ASAP: Peter Drucker - the Next Information Revolution

I The next information revolution is well under way. But it is not happening where information scientists, information executives, and the information industry in general are looking for it. It is not a revolution in technology, machinery, techniques, software, or speed. It is a revolution in CONCEPTS.

So far, for 50 years, the information revolution has centered on data—their collection, storage, transmission, analysis, and presentation. It has centered on the "T" in IT. The next information revolution asks, What is the MEANING of information, and what is its PURPOSE? And this is leading rapidly to redefining the tasks to be done with the help of information, and with it, to redefining the institutions that do these tasks.

The next information revolution will surely engulf all major institutions of modern society. But it has started, and has gone farthest, in business enterprise, where it has already had profound impacts. It is forcing us to redefine what business enterprise actually is and should be. This largely underlies the new definition of the function of business enterprise as the "CREATION OF VALUE AND WEALTH," which in turn has triggered the present debate about the "governance of the corporation," that is, for whom the business enterprise creates value and wealth. Yet, despite its importance and impact, the next information revolution has so far been largely ignored by the information establishment. For it has started in the information system of which—though it is the oldest and still the most widely used one—IT people, as a rule, tend to be both ignorant and contemptuous: Accounting.

II A half century ago, around 1950, prevailing opinion overwhelmingly held that the market for that new "miracle," the computer, would be in the military and in scientific calculations, e.g., astronomy. A few of us, however—a very few indeed—argued even then that the computer would find major applications in business and would have an impact on it. These few also foresaw—again very much at odds with the prevailing opinion (even of practically everyone at IBM, just then beginning its ascent)—that in business the computer would be more than a very fast adding

machine doing clerical chores such as payroll or telephone bills. On specifics, we dissenters disagreed, of course. But all of us nonconformists (including Russell Ackoff, John Diebold, and J. W. Forrester) agreed on one thing: The computer would, in short order, revolutionize the work of top management. It would, we all agreed, have its greatest and earliest impacts on business policy, business strategy, and business decisions.

The next information revolution is forcing us to redefine what business enterprise actually is—*the creation of value and wealth*.

We could not have been more wrong. The revolutionary impacts so far have been where none of us then anticipated them: on OPERATIONS. Not one of us, for instance, could have imagined the truly revolutionary software now available to architects. At a fraction of traditional cost and time, it designs the "innards" of large buildings: their water supply and plumbing; their lighting, heating, and air- conditioning; their elevator specifications and placement—work that even a few years ago still absorbed some two-thirds of the time and cost of designing an office building, a large school, a hospital, or a prison.

Not one of us could then have imagined the equally revolutionary software available to today's surgical residents. It enables them to do virtual operations, whose outcomes include virtually "killing" patients if the residents make the wrong surgical move. Until recently, residents rarely even saw much of an operation before the very end of their training.

Half a century ago no one could have imagined the software that enables a major equipment manufacturer such as Caterpillar to organize its operations, including manufacturing worldwide, around the anticipated service and replacement needs of its customers. And the computer has had a similar impact on bank operations, with banking probably the most computerized industry today.

But the computer and the information technology arising from it have so far had practically no impact on the decision whether or not to build a new office building, a school, a hospital, or a prison, or on what its function should or could be. They have had practically no impact on the decision to perform surgery on a critically sick patient or on what surgery to perform. They have had no impact on the decision of the equipment manufacturer concerning which markets to enter and with which products, or on the decision of a major bank to acquire another major bank. For top management tasks, information technology so far has been a producer of data rather than a producer of information—let alone a producer of new and different questions and new and different strategies.

MIS and IT people tend to blame this failure on what they call the "reactionary" executives of the "old school." It is the wrong explanation. Top executives have not used the new technology because it has not provided the information they need for *their own tasks*. The data available in business enterprise are, for instance, still largely based on the early 19th-century theorem that lower costs differentiate businesses and make them compete successfully. MIS has taken the data based on this theorem and computerized them. They are the data of the traditional accounting system. Accounting was originally created, at least 500 years ago, to provide the data a company needed for the preservation of its assets and for their distribution if the venture were liquidated. And the one major addition to accounting since the 15th century—cost accounting, a child of the 1920s—aimed only at bringing the accounting system up to 19th-century economics, namely, to provide information about, and control of, costs. (So does, by the way, the now-so-popular revision of cost accounting: total quality management.)

But, as we began to realize around the time of World War II, neither preservation of assets nor cost control are top management tasks. They are OPERATIONAL TASKS. A serious cost disadvantage may indeed destroy a business. But business *success* is based on something totally different, the creation of value and wealth. This requires risk-taking decisions: on the theory of the business, on business strategy, on abandoning the old and innovating the new, on the balance between the short term and the long term, on the balance between immediate profitability and market share. These decisions are the true top management tasks. It was this recognition that underlay, after World War II, the emergence of management as a discipline, separate and distinct from what was then called business economics and is now called microeconomics. (My 1954 book, *The Practice of Management*, especially Part 1, "Managing a Business," is generally considered to have established the discipline of management, precisely because it described the basic tasks of business enterprise as "innovation" and as "creating a customer," that is, as creating value and wealth.) But for none of these top management tasks does the traditional accounting system provide any information. Indeed, none of these tasks is even compatible with the assumptions of the traditional accounting model. The new information technology, based on the computer, had no choice but to depend on the accounting system's data. No others were available. It collected these data, systematized them, manipulated them, analyzed them, and presented them. On this rested, in large measure, the tremendous impact the new technology had on what cost accounting data were designed for: operations. But it also explains information technology's near-zero impact on the management of business itself.

We thought the computer would revolutionize the work of top management. We could not have been more wrong.

IV Top management's frustration with the data that information technology has so far provided has triggered the new, the next, information revolution. Information technologists, especially chief information officers in businesses, soon realized that the accounting data are not what their associates need—which largely explains why MIS and IT people tend to be contemptuous of accounting and accountants. But they did not, as a rule, realize that what was needed was not more data, more technology, more speed. What was needed was to redefine information; what was needed was new *concepts*. And in one enterprise after another, top management people during the last few years have begun to ask, What information concepts do we need for our tasks? And they have now begun to demand them of their traditional information providers, the accounting people. The first of the new information concepts to become widely used is economic-chain accounting.

Traditional accounting, true to its origin as the guardian of assets and as the record keeper of a corporation as a legal entity, furnishes data only on what happens financially within the firm. Economic-chain accounting provides costs throughout the entire economic chain, from supplier to ultimate customer. The customer, of course, pays for all these costs and is totally uninterested as to where or why they were incurred. Even the mightiest manufacturer (e.g., General Motors at the peak of its power, when it provided 70% of all parts and supplies that went into one of its finished cars) accounts for less than one-tenth of what the customer ultimately pays.

Economic-chain accounting was actually invented some 80 years ago in the United States by William C. Durant, who between 1908 and 1920 (well before Alfred Sloan) built GM, and who deserves to be called the inventor of the automobile industry. In the early 1920s his accounting model was copied (and slightly modified) by Sears Roebuck, and 10 years later—again in slightly modified form—by Marks & Spencer in England. Toyota, around 1950, copied it, practically without change, from the two companies. And then, 25 years later, the late Sam Walton repatriated it to the United States and made it the foundation of Wal-Mart's success.

Economic-chain accounting does not require a computer. Durant probably did not even have a crank-operated adding machine. But, of course, the computer helps enormously with the number crunching, and therefore in its computerized form, economic-chain accounting is now being introduced into manufacturing companies and even more quickly into service businesses such as retail chains.

Around 1980 came what is now known as activity-based accounting. Unlike traditional cost accounting, activity-based accounting is not designed to *minimize* costs. It is designed to *maximize* yields. It focuses on the creation of value rather than on the avoidance of waste. Since then we have had a steady succession of other new basic concepts and, with them, of new management information. For instance, EVA (economic value added), or the executive scoreboard, to name only the two most visible ones.

Each of these concepts has been developed separately and by different people. Each derives its data from the accounting system. But each uses the data in new and different ways. For each is based on the new definition of the enterprise as the creator of value and wealth rather than as the possessor of static property, or even, as in cost accounting, as the steward of existing

resources. And a small but rapidly growing number of companies, especially highly specialized middle-sized firms, are putting all these new concepts and tools together into an information system for top management. Of course, they use computers—though usually nothing more sophisticated than a PC is required, and speed is most definitely not of the essence. This new system, however, is being designed without much input from MIS or IT people and is rarely run by them. It is being designed and run by financial people.

The computer actually may have aggravated management's degenerative tendency to focus *inward* on costs.

We can already discern and define the next, and perhaps even more important, task in developing an effective information system for top management: the collection and organization of OUTSIDE-focused information. All the data we have so far, including those provided by the new tools, focus inward. But inside an enterprise—indeed, even inside the entire economic chain—there are only costs. Results are only on the outside. The only profit center is a customer whose check hasn't bounced. But as regards the outside (customers and, equally important, noncustomers; competitors and, equally important, noncompetitors; markets; technologies other than those already in place in one's own industry; currencies; economies; and so on), we have virtually no data. Few businesses use even the little information that is available or pay enough attention to demographics. And even fewer realize that the most important datum for planning and strategy is reliable information on whether the share of income that customers spend on their industry's products or services is increasing or declining.

How poorly top management is supplied with crucially important outside information, even where it is easily obtainable, showed in the recent collapse of the Asian economies. This collapse was predictable—at least a year ahead of time. The only question was what would trigger it and where it would start. But otherwise it was clearly foretold in public statistics on the size and composition of the various countries' debts, and on their balances of payment. Yet most big companies—American as well as Japanese—were totally surprised and unprepared for it. All their information was INSIDE information, despite their sizable stakes in these countries.

The top management information that the new revolution is beginning to provide will make information about the outside even more important and even more urgent. All of the new information concepts, from economic-chain accounting, activity-based accounting, through EVA and the executive scorecard, still provide inside information only. So, of course, does the existing MIS system. It can be argued that the computer and the data flow it made possible, including the new information concepts, actually have done more harm than good to business management. They have aggravated what all

along has been management's degenerative tendency, especially in the big corporations: to focus *inward* on costs and efforts, rather than *outward* on opportunities, changes, and threats. This tendency is becoming increasingly dangerous considering the globalization of economies and industries, the rapid changes in markets and in consumer behavior, the crisscrossing of technologies across traditional industry lines, and the increasing instability of currencies. The more inside information top management gets, the more it will need to balance it with outside information—and that does not exist as yet.

In the next 10 to 15 years, collecting *outside* information is going to be the next frontier.

Within the next 10 to 15 years, developing this data is going to be the next information frontier. The job is already being tackled, not by MIS and IT people, but primarily by top management people in middle-sized and highly specialized businesses in their role as their companies' main marketing executives. Again, few if any MIS and IT people seem to be aware of the challenge or are prepared for it.

The new information revolution began in the business sector and has gone farthest in it. But it is about to engulf education and health care. It is bound to change both of them drastically. Again, the changes in concepts will in the end be at least as important as the changes in tools and technology. It is pretty much accepted now that education technology is due for profound changes and that with them will come profound changes in structure. Long-distance learning, for instance, may well make obsolete within 25 years that uniquely American institution, the freestanding undergraduate college. It is becoming clearer every day that these technical changes will—indeed, must—lead to redefining what is meant by *education*. One probable consequence: The center of gravity in higher education (i.e., postsecondary teaching and learning) may shift to the continuing professional education of adults during their entire working lives. This, in turn, is likely to move learning off campus and into a lot of new places: the home, the car, or the commuter train; the workplace, the church basement, or the school auditorium where small groups can meet after hours.

In health care a similar conceptual shift is likely to lead from health care being defined as the fight against disease to being defined as the maintenance of physical and mental functioning. The fight against disease remains an important part of medical care, of course, but as what a logician would call a subset of it. Neither of the traditional health care providers, the hospital and the general practice physician, may survive this change, and certainly not in their present form and function. In education and health care, the emphasis thus will shift from the "T" in IT to the "I," as it is shifting in business and in the economy. Are the information people in MIS and IT prepared for this? I see no sign of it so far.

The current information revolution is actually the fourth information revolution in human history. The first one was the invention of writing 5,000 to 6,000 years ago in Mesopotamia; then—independently but several thousand years later—in China; and some 1,500 years later still, by the Maya in Central America. The second information revolution was brought on by the invention of the written book, first in China, perhaps as early as 1300 B.C., and then, independently 800 years later, in Greece, when Peisistratos, the tyrant of Athens, had Homer's epics—only recited until then—copied into books. The third information revolution was set off by Gutenberg's invention of the printing press and of movable type between 1450 and 1455, and by the contemporaneous invention of engraving. We have almost no documents on the first two of these revolutions, though we know that the impact of the written book was enormous in Greece and Rome as well as in China. In fact, China's entire civilization and system of government still rest on it. But on the third information revolution, printing and engraving, we have abundant material. Is there anything we can learn today from what happened 500 years ago?

The first thing to learn is a little humility.

Everybody today believes that the present information revolution is unprecedented in reducing the cost of, and in the spreading of, information—whether measured by the cost of a "byte" or by computer ownership—and in the speed and sweep of its impact. These beliefs are simply nonsense. At the time Gutenberg invented the press, there was a substantial information industry in Europe. It was probably Europe's biggest employer. It consisted largely of thousands of monasteries, many of which housed hundreds of highly skilled monks. Each monk labored from dawn to dusk, six days a week, copying books by hand. An industrious, well-trained monk could do 4 pages a day, or 25 pages during a six-day week, for an annual output of 1,200 to 1,300 handwritten pages.

Are the information people in MIS and IT prepared for the revolution? I see no sign of it so far.

Fifty years later, by 1500, the monks had become unemployed. These monks (some estimates go well above 10,000 for all of Europe) had been replaced by a very small number of lay craftsmen, the newly minted class of "printers," totaling perhaps 1,000, but spread over all of Europe (though only beginning to establish themselves in Scandinavia). To produce a printed book required coordinated teamwork by up to 20 such craftsmen, beginning with one highly skilled cutter of type, to a much larger number, maybe 10 or more, of much less skilled bookbinders. Such a team produced each year about 25 titles, with an average of 200 pages per title, or 5,000 pages ready to be printed. By 1505, print runs of 500 copies were becoming increasingly

common. This meant that a printing team could produce annually 25 *million* printed pages, bound into 125,000 books ready to be sold—or *2.5 million* pages per team member as against the 1,200 or 1,300 the individual monk had produced only 50 years earlier.

Prices fell dramatically. As late as the mid-1400s—as late as Gutenberg's invention, in other words—books were such a luxury that only the wealthy and educated could afford them. But when Martin Luther's German Bible came out in 1522 (a book of well over 1,000 pages), its price was so low that even the poorest peasant family could buy one.

The cost and price reductions of the third information revolution were at least as great as those of the present, the fourth information revolution. And so were the speed and the extent of its spread.

This has been just as true of every other major technological revolution. Though cotton was by far the most desirable of all textile fibers—it is easily washable and can be worked up into an infinite variety of different cloths—it was a time- and labor-expensive process. For it took 12 to 14 man-*days* to produce a pound of cotton yarn by hand, as against 1 to 2 man-days for wool, 2 to 5 for linen, and 6 for silk.

Between 1764, when machine tools to work cotton were first introduced—triggering the Industrial Revolution—and 1784, the time needed to produce a pound of cotton yarn fell to a few hours. The price dropped by 70% and production rose 25-fold. (This interval, incidentally, is exactly the same as that between the ENIAC and IBM's 360.) Yet this was still before Eli Whitney's cotton gin (1793), which produced a further fall in the price of cotton yarn of 90%-plus and ultimately to about a thousandth of what it had been before the Industrial Revolution of 50 or 60 years earlier.

Just as important as the reduction in costs and the distribution speed of the new printing technology was its impact on what information meant. The first printed books, beginning with Gutenberg's Bible, were in Latin and still had the same topics as the books that the monks had earlier written out by hand: religious and philosophical treatises and whatever texts had survived from Latin antiquity. But only 20 years after Gutenberg's invention, books by contemporary authors began to emerge, though they still appeared in Latin. Another 10 years and books were being printed not only in Greek and Hebrew but also, increasingly, in the vernacular (first in English, then in the other European tongues). And in 1476, only 30 years after Gutenberg, the English printer William Caxton (1422Ð1491) published a book on so worldly a subject as chess. By 1500, popular literature no longer meant verse—epics, especially—which lent themselves to oral transmission, but prose, i.e., the printed book.

In no time at all, the printing revolution also changed institutions, including the educational system. In the decades that followed, university after university was founded throughout Europe, but unlike the earlier ones, they weren't designed for the clergy or for the study of theology. They were built around disciplines for the laity: law, medicine, mathematics, natural philosophy (science).

The new information revolution will surely engulf *all* major institutions of modern society.

Printing's greatest impact, however, was on the core of pre-Gutenberg Europe: the church. Printing made the Protestant Reformation possible. Its predecessors, the reformation of John Wycliffe in England (1330-1384) and of John Huss in Bohemia (1372-1415), had met with an equally enthusiastic popular response. But those revolts could not travel farther or faster than the spoken word and could thus be localized and suppressed. This was not the case when Luther, on October 31, 1517, nailed his 95 theses to a church door in an obscure German town. He had intended only to initiate a traditional theological debate within the church. But without Luther's consent (and probably without his knowledge), the theses were immediately printed and distributed gratis all over Germany, and then all over Europe. These printed leaflets ignited the religious firestorm that turned into the Reformation.

Would there have been an age of discovery, beginning in the second half of the 15th century, without movable type? Printing publicized every single advance the Portuguese seafarers made along the west coast of Africa in their search for a sea route to the Indies. Printing provided Columbus with the first (though totally wrong) maps of the fabled lands beyond the western horizon, such as Marco Polo's China and the legendary Japan. Printing made it possible to record the results of every single voyage immediately and create new, more reliable maps. Noneconomic changes cannot be quantified. But surely the impact on society, education, culture—let alone on religion—of the printing revolution was easily as great and surely as fast, if not faster, as the impact of the present information revolution.

EPILOGUE

The most im-portant lesson of the earlier information revolution may, however, be found in the fates and fortunes of its technologists. The printing revolution immediately created a new and unprecedented class of information technologists, just as the most recent information revolution has created any number of information businesses, MIS and IT specialists, software designers, and chief information officers. The IT people of the printing revolution were the early printers. Nonexistent—and indeed not even imaginable—in 1455, they flourished throughout Europe 25 years later and had become great stars. Unlike earlier craftsmen, they were great gentlemen. These virtuosi of the printing press were known and revered all over Europe, just as the names of the leading computer and software firms are recognized and admired worldwide today. Printers were courted by kings, princes, the pope, and rich merchant cities and were showered with money and honors.

The first of these printing tycoons was the famous Venetian printer Aldus Manutius (1449-1515). He realized that the new printing press could make a large number of impressions from the same plate—1,000 by the year 1515. Thus he created the first low-cost, mass-produced book. Aldus Manutius

created the printing industry: He was the first to extend printing to languages other than Latin and also the first to do books by contemporary authors. Altogether his press turned out well over 1,000 titles.

The last of these great printing technologists, and also the last of the printing princes, was Christophe Plantin (1520-1589) of Antwerp. Starting as a humble apprentice binder, he built Europe's biggest and most famous printing firm. By marrying the two new technologies, printing and engraving, he created the modern illustrated book. He became Antwerp's leading patrician (Antwerp was then one of the richest cities in Europe, if not the world), and he became so wealthy that he was able to build himself a magnificent palace, still preserved today as a printing museum. But Plantin and his printing house began to decline well before his death and soon faded into insignificance.

By 1580 or so, the printers, with their focus on technology, had become ordinary craftsmen, respectable tradesmen to be sure, but definitely not of the upper class. Their place was soon taken by what we now call publishers (though the term wasn't coined until much later), people and firms whose focus was no longer on the "T" in IT but on the "I."

This shift got under way the moment the new technology began to have an impact on the MEANING of information, and with it, on the meaning and function of the 15th century's key institutions such as the church and the universities. It thus began at the same juncture at which we now find ourselves in the present information revolution as we undergo the shift in business information and, with it, the redefinition of the function and purpose of business.

Is there a lesson in this for today's information technologists, the CIOs in organizations, the software designers and developers, the devotees of Moore's Law?