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**Thought Leaders** 

## A Long-Wave Theory on Today's Digital Revolution

Historian Elin Whitney-Smith looks at previous periods of disruption to understand what companies (and people) are going through today.

#### by Art Kleiner

According to Elin Whitney-Smith, executives facing technological and economic change have a major decision to make: Will they handle disruption like the Spanish grandees who dominated the 17th-century economy or like the English weavers who supplanted them by embracing the printing press? This is only the sixth time since the dawn of civilization, says this long-wave theorist and economic historian, that human societies have faced a wave of change similar to the one that humanity is going through today. Each time, the disruption has been triggered by an innovation in information technology, which prompts a new form of organization. Today's leaders have an advantage over the old guard in the five previous waves of change: They can see what's happening more clearly. But whether they will heed the lessons of the past remains to be seen.



Whitney-Smith has spent 30 years researching and refining her theory of economic progress as a series of information technology disruptions, drawing

on studies of subjects as varied as digital media design, medieval gender relationships, and the extinctions at the end of the Pleistocene epoch. (For the perspective of another long-wave theorist, see my <u>interview with Carlota Perez</u> in the Winter 2005 issue of s+b.) Whitney-Smith is currently refining this story in a new book, *Winning Information Revolutions: From the Ice Age to the Internet*, which she is <u>publishing online</u>, chapter by chapter. She also founded Netalyst, a small Internet consulting firm that specializes in the interface between social organization and technology, where she is now president emeritus. The company has always been virtual — work, meetings, and day-to-day management all take place over the Internet — in part to stake out a role as an early adopter of what Whitney-Smith sees as the victorious form of management to come.

Even leaders who don't typically pay attention to history may find Whitney-Smith's views highly relevant, if only because of the strategic implications. She says that for leaders of business and society, in each previous era of information technology revolution, a short-run strategy has been irresistible — but ultimately self-defeating. We met with Whitney-Smith in New York in the fall of 2010 to explore the implications of her ideas.

### S+B: Your book-in-progress says that today's turbulent economic events all have the same root cause — a shift in the way information is managed. Can you please explain that idea?

**WHITNEY-SMITH:** There have been six information revolutions in human history. Each represents a major change in the organizational paradigm — a change in how people form themselves into groups. The first was among hunter–gatherers just before the invention of agriculture; second, the rise of counting and written language; third, the fall of Rome; fourth, the invention of the printing press; fifth, the electric information revolution that accompanied trains, telegraph, and telephone; and sixth, the digital information revolution that we are now living through. In the last three,

the economics follow the same pattern: a long boom followed by a crash. Then a difficult and turbulent struggle begins. New ways of organizing emerge and the old ways, supported by established elites, fail.

#### S+B: Why do the old elites lose power?

**WHITNEY-SMITH:** In the short run, it's always better to be a Spanish grandee than it is to be an English weaver. In the 1600s, the Spanish grandees had no reason to innovate since their wealth was already assured, and they were suspicious of the newly invented technology of the printing press. As a result, the economic leadership of the world shifted to northern countries, like England and Holland, where weavers and other tradespeople reorganized to take advantage of the new capabilities that the press afforded them. It took time for this new approach to pay off, but it did. The world changed accordingly, while the grandees gradually fell behind.

Similarly, in the 1840s, it was better in the short run to be a Massachusetts mill owner than a Pennsylvania Railroad managing engineer drawing an early organization chart. In the 1970s, it was better in the short run to be the president of General Motors than a college student writing computer code. In each of these cases, the member of the existing elite had little incentive to change the way the system worked, or to "mess with success," but the member of the "out group" — the weaver, engineer, or student — had little to lose and much to gain through being innovative. These out groups ultimately change the way the system works.

Today our own grandees — our economic and political leaders — are making a lot of the same kinds of mistakes that previous elites made. By doing so, they are reducing their chances of dominance in the future. They either ignore the new information technology and miss out on opportunities, or they fear the world it creates and try to co-opt it, shut it down, or control it. This generally fails, their fortunes decline, and a new group of dominant competitors emerges.

#### S+B: How long does this transition take?

**WHITNEY-SMITH:** Throughout history, the time frame has gotten shorter. Among hunter–gatherers, it took thousands of years to make the transition to agriculture. From the fall of Rome to the press was almost 1,000 years. The printing press revolution took 220 years. The electric revolution [trains, telegraph, and telephone] took 110 years, and, as I count it, the digital revolution started about 50 years ago. So, in recent information revolutions, there is a kind of rule of halves.

### S+B: Why do you call some of these early transitions, such as the shift to agriculture, *information* revolutions?

**WHITNEY-SMITH:** First, an information revolution isn't always associated with an information technology. It is about how information "works" in a culture. Second, if preagricultural people were anything like current-day indigenous hunter–gatherers, they were the purest information culture that has ever existed. They made their living by what they knew, not what they owned. They knew where the animals would be and when to gather the plants they needed. They perceived a world of plenty. Their status didn't come from having possessions, but from information — having a better story or a better song or dance. Their world view was thus based on sharing; a song or story gained in value by being shared. That's how people lived until about 10,000 years ago.

At that point, extinctions led to a radical change in people's perception — they began to see the world as scarce. They began to hoard material goods to be safe, and we've lived in a world of perceived scarcity ever since.

This was the essence of the first information revolution. People made a transition away from a pure information culture to relying on owning material goods. Along with that shift came a major change in social organization. Hoarding is difficult when people walk 20 miles a day. At first, people started keeping their things in caches. Then they created seasonal villages. Then they started living in villages year-round to protect their belongings. Once they were sedentary, they used up all the resources in their immediate area and began to supplement their hunting and gathering with agriculture, developing and using their knowledge of plants. Then, as hunted animals became scarce, they used their knowledge of animal behavior to domesticate livestock.

Archaeologists tell us that in many ways, this was a bad move. It reduced the quality of life. People lived more closely

together so there was more waste, germs, and disease.

It took more work to tend crops and animals. This, along with the growing reliance on material goods, led to specialization. Instead of each household making things its own way, the production of goods became standardized. Different people specialized in producing different goods. Specialization led in turn to hierarchy and social classes. This was accompanied, not coincidentally, by the emergence of counting. Tokens found in Middle Eastern archaeological sites from that time show that commerce was beginning. Farmers kept their tokens in a clay envelope with the number of tokens impressed on it, which, in turn, evolved into pictographic cuneiform and eventually into writing.

For the next 5,000 years or so, the world was defined by writing. Writing changed the organizational paradigm from small villages with charismatic leaders to a tripartite elite: the political leadership (a monarch and supporting court and aristocracy), the military, and the church or priesthood. This is an amazingly stable organizational structure. City-states and empires came and went, but the structure was the same. The king and court administered justice and wrote laws, the military controlled violent force for use against internal and external enemies, and the priesthood — the information controllers — maintained the records and gave people a narrative that kept them participating. In much of the world, with some adjustments, this is still an important form of organization. In Europe, it continued until the fall of Rome.

The next information revolution began with the fall of Rome. The political shifts of the early Middle Ages broke the tripartite elite in Europe. Only the church — the information controller — retained its organizational structure and power. This had the effect of setting information free and improving the lives of the common people. The church also changed the perception of labor, from something done only by slaves to something fit for gentlemen. An individual who made something and sold it in the marketplace gave a tenth of the money to the church. Church leaders like St. Benedict encouraged work as a virtue. Innovation and technological development thus gained crucial support. It was the beginning of the wealth of the West.

### S+B: I imagine that the invention of the printing press was different from the information revolutions that came before it.

**WHITNEY-SMITH:** Yes, but the main difference may be visibility; we have a more detailed history of the press because of the press itself, and the records people kept. Starting with the press, we can detect two distinct phases of innovation. The first phase, fostered by the elite, involved new forms of governing, science, poetry, and gallantry. Government went from small feudal states to larger states ruled by kings. The newly centralized governments could administer a larger geography because they had ministers who learned statecraft in the new universities and schools. The elites also used printing technology to begin the age of exploration. The press produced standardized maps. With a printed map, all explorers shared the same information, so as they learned more, maps could be corrected without loss of the old knowledge. This in turn led to more consistent ways of thinking about the world.

The second phase of innovation took place largely in the northern, Protestant countries. In the south, in Spain and the other Catholic countries, fear of Protestant heresy led to restrictions on the press. Holland, England, and other Protestant countries didn't have those restrictions. Competition among printers in those regions resulted in a glut of published materials. And because of the Protestant belief that ordinary men should read the Bible, many people from the "lower orders" learned to read. Indeed, by the 17th century, in England and Holland, the printing press had spread widely enough — and fostered enough literacy and numeracy among members of the crafts-producing classes — that innovation bubbled up from the bottom.

Jack of Newbury was the son of a weaver who hired one hundred apprentices, whereas the master he had been apprenticed to had only had two or three. Why? Because Jack was literate and numerate; he had the skills to keep track of how much product they made. Earlier generations of craftsmen had to live with their workers to know what they were doing, but Jack could allow them to live elsewhere, to take materials home and bring back finished work. So Jack and others like him expanded their production capacity, reduced prices, and made much more money than previous generations of craftsmen. This was true in many crafts. People found new ways to track production and became the first capitalists. In the Protestant countries, craftspeople like Jack made fortunes through new forms of organization. Catholic Europe fell behind. However, even in the Protestant countries, change wasn't good for everyone. There are always people who are disadvantaged by change. For example, the printing press was not entirely good for women. In the Middle Ages, business was transacted in the common room of the home. Now it moved to its own room, and then to its own building. Men started to go elsewhere to work during the day. In this transition, both upper-class and lower-class women lost a great deal of power and privilege. As literacy spread among men, the relative number of women being educated shrank, and the domain of women began to be perceived as the home. This perception persisted for centuries.

### S+B: Your next information revolution involves the railroad, telegraph, and telephone. What difference did they make?

**WHITNEY-SMITH:** The railroad and telegraph emerged in the 1830s and 1840s. They were bound closely together, since the telegraph signals were needed to coordinate the trains; thus telegraph wires always accompanied the railroad tracks. Before this information revolution, people identified much more with their local context — a village, town, or county — than with a nation. The larger geography wasn't high in everyday consciousness. If you look at a railroad map of the U.S. before 1860, you'll see connections throughout the North: The lines go in every direction. But in the South, the rail lines only go north, carrying cotton to the Northern mills. There are very few connections among the Southern cities. When the Civil War broke out, Northern people identified with the Union because they had experienced connection with other states and people, whereas in the South people still identified with their local context, and thus with states' rights.

Something similar happened in businesses. The old local, class-based hierarchy — in which everyone at a lower level had to obey everyone at a higher level, as with ranks in the church, the university, or the army — was replaced with a broader-based but more constrained, more rational hierarchy. Now workers only had to obey their manager in a direct chain of command, instead of everyone with superior rank. Suddenly, everyone knew their place on the org chart (which was inspired by telegraph switching diagrams). Railroads were the first companies with this kind of management. Then, during the depression of 1880, railroads managed well, whereas many companies with the old structure went out of business. By the start of the Great Depression in 1929, the only major companies left were rationally managed companies such as Ford, DuPont, and Birdseye, those that had reformed their organizational structure.

Meanwhile, the country that had most strongly embraced this new information technology — the United States — took the economic lead. England, the winner in the printing press revolution, now lost its economic power.

#### S+B: Then came the digital revolution, which is happening now.

**WHITNEY-SMITH:** I use 1957 as the start of the digital revolution. That was the date of the Walter Lang movie *Desk Set.* It's a screwball comedy with Spencer Tracy as an engineer who installs a computer called EMERAC (really IBM's ENIAC computer) at a television network. Katherine Hepburn plays the head research librarian. (As usual in Hepburn/Tracy movies, they fight, because each is threatened by the other, but they end up in love.) By 1957, people could already see that computers would be universally accessible and contain every kind of communication: audio, video, text, and data. They were beginning to worry that they might be replaced by smart machines. The film was partially financed by IBM, and part of its purpose was to allay these fears.

Once again, there was an early phase — this time, the mainframe phase — during which established institutions adopted computers as a management tool. The scientific approach to management took hold. At the beginning of this first phase, the Soviet Union was the United States' biggest competitor. Both superpowers had nuclear weapons and computers, and both were secretive about the former. But when it came to computers, their policies differed. The U.S. had an open information policy, giving it a huge edge. The USSR couldn't compete. With digital technology, as with every other information technology, the entity with greater information freedom wins.

We're just starting to see the organizational innovation of the second phase emerge. These new companies take the Internet for granted. They are designed by a generation that had access to computers from childhood. Businesses that are less bound by old forms of hierarchical authority, such as Facebook (where any engineer can modify any part of Facebook's code base), are thriving. So are companies with massive line worker input such as the "open management" companies pioneered by people like <u>Jack Stack</u>.

### S+B: Yet you have a country like China, where the government seems able to control information flow while maintaining a technologically vibrant society.

**WHITNEY-SMITH:** That is temporary, just as it was for the Spanish grandees. Lasting innovation in an information revolution doesn't come from the elite, or from people who already have access to wealth and authority. It comes from the edges, from people who are just gaining access for the first time. China, because it is less developed relative to the West, is in a position to take advantage of technology to build its economy, as Japan was 20 years ago. However, <u>the innovators in China</u> are a relatively small number of people. They have taken the best of what they've seen and improved upon it, <u>in copycat fashion</u>. But lasting innovation, at an organizational level, comes from having broad access to information — which China lacks.

In the short run, it's better to be a member of the elite in China than a college student elsewhere with free information access. But bottom-up innovation will always be more successful in the long run. Therefore, if China continues its closed information policy, its success won't last because regular people won't be able to innovate. And, by the same token, if U.S. leaders adopt restrictive Internet policies, it will be to the United States' detriment.

### S+B: In comparing today's major companies to Spanish grandees, are you saying that their survival is in doubt?

**WHITNEY-SMITH:** Yes, unless they change themselves. This is possible; corporations have done it before, in previous information revolutions. Alfred D. Chandler Jr. wrote about how the DuPont Corporation survived as a family-held company through the last major information revolution. They did it by becoming professional managers and organizing according to the principles pioneered by railroads. DuPont's leaders recognized that the new organizations didn't look like the old family-owned, class-based organizations.

In today's world, the new wave of surviving organizations will also have a different structure. It's not entirely clear yet what they'll look like, but we know they'll involve many more people at lower levels in decision making. In fact, in each new information revolution, decision rights have been pushed lower in the organization. One of the social innovations of the electric information revolution was the train conductor. He was a working-class individual, but he wore a suit and tie and carried a watch. He could say "all aboard!" to an aristocrat and the aristocrat would have to get on the train or get left behind. That was a huge social innovation.

Digital technology makes it possible for those who have a vested interest in the long-term health of the organization to have more information. In new, flatter organizations, the rank and file will know everything about the organization, including its financial secrets. They will know everybody's salary. They will be able to say, "Well, I think you're making too much for the amount of value you're producing. You can't siphon off that money, because we need to reinvest it." Companies that become flatter, that look more like networks and less like hierarchies, and that reform their finances, will be able to survive. Otherwise, companies that use these new ways of organizing will out-compete the old. If the rule of halves still applies, we would expect this new information order to manifest itself by sometime around 2012. s+b

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