In what now seems a distant past, company research facilities like Xerox PARC and Bell Labs fueled innovation and growth for dominant American manufacturing firms. As the pace of technological change has quickened and the costs of R&D have grown, that model has ceased to work. Meanwhile, global competition has intensified the imperative to innovate; even long-standing manufacturing companies, such as Parker Hannifin, Timken, Kennametal, and United Technologies, strive to have 20% or more of their products be new or substantially revamped each year. Although many companies still maintain proprietary research operations (Google X lab, for example), they’re increasingly turning outward and depending on distributed or open research, in which firms or clusters of firms tap into larger networks of academic and applied work to drive new product and process development.

Of course, no single model of distributed R&D works for all companies. Large firms like Proctor & Gamble can push R&D and product innovation out through their supplier networks. P&G maintains a goal of 50% of its total innovation from outside the company, and half of that from outside suppliers. As Henry Chesbrough has argued, such a model requires rethinking internal organization as well as effectively working with the broader research community. Japanese automakers have long relied on their suppliers as innovation partners. U.S. automakers too have pushed product and process improvement out through their supply chain via the relentless drive to achieve 3% cost reduction year after year and still build competitive new models. Large firms can also buy smaller ones to acquire new technology.

Smaller companies in the manufacturing sector, competing in a global environment for increasingly sophisticated products, often don't possess the financial strength or the in-
house technical expertise to take advantage of the available science and engineering resources that can help them innovate and grow. New types of local and regional consortia or clusters are popping up in response to this problem, sometimes facilitated by public-private partnerships. An interesting example, just getting under way, is the Midwest Project for SME-OEM Use of Modeling and Simulation—a consortium of large OEMs like General Electric, Proctor & Gamble, and Deere; the State of Ohio; and several projects funded by the National Science Foundation (NSF), including the Center for Manufacturing Services, the Ohio Super-Computer Center, and the Network for Computational Nanotechnology (NCN). NCN serves as a virtual laboratory through online simulation and education. It develops models and simulation tools to predict behavior at the device, circuit and system levels for nanoelectronics, nanomechanics, and nanobio systems. It serves over 180,000 users and mounts over 10,000 simulations a year, and also provides access to supercomputers to its users as needed.

The idea behind the Manufacturing HUB, a NSF-funded initiative at Purdue and a key part of the Midwest Project, is similar to the NCN but more explicitly designed to aid small and medium manufacturers (SMEs) in getting access to models, computing power, and technical expertise to aid their product and process innovation. The models and computational resources will give SMEs access to the resources needed to solve advanced problems in areas like fluid flow, structural behavior, and material strength which are crucial to building advanced products and processes.

The common thread of these developments is building and accessing larger networks—beyond the single firm or even clusters of small firms—to create the new products and processes needed to compete in a global manufacturing market. Many questions about these models remain to be solved with actual experience—systems integration, disconnect between R&D and production, intellectual property rights issues, tragedy of the commons, leaking competitive advantage—but the trends are well embedded at this point.

What are you seeing in your business or research that can point to the strengths and weaknesses of these models?