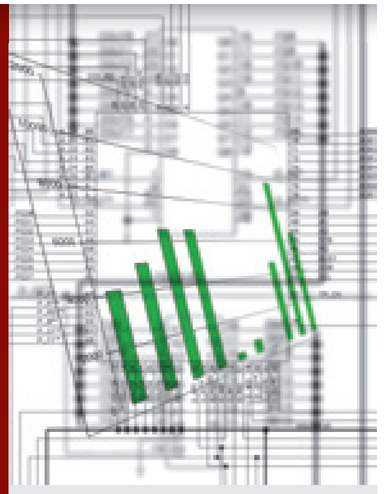
Operating Engineering Effectiveness

Managing engineering for maximum performance

Companies that employ thousands of highly paid engineers in industries from aerospace and defense, high-tech, and automotive to telecommunication and construction can find it challenging to control and improve their engineering performance. But it can be done. A.T. Kearney has transferred the tools used to improve operating asset effectiveness in factories to the world of engineering, with proven results: More companies are reducing waste while safeguarding quality and performance.



Engineering has remained relatively untouched by the waves of performance improvement that have swept through other industries. Those who try to apply performance improvement standards to engineering are likely to hit a nerve: Engineers will warn of "safety issues" to consider or "you're endangering the company's future." Failing to measure engineering productivity, most of these efforts run aground. Even Six Sigma, a well-known tool for improving manufacturing performance, is rarely used to improve engineering performance.

Nevertheless, engineering firms today face increasing pressure to enhance their performance. For example, highly skilled engineers' are scarce in Western European markets while the complexity of customized high-tech products has increased. More engineering organizations must work as virtual networks across the supply chain, coordinating with several subtier engineering teams (see sidebar: New Industry Challenges). By improving the effectiveness of their engineers, companies can undercut these challenges and perform more complex work with fewer hands, across multitiered organizational structures.

Through our work with clients, we have developed tools for improving a company's performance. First applied to other kinds of industrial work, these tools pinpoint where a firm's processes can be restructured to eliminate waste. In manufacturing, for example, operating asset effectiveness (OAE) optimizes asset output by comparing a theoretical best with actual net output in three specific areas: utilization, throughput and acceptance rates. Now we are taking the OAE approach and applying it to engineering. We've termed the concept operational engineering effectiveness, or OEE.

Engineering firms should treat capacity the way a manufacturer handles assets, eliminating waste and freeing up much-needed resources.

"But optimizing engineering is totally different from optimizing a single asset like a machine or a factory." A statement like this is not uncommon from engineers who often consider their work a creative, not formulaic, process, and more related to art than to industrial manufacturing. If we look at engineering from a managerial perspective, however, these teams and departments do in fact produce output much like a cell or cluster on the shop floor. This makes it easier to apply a factory-like optimization logic to engineering.

OEE identifies sources of waste by transferring the OAE logic to engineering (see figure). It is time for engineering firms to treat capacity the way a manufacturer handles assets-eliminating waste and freeing up much-needed resources for a challenging market environment.

Reengineering Waste

Using our OEE methodology, we analyzed a wide range of engineering projects, discovering that companies can identify and resolve sources of waste in three areas:

Engineering utilization. Utilization measures the amount of time actually spent on engineering activities and compares it against a theoretical maximum amount. This is a critical issue in large organizations, where employees are often distracted by meetings and bogged down by poor information flow. The primary sources of lost time include project downtime, routine administrative tasks, and waiting periods due to coordinating across different work sites.

Figure 1: OEE calculation model

$$\text{OEE} = \frac{\text{Effective engineering (h)}}{\text{Theoretical maximum engineering (h)}}$$

$$\text{OEE} = \text{Utilization} = \frac{\text{Used design time}}{\text{Total time}}$$

$$\times \ \text{Throughput} = \frac{\text{Actual deliverables}}{\text{Maximum deliverables}}$$

$$\times \ \text{Acceptance} = 1 - \text{\% rejected deliverables and deliverables with failures}$$

Quelle: A. T. Kearney

Determining utilization rates starts with examining the „housekeeping" tasks that often conflict with specific engineering assignments. For example, where are the bottlenecks in room and infrastructure equipment for running reviews of the digital mock-up? How are shared files and drives, e-rooms and office applications used? How lean, efficient and consistent are your progress and performance reporting structures? How much time is wasted due to missing information or system unavailability?

Once you've determined utilization rates, you can then plan and model your resources effectively in order to minimize time lost. For most of this work, IT will provide the main backbone. In multitier business environments, IT can help map and synchronize the entire process-outlining which products the engineers deliver, the tasks necessary to develop the product, and the activities performed across various functions. Video conferences can mean less time lost traveling to and from meetings, and efficient workflow management-tool-based or not-can have a significant impact on utilization rate.

Engineering throughput. Throughput measures the number of deliverables engineering actually produces (such as specifications, predesigns and drawings) versus the maximum number of deliverables it could have produced.

Using our OEE analysis, we found that challenges to high throughput generally stem from a lack of clarity and control in the work process. If engineers begin their work without clear assumptions or design specifications, this will lead to repeated changes later on in the process. In a new product development project, for example, we discovered that engineers were changing deliverables 1.2 times compared to 0.4 times expected at project start. This lack of up-front work creates tremendous loss in the throughput rate.

The situation is exacerbated in large-scale projects where companies tend to assign overlapping responsibilities to their engineers, or not coordinate efforts across the project, or leave external service suppliers "alone" to manage themselves. In addition, throughput suffers when IT systems are not designed to support the workflow, manage configurations, control the various changes in documents and versions, or develop 3D-design tools.

Using OEE, companies boost throughput performance by restructuring their work processes. The key is to bring strong project management skills to bear on engineering. To prevent last-minute changes, set your priorities in advance. Assign unique engineering responsibilities and develop a process for integrating them closely around one another. Ideally, IT tools will harmonize across different programs and those developing the tools will communicate one-on-one with the engineers who will be using them. With the right tools in place, IT can be crucial for improving performance.

Engineering acceptance. Acceptance measures the output quality of the design process. An acceptance rate of less than 100 percent means that engineering's customers in manufacturing have rejected deliverables because of errors, inconsistencies and other defects. Typically, errors caught that late in the process incur significant additional costs or have a severe impact on performance.

From our OEE analysis, we found that engineering design inaccuracies are the main driver of low acceptance rates, followed by inaccurate definitions and changes made by suppliers, manufacturing and assembly. Improving the acceptance rate not only reduces costs in engineering, but also in manufacturing and assembly. Otherwise parts or even tools need to be changed or redesigned, and installation must be carried out several times, putting overall product completion at risk.

New Industry Challenges

A survey of industry trends reveals a number of pressures confronting engineering firms:

Scarce capacity. The German labor market reflects the scarcity of skills in specific engineering areas. Although more than 4.5 million people were listed as unemployed in 2006, companies such as aircraft manufacturers continue to fall short in their demand for engineers, and struggle to fill even a thousand engineering positions in the short term.

More complexity. In industrial and consumer products, engineering must deliver more complex products in shorter lead times. For example, high-velocity trains must be able to run on different European rail network technologies. Mobile phones now integrate TV, video, sound and photo options. Products have more functions as customers demand more customized solutions.

Multiple interfaces. Increased complexity has led to business ecosystems in which original equipment manufacturers (OEMs) contract out for a multitiered supply base, not only in manufacturing and assembly but also in development and design. Consider that Italy's Alenia Aeronautica and U.S.-based Vought Aircraft Industries are building a large portion of the Boeing 787's fuselage, while Japanese partners build the wings. Many of today's OEMs focus their activities on integration, a task that is more challenging than manufacturing, which means engineering has to manage a broader range of interfaces than in the past.

Faster time-to-market. Stakeholders are demanding faster time-to-market. A typical example is the automotive industry, where there are more varieties of cars yet shorter production life cycles. A company's reputation and shareholder value could suffer if the program schedule is not met, which in turn affects the original business case. Once again, engineering is under pressure to deliver a mature product in time.

Implementing OEE

Improving OEE is a smart option to meet the new expectations of markets, customers and corporate performance targets. OEE increases transparency, making it easier to plan and measure the impact of engineering investments. It reveals the limits of performance improvements and indicates where performance breakthroughs and paradigm shifts in engineering are required. Lastly, OEE delivers the arguments for making major changes, and in some cases increasing investments in specific areas.

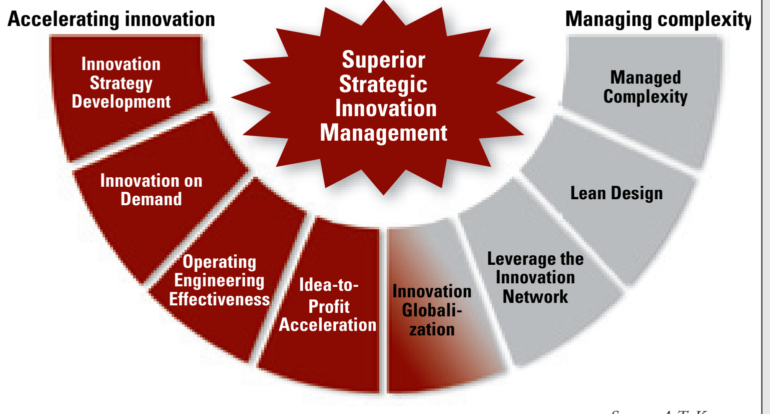
Of course, how successful your OEE is depends on how well it is implemented. While maximum impact is naturally achieved in large-scale development programs, projects or departments, it is often better to start OEE in select areas (for example, a particular engineering site or team) and to use pilots before pursuing a companywide rollout. Analyzing the utilization, throughput and acceptance rates becomes part of a continuous improvement process, with OEE serving as a key element in engineering performance management.

Faced with new challenges, the engineering industry requires innovative approaches for boosting its efficiency. OEE is a proven method for doing just that-allowing companies to meet and exceed their high performance expectations while still safeguarding quality.

Superior Strategic Innovation Management

Professional Innovation Management is key to achieving higher profitability and superior growth. A.T. Kearney has a proven, comprehensive set of service offerings to improve the innovation management capabilities of companies by answering a range of questions from how to accelerate innovation to how to better manage complexity:

- Innovation Strategy Development: Which needs to address by when?
- Innovation on Demand: What are the potential product and/or process solutions to fulfill customer needs?
- Operating Engineering Effectiveness: How to develop most efficiently?
- Idea-to-Profit Acceleration: How to minimize time-to-profit?
- Innovation Globalization: How to structure Innovation in a globalized context?
- Leverage the Innovation Network: What are the right capabilities to be sourced and where to get them?
- Lean Design: How to minimize lifecycle cost of existing and/or new products or services?
- Complexity Management: How to manage complexity best?



Source: A.T. Kearney

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A.T. Kearney is a global strategic management consulting firm known for helping clients gain lasting results through a unique combination of strategic insight and collaborative working style. The firm was established in 1926 to provide management advice concerning issues on the CEO's agenda. Today, we serve the largest global clients in all major industries. A.T. Kearney's offices are located in major business centers in 33 countries.

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