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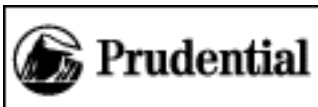
Beyond the Information Revolution

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The author uses history to gauge the significance of e-commerce - - "a totally unexpected development" -- and to throw light on the future of "the knowledge worker," his own coinage

by Peter F. Drucker

(The online version of this article appears in three parts. Click here to go to parts [two](#) and [three](#).)

THE truly revolutionary impact of the Information Revolution is just beginning to be felt. But it is not "information" that fuels this impact. It is not "artificial intelligence." It is not the effect of computers and data processing on decision-making,

policymaking, or strategy. It is something that practically no one foresaw or, indeed, even talked about ten or fifteen years ago: *e-commerce* -- that is, the explosive emergence of the Internet as a major, perhaps eventually *the* major, worldwide distribution channel for goods, for services, and, surprisingly, for managerial and professional jobs. This is profoundly changing economies, markets, and industry structures; products and services and their flow; consumer segmentation, consumer values, and consumer behavior; jobs and labor markets. But the impact may be even greater on societies and politics and, above all, on the way we see the world and ourselves in it.

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"Living in Candlestick Park," by John Lewis Gaddis (April, 1999)

In the twenty-first century geopolitics might well take its metaphors from geology, as the state system of international relations gets shaken to its foundations.

"The Age of Social Transformation," by

Peter F. Drucker (November, 1994)

A survey of the epoch that began early in this

At the same time, new and unexpected industries will no doubt emerge, and fast. One is already here: biotechnology. And another: fish farming. Within the next fifty years fish farming may change us from hunters and gatherers on the seas into "marine pastoralists" -- just as a similar innovation some 10,000 years ago changed our ancestors from hunters and gatherers on the land into agriculturists and pastoralists.

It is likely that other new technologies will appear suddenly, leading to major new industries. What they may be is impossible even to guess at. But it is highly probable -- indeed, nearly certain -- that they will emerge, and fairly soon. And it is nearly certain that few of them -- and few industries based on them -- will come out of computer and information technology. Like biotechnology and fish farming, each will emerge from its own unique and unexpected technology.

Of course, these are only predictions. But they are made on the assumption that the Information Revolution will evolve as several earlier technology-based "revolutions" have evolved over the past 500 years, since Gutenberg's printing revolution, around 1455. In particular the assumption is that the Information Revolution will be like the Industrial Revolution of the late eighteenth and early nineteenth centuries. And that is indeed exactly how the Information Revolution has been during its first fifty years.

The Railroad

THE Information Revolution is now at the point at which the Industrial Revolution was in the early 1820s, about forty

century, and an analysis of its latest manifestations: an economic order in which knowledge, not labor or raw material or capital, is the key resource; a social order in which inequality based on knowledge is a major challenge; and a polity in which government cannot be looked to for solving social and economic problems.

years after [James Watt's](#) improved steam engine (first installed in 1776) was first applied, in 1785, to an industrial operation -- the spinning of cotton. And the steam engine was to the first Industrial Revolution what the computer has been to the Information Revolution -- its trigger, but above all its symbol. Almost everybody today believes that nothing in economic history has ever moved as fast as, or had a greater impact than, the Information Revolution. But the Industrial Revolution moved at least as fast in the same time span, and had probably an equal impact if not a greater one. In short order it mechanized the great majority of manufacturing processes, beginning with the production of the most important industrial commodity of the eighteenth and early nineteenth centuries: textiles. [Moore's Law](#) asserts that the price of the Information Revolution's basic element, the microchip, drops by 50 percent every eighteen months. The same was true of the products whose manufacture was mechanized by the first Industrial Revolution. The price of cotton textiles fell by 90 percent in the fifty years spanning the start of the eighteenth century. The production of cotton textiles increased at least 150-fold in Britain alone in the same period. And although textiles were the most visible product of its early years, the Industrial Revolution mechanized the production of practically all other major goods, such as paper, glass, leather, and bricks. Its impact was by no means confined to consumer goods. The production of iron and ironware -- for example, wire -- became mechanized and steam-driven as fast as did that of textiles, with the same effects on cost, price, and output. By the end of the Napoleonic Wars the making of guns was steam-driven throughout Europe; cannons were made ten to twenty times as fast as before, and their cost dropped by more than two thirds. By that time Eli Whitney had similarly mechanized the manufacture of muskets in America and had created the first mass-production industry.

These forty or fifty years gave rise to the factory and the "working class." Both were still so few in number in the mid-1820s, even in England, as to be statistically insignificant. But psychologically they had come to dominate (and soon would politically also). Before there were factories in America, Alexander Hamilton foresaw an industrialized country in his 1791 *Report on Manufactures*. A decade later, in 1803, a French economist, Jean-Baptiste Say, saw that the Industrial Revolution had changed economics by creating the "entrepreneur."

The social consequences went far beyond factory and working class. As the historian Paul Johnson has pointed out, in *A History of the American People* (1997), it was the explosive growth of the steam-engine-based textile industry that revived slavery. Considered to be practically dead by the Founders of the American Republic, slavery roared back to life as the cotton gin -- soon steam-driven -- created a huge demand for low-cost labor and made breeding slaves America's most profitable industry for some decades.

The Industrial Revolution also had a great impact on the family. The nuclear family had long been the unit of production. On the farm and in the artisan's workshop husband, wife, and children worked together. The factory, almost for the first time in history, took worker and work out of the home and moved them into the workplace, leaving family members behind -- whether spouses of adult factory workers or, especially in the early stages, parents of child factory workers.

Indeed, the "crisis of the family" did not begin after the Second World War. It began with the Industrial Revolution -- and was in fact a stock concern of those who opposed the Industrial Revolution and the factory system. (The best description of the divorce of work and family, and of its effect on both, is probably Charles Dickens's 1854 novel *Hard Times*.)

But despite all these effects, the Industrial Revolution in its first half century only mechanized the production of goods that had been in existence all along. It tremendously increased output and tremendously decreased cost. It created both consumers and consumer products. But the products themselves had been around all along. And products made in the new factories differed from traditional products only in that they were uniform, with fewer defects than existed in products made by any but the top craftsmen of earlier periods.

There was only one important exception, one new product, in those first fifty years: the steamboat, first made practical by Robert Fulton in 1807. It had little impact until thirty or forty years later. In fact, until almost the end of the nineteenth century more freight was carried on the world's oceans by sailing vessels than by steamships.

Then, in 1829, came the railroad, a product truly without precedent, and it forever changed economy, society, and politics.

In retrospect it is difficult to imagine why the invention of the railroad took so long. Rails to move carts had been around in coal mines for a very long time. What could be more obvious than to put a steam engine on a cart to drive it, rather than have it pushed by people or pulled by horses? But the railroad did not emerge from the cart in the mines. It was developed quite independently. And it was not intended to carry freight. On the contrary, for a long time it was seen only as a way to carry people. Railroads became freight carriers thirty years later, in America. (In fact, as late as the 1870s and 1880s the British engineers who were hired to build the railroads of newly Westernized Japan designed them to carry passengers -- and to this day [Japanese railroads](#) are not equipped to carry freight.) But until the first railroad actually began to operate, it was virtually unanticipated.

Within five years, however, the Western world was engulfed by the biggest boom history had ever seen -- the railroad boom.

Punctuated by the most spectacular busts in economic history, the boom continued in Europe for thirty years, until the late 1850s, by which time most of today's major railroads had been built. In the United States it continued for another thirty years, and in outlying areas -- Argentina, Brazil, Asian Russia, China -- until the First World War.

Continued...

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Peter F. Drucker is a professor of social science at Claremont Graduate School and the author of more than thirty books. His most recent is [Management Challenges for the 21st Century](#) (1999).

Illustration by Valerie Sinclair.

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