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Making Offshore Engineering Pay Off

by Anil Verma and Serge Lambermont

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How some companies send design work overseas without fear of diminished quality or intellectual property theft.

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Most manufacturers can easily tick off any number of practical reasons either for building new factories in China, India, Vietnam, and other low-cost nations or for buying parts from suppliers based in those countries. Simplified supply chains, better inventory management, and sharply reduced costs are among the obvious benefits. But the same group displays less enthusiasm for offshoring design and engineering.

On the face of it, that's a logical response. For one thing, compared to manufacturing and materials, engineering typically accounts for a tiny portion of the total cost of a product and therefore tends to merit little attention from top management. And perhaps more importantly, many manufacturers view engineering as the company's "crown jewel" — and they thus desire to keep it close to home, where it can be sheltered from intellectual property theft.

These rationales, however, overlook a critical but seldom recognized fact: As with factory operations, not all engineering tasks are created equal. Some design tasks are complex, continually evolving, or proprietary, and require sophisticated skills, a high degree of consultation with customers, or protection from piracy. Consequently, these activities are usually best maintained in-house. But other endeavors, such as engineering simple, modular parts, are the equivalent of commodities and can be handled advantageously in low-cost regions.

Indeed, a global engineering footprint — one that includes engineering facilities in both developed and developing nations — can generate measurable cost savings and greatly increase customer satisfaction. By shifting auto parts engineering operations from the United States to Eastern Europe and Asia, for example, the Delphi Corporation slashed its overall engineering costs by as much as 65 percent. Moreover, the company's non-U.S. revenues grew significantly, a substantial benefit of its extended engineering footprint in locations such as Sao Paulo, Bangalore, Seoul, Tokyo, Shanghai, Krakow, Singapore, and Juarez.

The approach many companies take in figuring out their mixed footprint is to distinguish between *performance-based* design cycles, which typically involve myriad changes in design from one generation to the next, and *cost-based* cycles, used for products with a mature underlying technology and slow rate of innovation. With performance-based cycles, upper management and customers (in the case of suppliers), as well as the marketing, sales, design, and engineering departments, usually play a big role in the frequent blueprint alterations. To juggle the continuous flow of new ideas and implement them efficiently, it is critical to have cross-func-

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tional development teams tied closely to corporate headquarters and a skilled engineering workforce — the kind often found only in more developed regions. But cost is not a major factor.

The opposite can be said about cost-based cycles. For these tasks, limiting expenses is the overriding issue, and frequent consultation with management, customers, and other stakeholders is unnecessary. The product's design and fundamental technology are well established and unlikely to undergo significant alteration. Consequently, companies can benefit from offshoring these engineering processes to low-cost nations.

Assessing performance- and cost-based cycles will provide some initial benefits. But over a longer period of time companies will find that few products are clear-cut enough, and few customer relationships static enough, for this approach to suffice. Nuances make it difficult to place the development activity easily in one camp or the other. And customers frequently change their product designs, necessitating continual reevaluation of engineering needs in many cases. Consequently, a more effective method for suppliers is to determine the *product* and *integration* complexity of each component in their portfolio and place these findings against one another to map the most advantageous locations for each engineering activity.

Product complexity is measured by the number of subcomponents, mechanical movements, process or design technologies, software modules, and suppliers. In the automobile industry, integration complexity is gauged by the number of intercompany interactions that are required by design, input–output ports, connector pins, customer change requests, and interrelated systems.

For example, an automobile's wiring harness — the basic electronic circuitry for switched devices like headlights, wipers, heater, and starter — has relatively low product complexity but very high integration complexity because the part must be woven into the architecture of the entire vehicle. On the other hand, a satellite digital audio receiver is a highly complex product from a design perspective, but sufficiently stand-alone to reflect limited integration complexity. A traditional lead–acid car battery is neither complex nor integrated; its design is based on a set of standard requirements with extremely minor customization for holding brackets, labels, and the like. And an automotive telematics system, by contrast, has a high degree of both complexity and integration, because it must communicate with satellite receivers for radio traffic information, with navigation systems, and with servers via mobile phone networks. Assessment of product and integration complexity thus produces a matrix of four possibilities, each with its own preferable strategy for engineering location:

High Product Complexity, High Integration Complexity. *Example: telematics system.* This category requires a deep well of technical talent, diverse skills, and extensive customer contact. The supplier and customer are part of one extended value stream. Consequently, the supplier's technical horsepower must be in close proximity to the customer's design center. With the skills and teamwork required to make a product like this, offshoring is not a feasible option.

High Product Complexity, Low Integration Complexity. *Example: digital audio receiver.* Because there are few (or no) customer touch points, product performance is a critical driver of success in this category. Offshoring to a locale with a broad base of engineering talent is feasible.

Low Product Complexity, High Integration Complexity. *Example: wiring harness.* A great deal of customer interaction is needed to ensure that parts in this category dovetail with other components, most of which are made by different suppliers. Because of the nature of the parts' configurations, these items should be designed close to the customer's factories in either developed or low-cost nations — what is known as a lean, distributed footprint.

Low Product Complexity, Low Integration Complexity. *Example: lead–acid car battery.* Leverage existing design capacity and mass production for these products. Because minimizing expenses is a critical factor in profiting from these commodities, all additional engineering needs should be offshored to a low-cost location.

At Delphi, in formulating a mixed engineering footprint strategy, we endeavored to go beyond the simplistic strategy of shifting low-tech work to low-cost countries. Instead, we hoped to create a systematic approach that defines how a company might deploy the right capabilities at the right place at the right time and at the right cost. This would allow us to better meet customer needs while improving the effectiveness of the company's engineering processes. +

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