



RESEARCH & IDEAS

Why America Needs a Manufacturing Renaissance

Published: October 17, 2012

Authors: Gary P. Pisano and Willy C. Shih

In their new book, *Producing Prosperity: Why America Needs a Manufacturing Renaissance*, Harvard Business School professors **Gary P. Pisano** and **Willy C. Shih** discuss the dangers of underinvesting in the nation's manufacturing capabilities. This excerpt discusses the importance of the "industrial commons."

*Editor's note: In their new book, *Producing Prosperity: Why America Needs a Manufacturing Renaissance*, Harvard Business School professors Gary P. Pisano and Willy C. Shih argue that reinvesting in America's manufacturing prowess is necessary not only for creating jobs, but also for maintaining the country's lead in innovation.*

"R&D is a critical part of the innovation process, but it is not the whole thing"

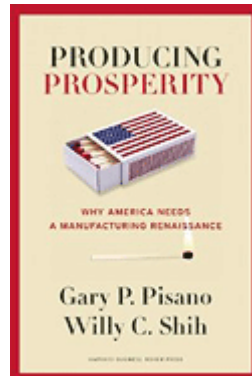
In this excerpt, Pisano and Shih discuss the concept of the "industrial commons." In the past a commons—a shared farming pasture—was the foundation of the local agricultural economy. Manufacturing commons are "webs of technological knowhow, operational capabilities, and specialized skills" that underlie many industries, universities, and the government.

Also, see Professor Jim Heskett's conversation with his readers on the need for a manufacturing renaissance.

Excerpt: The Erosion of the Industrial Commons

From, *Producing Prosperity: Why America Needs a Manufacturing Renaissance*

By Gary P. Pisano and Willy C. Shih



foundation for the local agricultural economy. If the commons fell into disrepair—either through overuse or neglect—everyone suffered. Although taking care of the commons was no individual's responsibility, it was in everyone's interest to do so because all benefited from a healthy commons.

Modern industries have commons as well, although they are infinitely more complex than the simple town greens of centuries past. Today's industrial commons consist of webs of technological knowhow, operational capabilities, and specialized skills that are embedded in the workforce, competitors, suppliers, customers, cooperative R&D ventures, and universities and often support multiple industrial sectors. Although industrial commons are largely supported by private for-profit entities, the knowledge produced by these entities flows across businesses through movements of people from one company to another, supplier-customer collaborations, formal and informal technology sharing, and outright imitation of competitors.

Although there is much talk these days about the world being "flat," in fact, know-how and capabilities are often highly local. This means that industrial commons can have a local character as well. As a result, companies located in some places have advantages over others by virtue of their access to the appropriate set of workers, engineers, managerial talent, suppliers, and universities. The solar PV industry discussed earlier is an example. Throughout this book, we will document how the presence of an industrial commons can exert a powerful gravitational pull on the location of industries and innovation

In times past, farmers and local townspeople would bring their livestock to the commons—a local pasture that everyone could use. The commons was a critical community resource because it nourished the livestock that provided a

(and conversely, how the absence of an appropriate commons creates a chasm).

View a table of industrial capabilities that are gone or at risk in the US.

The rough and tumble of international competition means we should expect industries to come and go. Even if this is sometimes painful, it is, in fact, a healthy process by which resources flow to their most productive uses. When a commons erodes, however, it represents a deeper and more systematic problem. It means the foundation upon which future innovative sectors can be built is crumbling. When the semiconductor production business moved to Asia in the 1980s, it brought with it a whole host of capabilities—electronic-materials processing, deposition and coating, and sophisticated test and assembly capabilities—that formed an industrial commons needed to produce a whole host of advanced, high-valued-added electronic products such as flat-panel displays, solid-state lighting, and solar PV. In this book, we will examine the dynamics that underlie both the rise and decline of commons, and the consequence of those declines. Our argument is built around three core themes.

Theme 1: When a Country Loses the Capability to Manufacture, It Loses the Ability to Innovate

Innovation and manufacturing are often viewed as residing at the opposite ends of the economic spectrum—innovation being all about the brain (knowledge work) and manufacturing all about brawn (physical work). Innovation requires highly skilled, highly paid workers, and manufacturing requires low-skilled, low-paid workers; innovation is a high-valued-added specialty, and manufacturing is a low-value-added commodity; innovation is creative and clean, and manufacturing is dull and dirty.

"The unraveling of a commons is a vicious circle"

Such a view of manufacturing is a myth and is based on a profound misunderstanding of how the process of innovation works and the

link between R&D and manufacturing. R&D is a critical part of the innovation process, but it is not the whole thing. Innovation is about moving the idea from concept to the customer's hands. For some highly complex products (flat-panel displays, PV cells, and biotechnology drugs, to name a few) the transfer from R&D into production is a messy affair, requiring extremely tight coordination and the transfer of learning between those who design and those who manufacture. If you do not understand the production environment, you have a harder time designing the product. In these settings, there are strong reasons to co-locate R&D and production. It is a lot easier for an engineer to walk across the street to the plant or drive down the road than to fly halfway around the world to troubleshoot a problem. This helps to explain why the American company Applied Materials, a leading maker of equipment for manufacturing semiconductors and solar panels, moved its chief technical officer from the United States to China. Because most of its large customers are now in China, Taiwan, and South Korea, it makes sense for the company to do its research close to the factories that use its equipment. Applied Materials is now moving much of its manufacturing operations to Asia as well. In chapter 4, we will offer a framework for determining when it matters whether R&D and manufacturing are located near each and when it does not.

Theme 2: The Industrial Commons Is a Platform for Growth

The industrial commons perspective suggests that a decline of competitiveness of firms in one sector can have implications for the competitiveness of firms in another. Industries and the suppliers of capabilities to the industries need each other. Kill a critical industry, and the suppliers probably will not survive for long; other industries in the region that depend on those suppliers will then be jeopardized. When the auto industry declines, it causes an atrophy of capabilities (such as casting and precision machining) that are also used in industries such as heavy equipment, scientific instruments, and advanced materials.

The unraveling of a commons is a vicious circle. As capabilities erode, it is harder for companies that require access to stay in business. They are forced to move their operations or their supplier base to the new commons. As they move, it is harder for

existing suppliers to sustain themselves. Ultimately, they must either close shop or move their operations.

Even worse, the loss of a commons may cut off future opportunities for the emergence of new innovative sectors if they require close access to the same capabilities. Four decades ago, when US consumer electronics companies decided to move production of these "mature" products to Asia, who would have guessed that this decision would influence where the most important component for tomorrow's electric vehicles—the batteries—would be produced? But that is what happened. The offshoring of consumer electronics production (often contracted to then-little-known Japanese companies such as Sony and Matsushita) led to the migration of R&D in consumer electronics to Japan (and later to South Korea and Taiwan). As consumers demanded ever-smaller, lighter, and more powerful (and power hungry!) mobile computers and cell phones, electronics companies were pushed to innovate in batteries. In the process, Asia became the hub for innovation in the design and manufacturing of compact, high-capacity, rechargeable, lithium ion batteries, a technology that was invented in America. This explains why Asian suppliers have become the dominant source of the lithium ion battery cells used in electric vehicles.

Theme 3: There Is Nothing "Natural" About Erosion of the Industrial Commons—Management and Policy Matter

The erosion of the industrial commons in the United States is the result not of the "invisible hand" of markets but rather the "visible hand" of managers and policy makers. The skills, know-how, and capabilities underpinning an industrial commons accumulate over time. Both government policies and the investment decisions of private enterprises determine what capabilities are fostered where. Decisions by US companies to outsource a growing array of increasingly complex processes (including product R&D) and to reallocate resources away from long-term research have played a central role in the erosion of the US industrial commons.

As we shall discuss, each of these individual decisions, when viewed in isolation, may look like it makes perfect sense. Cumulatively and collectively, however, they have serious consequences for both a country and individual companies.

Consider outsourcing. For many companies, it was simply far too attractive to shutter their production in the United States and have Asian suppliers make the products. Many companies have even decided to buy their R&D from suppliers in Asia as well. (For instance, most laptop computers are designed and manufactured by a small handful of Taiwanese companies.) In the short term, such outsourcing could dramatically lower the costs of goods and supercharge earnings, which is tough logic to combat. Yet, as each company makes such a decision, it becomes increasingly difficult for existing suppliers to stay in business. Investing in new technologies or training workers becomes less economically feasible. This lack of investment in technological and human resources leads to further erosion in competitive performance, which makes it even more attractive for other companies to move their supply base overseas. The process looks like a natural reaction to market forces, but, in fact, it was driven by some very specific management decisions.

Government policy, too, plays a huge role, even in highly market-oriented economies like America's. There was nothing natural about the creation of the United States' strength in science-based industries. Government policy played a critical role. After World War II, the US government began to implement a policy of massive support for basic scientific research through newly created agencies such as the National Science Foundation (NSF) and the National Institutes of Health (NIH), and through existing agencies such as the Department of Defense and Department of Energy. Cumulatively, these investments established the basic sciences that laid the institutional foundations for innovations in semiconductors, high-speed computers, computer graphics, broadband communications, mobile telephony, the Internet, and modern genomics-based methods of drug discovery. Reversing the decline of the US industrial commons will require both effective management and government policy.

Reprinted by permission of Harvard Business Review Press. Excerpted from *Producing Prosperity: Why America Needs a Manufacturing Renaissance* by Gary P. Pisano and Willy C. Shih. Copyright 2012. All rights reserved.