

The Weightless Developing Economy

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by

Danny Quah

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London School of Economics and Political Science

For over fifty years, economists and development practitioners have taken the accumulation of physical capital—machines, buildings, and highways—to be the key to economic growth. But some now view that apparent unity of purpose as misguided. Analytical reasoning and historical evidence both show that overwhelmingly more important is technological advance, reflecting the accumulation of knowledge. Now, new opportunities to use knowledge in economic development present themselves: Outsourcing data entry and even software engineering to emerging economies like India is just one example.

To be clear, economic progress has always been knowledge-driven—certainly since the late 18th-century's Industrial Revolution. Some might argue the knowledge-driven economy goes back even further, to ancient Sumerians who first began carving financial records onto clay tablets 5,000 years ago. And while we might worry now about social problems like job destruction and rising inequality resulting from a progressively knowledge-based economy, these concerns had already materialized full-blown more than two centuries back, with the widespread introduction of then high-tech developments in spinning jennies and steam engines.

New Issues in the Weightless Economy

However, fresh questions do emerge from present developments in information and communications technology (ICT). Today's *weightless economy* comprises ICT together with intellectual assets—patents, copyrights, trademarks, images, brands, and so forth—as well as biotechnologies and electronic libraries and databases. I call this a weightless economy because all these identified sectors—fast-growing worldwide—embody progressively greater economic value in ever less physical (weighty) material. This new industrial makeup means that the economy now differs profoundly from earlier versions of a knowledge economy.

A traditional knowledge economy of the early 20th century might be described as follows. Knowledge workers—scientists, engineers, R&D laboratorists—advance the science and technology base through what they do. Intellectual property institutions, such as

patents, grant monopoly rights for the use of that new knowledge to its originators and owners. Such a profits stream provides the incentives for continuing technological advances. Finally, those advances are made concrete in an industrial production process, improving the manufacture of goods and services and making more efficient their delivery to society.

The new weightless economy short-circuits this chain of value creation. It is an economy built on strings of information: These might be held on the hard disk of a PC or on an Internet server; they might consist of a paper blueprint, a gene sequence, or even simply be an idea in someone's mind. The material form they take is irrelevant to their value and, in the main, to their use. As a result, intellectual assets are more difficult to control and to protect in the new weightless economy. Drawing a revenue stream from them, and thereby incentivizing their continued production is no longer straightforward and immediate. On the flip side, however, compared to earlier knowledge-based economies, the dissemination of intellectual assets is more widespread, and therefore their use to society correspondingly greater.

In the weightless economy, these valued information strings do not, as before, need to plug into a production process before delivery to the ultimate consumer. Instead, consumers deal directly with such knowledge products. This happens every time on a PC someone boots up computer software, enjoys digital entertainment, or buys over the Web health consultations, financial assets, or valuable information.

Finally, in the weightless economy, the enjoyment of such knowledge products by one person does not physically preclude their consumption or use by anyone else. This makes for a profound difference from how consumers interacted with the older, knowledge-based manufacturing economy.

Policies for a Weightless Economy

Obviously, encouraging ongoing technological development is critical to growth in any economy, much less a weightless economy. Less obviously, systems for managing intellectual assets must be changed—sometimes radically. Protecting intellectual property and thus the incentive to innovate without at the same time creating socially harmful monopolies is a key issue in the weightless economy, whether that problem arises in computer software, in Internet development, or in exploiting the DNA profile of Iceland's population. Access is also critical: worldwide, there are potentially six billion consumers in the weightless economy, but getting them hooked up is not straightforward. Governments and other public bodies might need to contribute more to the fixed costs that would otherwise inhibit global access, and might need to encourage further the spread of knowledge about and desire to use these exciting, but sometimes complex, knowledge products.

Lessons from Ancient China for the Weightless Economy

China at the end of the Sung dynasty in the 14th century was neither chockful of dot-com entrepreneurs nor brimming with Internet infrastructure. However, it did stand on the brink of an industrial revolution, 400 years before the Industrial Revolution of late-18th century Western Europe. China produced more iron per capita than did Europe in the 18th century.

This lead in blast-furnace technology as well as similar advances along a range of other technological fronts suggest to historians that China should have seen an industrial revolution four centuries before Europe. Yet, the following five centuries saw dismal economic decline instead of sweeping economic progress. Why?

At base, China's failure to exploit its technical lead was a failure of demand. In 14th-century China, technological knowledge was tightly controlled—scholars and bureaucrats kept technical secrets to themselves; it was said that the Emperor 'owned' time itself. The bureaucrats believed that disseminating knowledge about technology subverted the power structure. That might well have been so. But as a result no large customer base developed in China, and technological development languished after its early and promising start.

A European of the eighteenth century was, in contrast, eager to use high-tech products like the spinning jenny and the steam engine. Strong consumer demand encouraged yet further technological progress. In 1781 to encourage James Watt to sharpen his engineering efforts Matthew Boulton wrote him that, "The people in London, Manchester, and Birmingham are steam mill mad". Great excitement across broad swathes of society fired the economic imagination and drove technology into immediate application. Europe took the lead; China languished.

Protecting the Incentive to Innovate in the Weightless Economy

The weightless economy is a new form of the knowledge-based economy. In all knowledge-based economies, the incentive to innovate must be safeguarded. From very early on, therefore, societies developed systems of intellectual property protection. While such systems reduced social efficiency through restricting the dissemination of knowledge, the spur to innovation made the sacrifice worthwhile. As ICT and other technologies drive economies to be progressively weightless, so protecting innovation incentives becomes ever more important—but old systems for achieving this are now less effective. Meeting this challenge successfully is critical if the weightless economy is to prosper.

Societies must now also develop the skills and attitudes necessary to consuming and appreciating complex technologies, not just to producing them. Because participation

matters—not just access—openness to new ideas is crucial to societies seeking to develop a weightless economy. Sung Dynasty China is the dramatic case in point. There, insufficient scientific knowledge in the general population and inadequate appreciation in the governing elite about the benefits of science—rather than inadequate scientific knowledge per se—crippled that society’s prospects for economic growth and development.

Conclusions

The lessons from this presentation can be summarized as follows. First, economic progress has always been knowledge-driven, but its weightless form now makes it differ profoundly from progress in the past. Second, intellectual assets have become progressively difficult to protect in the weightless economy, while at the same time their dissemination to the largest base of users possible has become ever more beneficial. Next, governments can increase the spread of knowledge by improving access and cultivating positive learning attitudes. Finally, studying how science and technology failed in Ancient China shows how the supply side alone is insufficient; institutions supporting the use of technology matter critically.