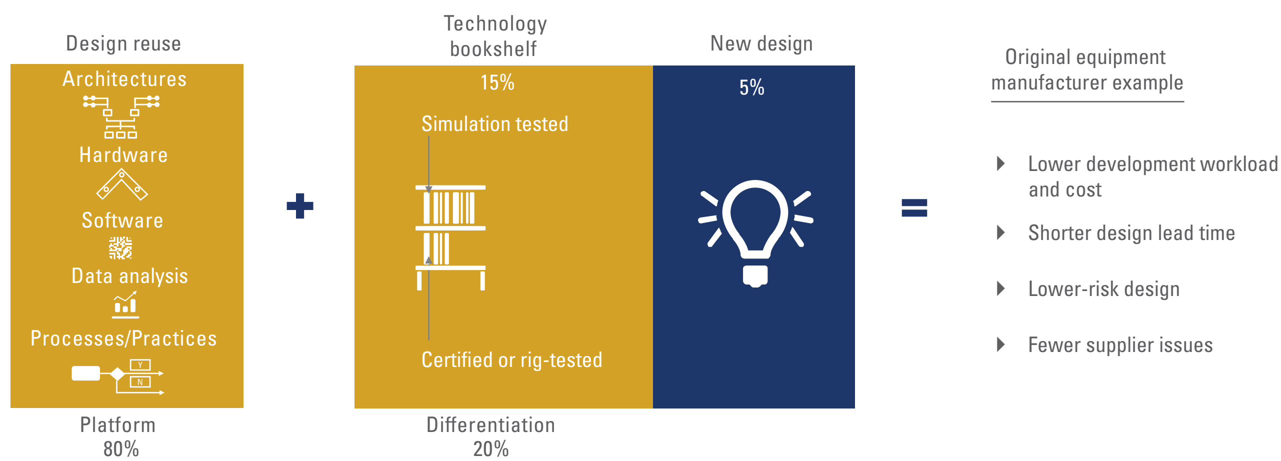
The best practices in the area of product development at companies manufacturing both commercial and industrial high-technology products have certain commonalities. The most-productive engineering teams make design reuse the default option, and they authorize and fund new design efforts only when an overwhelming business case justifies the additional work and expense. Those teams recycle designs for hardware, software, and system architectures, and they often reuse data analysis while demanding rigorous common-process adherence.

Engineering leaders have demonstrated that it's possible for engineering teams to reduce the quantity of new design to less than 5% of design content (Figure 3).

locations and distributions of work and about organizational choices that come down to the question of design "make versus buy." The results were sometimes underwhelming in terms of overall company performance. Critical decisions about what to do in-house, where to do it, and what should be outsourced often drive up total engineering labor rates to levels much higher than appropriate for the required skills, with process cycle times that do not meet program management expectations.

Improved engineering operating and financial performance often comes from directly challenging the assumptions behind previous design decisions and closely examining the historical norms that shaped the current team's structure, built its operating practices, and led to its metrics and measures.

Figure 3: Maximizing design reuse



Source: AlixPartners

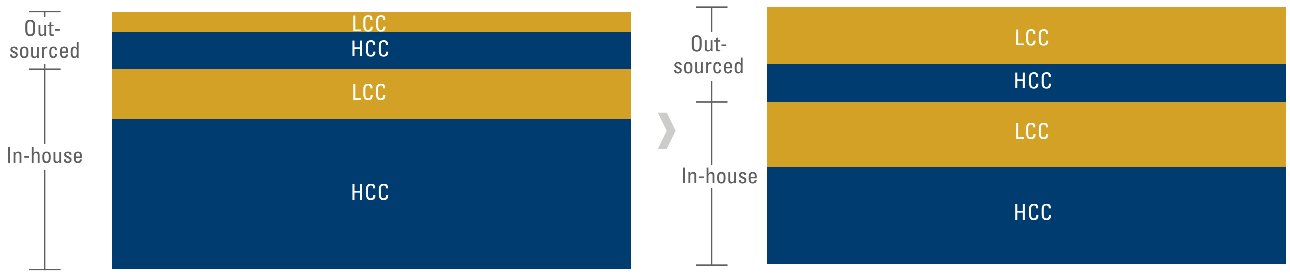
Optimizing Engineering Costs: Evolution or conscious design?

Many industries with highly complex, engineered products grew from a core group of technology-focused companies. Company founders were typically visionary engineers, diligent scientists, and other applied technologists who focused their entrepreneurial talents to create large and successful organizations. They developed cultures that rewarded technical excellence and still celebrate the spirit of the heroic, individual engineer. "Get it right—at any cost" often gets repeated to invoke organizational heritage and legacy. That evolutionary approach to engineering organizational design—and its regard for cost as a secondary measure of engineering success—has influenced companies' decisions about the geographic

The following guidelines help shape such an analysis.

- Establish unbiased make-versus-buy criteria by challenging what is truly proprietary and core.
- Optimize the in-house allocation of work across design centers in different geographies, growing low-cost-country design capacity when appropriate.
- Bundle outsourced work into logical packages and introduce competitive bidding globally to get best prices for given requirements.
- Limit spot buys and tighten procurement processes for engineering services such as the use of individual contractors.

Figure 4: Design footprint optimization



Typical outcomes:
- Increased outsourcing and use of LCC sources
- 10%-15% average rate reduction

HCC = high-cost country, LCC = low-cost country

Source: AlixPartners

Rigorous application of those design-footprint-optimization principles, particularly finding locations where lower labor costs can produce the same engineering results, can be central to achieving structural reforms in underperforming organizations (Figure 4).

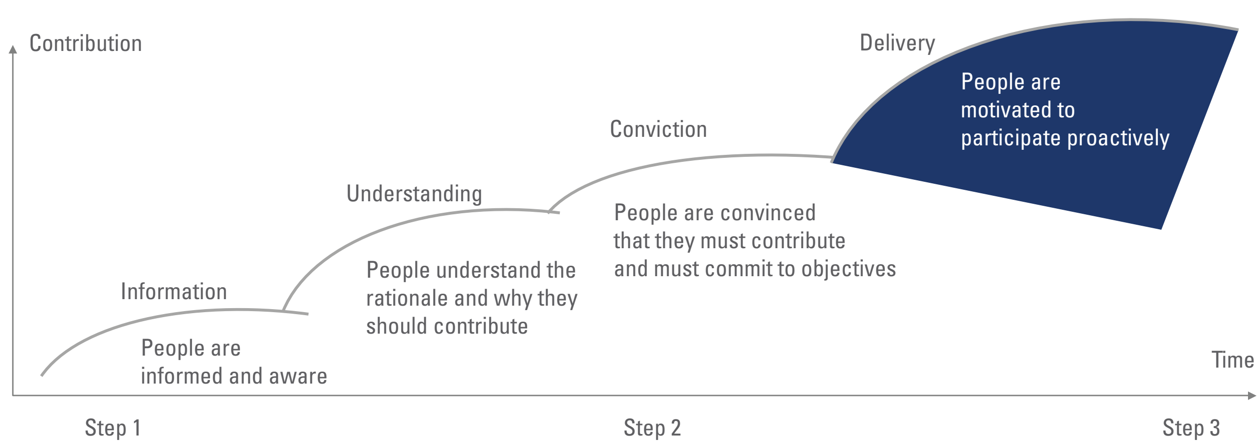
Implementation: Change becomes cash

Improved engineering performance management can pay huge dividends, increasing engineering productivity by 15% to 20%, with corresponding reductions in design cycle times. Such changes often yield proportionally similar results in market share gains and financial performance. While those concepts are being implemented, though, many engineers resist changes to the status quo and buck the additional accountability for measured achievement. They inherently grasp the concept of inertia, and they rely on time to dampen the drive for change. That resistance can be overcome through effective communication and change management programs that can increase the quality and quantity of employee contribution to successful change, accelerate results, and sweep aside organizational inertia (Figure 5).

The final outcome: Efficiency in function and cost

Applying a structured and logical communication program tailored specifically to engage engineering teams often helps overcome engineers' resistance, winning their support for changes that make it easier to get things done more efficiently. Performance management and productivity improvement in engineering organizations have historically been considerations secondary to product quality and mission success. But today's business environment makes cost control a prerequisite for financial success, which means that reducing engineering expense becomes an organizational priority.

Figure 5: Change management continuum



Source: AlixPartners

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