

EXTRA-PRENEURSHIP*

Re-Inventing Enterprise for the Information Economy

by

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Re-Inventing Enterprise for the Information Economy

Physical technologies -- machinery, electric power, structures, etc. -- are the products of how we organize physical materials, forces and processes. Social technologies -- laws, institutions and communities -- are ways in which we organize people, capital and information. *The continuing interplay of our co-evolving physical and social technologies is the forge of human progress!*

PHYSICAL AND SOCIAL TECHNOLOGIES: PARTNERS IN PROGRESS

In the 1860s, for example, laws were enacted in Europe, North America and Japan permitting the creation of *limited liability corporations* (LLCs), a new social technology that was needed to mobilize sufficient capital to fully exploit the economic potential of newly-invented industrial production technologies. Successful LLCs quickly grew to a scale greater than any previous human enterprise other than organized religion or waging war. Not surprisingly, the social technology ultimately adopted for organizing large private and public enterprises – the *authoritarian, hierarchical, self-servicing bureaucracy* – was closely modeled on religious orders and traditional military principles of command and control.

As they grew, industrial enterprises began to use mathematical statistics to measure the performance of their increasingly far-flung operations. And, in the 1880s, when Frederick Taylor began to use statistical analysis to develop work rules to optimize the output of *individual employees*, he invented another new social technology: **scientific management**. Not only did scientifically managed industrial bureaucracies

successfully exploit the economic potential of industrial production technologies, they also exploited their workers. This subsequently gave rise to another social technology – **the labor union**. Unions, in turn, promoted the creation of other social technologies, including **workman’s compensation, unemployment insurance and social security**, which became the basic components of the social contract of the industrial workplace, and extended the economic benefits of the industrial revolution to large segments of society.

It is entirely reasonable to assume that a similar interplay will occur between our new information technologies and the numerous new social inventions – organizations, laws, resource allocations -- that will be made possible, or necessary, by the widespread use of those technologies.

DISMANTLING OUR INDUSTRIAL ERA BUREAUCRACIES

Strikingly, the new social technology that is rapidly supplanting our vertically-integrated industrial era bureaucracies was first described back in 1931, by a young American economist, Ronald Coase, in a lecture at the Dundee School of Economics and Commerce. In his paper, "The Nature of the Firm," Professor Coase argued that the vertically-integrated, self-servicing bureaucracy was almost certainly NOT the most productive form of organization possible in the free market.

Specifically, in **The Wealth of Nations** (1776), the "father" of free-market capitalism, Adam Smith, had demonstrated the superior productivity of specialists over generalists. Thus, Coase reasoned that a consortium of independent specialized producers of components and services should routinely be expected to generate superior output at lower costs than a self-sufficient enterprise, one or more of whose in-house components were likely to be less than competitively competent in the open marketplace. However, as Professor Coase explained 70+ years ago, communication at THAT time was so slow, and shipping so unreliable, that the risks and the overhead “transaction costs” of successfully contracting out important in-house functions were so high that the inefficiencies of vertical integration were embraced by all large enterprises. “The costs of gathering information,” Coase concluded “determines the size of organizations.”

Today, our new Internet information info-structure and our modern transportation infrastructure have combined to dramatically reduce both the "transaction costs" and the operational risks of outsourcing. **As a result, our hierarchical, vertically-integrated, industrial-era bureaucracies** are rapidly transforming themselves into **flat, virtually-integrated collaborative networks**. My colleague, Gregg Edwards, and I have characterized these multi-firm collaborations “extra-preneurships.” James Champy recently wrote that “outsourcing” was what he and Michael Hammer were actually describing in their hugely influential 1993 management classic, **Re-Engineering the Corporation**. In his current book, **X-Engineering the Corporation**, Champy spells out the principles of successful extra-preneurships.

Professor Coase received the 1991 Nobel Prize in Economics, in part for his 1931 paper. The important thing to realize here is that – unlike "teamwork," "TQM," or "positioning" – the outsourcing movement is not the result of a management fad launched by some academic guru. The outsourcing revolution is the spontaneous product of timeless marketplace principles made practicable by our newly-mature info-com technologies! **Extra-preneurship is the new social technology for post-industrial enterprise** that is now widely expected to supplant the traditional, monolithic, self-sufficient, industrial-era bureaucracy – in both the private and public sectors – over the next ten to fifteen years.

Simply as a straight-forward employer adaptation to new telecommunications realities in the domestic marketplace, outsourcing is unquestionably a revolutionary development. But the Internet is not just a phenomenon of the U.S. domestic marketplace, nor even of the marketplaces of the mature industrial economies. The "Web" is a worldwide phenomenon; an integrating info-structure for the increasingly duty-free global marketplace created by the social technology commonly called "GATT;" the General Agreement on Trade and Tariffs. This complementary combination of physical and social technologies – the Internet, out-sourcing and GATT – promises to catalyze dramatic long-term economic changes throughout the world. Because human resources constitute 65% to 75% of average business operating costs in Europe and North America, there will be enormous pressure for labor-intensive information work to "migrate" from high labor-cost to low labor-cost countries. Moreover, most economists expect that, over time, direct international competition in a single, global electronic marketplace for information products and services will gradually drive all labor markets around the world to pay *comparable wages for comparable work*.

THE AMERICAN WORKPLACE: A TROUBLING LONG VIEW

While no one predicted the outsourcing revolution, it has quickly become not only a fundamental assumption of most MBA programs, but also of most long-range scenarios for the future of business, including:

- ***Adapt and Survive***; a ten-year, multi-factor scenario for the future of U.S. and global business, produced by a Delphic Survey of 180 international business futurists and corporate planners conducted by the Global Futures Forum (GFF) between May and December 2003. (A LEADERSHIP PERSPECTIVE.)
- ***The Future of Work*** by Sloan School Professor Thomas W. Malone; an open-ended, multifactor extrapolation of recent trends in enterprise and employment, based on the work of the "New Order of Business Management and Worklife" project at MIT, released in January 2004. (A MANAGEMENT PERSPECTIVE.)

- *The 21st Century at Work: Forces Shaping the Future Workforce and Workplace in the United States*; a multi-factor scenario produced by the RAND Corporation for the U.S. Labor Department, describing how a combination of most-probable demographic, economic and technologic trends are likely to alter the nature of work in America over the next fifteen years; released in February, 2004. (A Public POLICY PERSPECTIVE.)

Not only were these three scenarios produced from three distinctly differing perspectives, they employed differing methodologies. The GFF scenario was based on an expert survey, the MIT scenario emerged from a long-term scholarly research project, and the RAND scenario was based almost entirely on the Labor Department's 10-year forecasts of U.S. workforce composition and labor demographics. In spite of these disparities, all three scenarios are in consensus regarding three fundamental aspects of the future.

1. All three scenarios assume that the dis-aggregation of big, integrated industrial era businesses will continue until networked extra-preneurships become the normative form of large enterprise worldwide.
2. All three scenarios assume that the future economy will be global.
3. All three scenarios are remarkably silent on the future emergence of any new class of high-value-adding, middle-income employment to replace the millions of median-income jobs being eliminated by automation, information and global competition.

This omission is particularly apparent in the RAND scenario, which hews most closely to the actual long-term trends and extrapolations reflected in Census and Labor Department statistics. The think tank expects the future of work in America to be characterized by (a) HIGHER TURNOVER, (b) REDUCED JOB SECURITY, (c) DIMINISHED BENEFITS, and (d) PROFITS-BASED COMPENSATION.

EXTRAPOLATED TRENDS VS. ARTICLES OF FAITH

In the RAND scenario, all able-minded Americans – including millions of home-bound disabled working on-line – will have to participate in gainful employment in order to keep our labor costs low and our enterprises competitive. Moreover, RAND's demographers expect that the great majority of young Americans will continue to reject degrees and careers in engineering, math and the sciences in favor of more “socially engaging” work, while India and East Asia turn out hundreds of thousands of technically-skilled graduates a year. In fact, both the RAND and GFF scenarios assume, rather casually, that America will lose its overwhelming global preeminence in basic research, applied science and engineering over the next decade or two. Before 2020, many tech forecasters assert, U.S. research and development

will be competing head-to-head with Chinese and Indian R&D, just as our skilled production workers are already competing with their skilled production workers.

By comparison, MIT's *Future of Work* appears to offer a much more promising scenario. To begin with, the key functions of management are characterized as evolving from "command and control" to "coordination and cultivation," as organizational responsibilities and decision-making are either decentralized . . . or outsourced. In this scenario, employees made redundant by the hyper-productive utilitarian restructuring of our hierarchical industrial enterprises will become a "contingent workforce" of free agents or "e-lancers," who will market their competencies – individually and collectively – in the global, on-line workplace, while depending upon their *agencies* (Kelly, Manpower, Red Arrow, etc.), their alumni associations, or professional "guilds" for their on-going employment, continuing development and benefits.

Other management visionaries have rhapsodized over the end of "wage slavery" while extolling the self-actualizing pleasures of "free-agentry" – Charles Handy and William Bridges, among others – and most recently, Frank Levy and Richard Murnane in their important book, *The New Division of Labor: How Computers are Creating the Next Job Market*. But none of these optimistic scenarios describe the exact nature of the work that these millions of contingent info-preneurs will perform. These visionary scenarios simply assume that economic history will repeat itself, and that information technology will, like mercantile and industrial technology before it, inevitably create a future workplace full of new, high value-adding middle-income jobs. ***But this is only an expectation; an article of faith, not a probabilistic certainty!*** In fact, current trends – and techno-economic history – make it clear that, unless we can invent a new modality of high value-adding mass market employment involving easily-taught generic skills, some variation of the three consensus scenarios is likely to be the BEST outcome we can hope for.

While management philosophers envision a future where all capable people will thrive in a workplace filled with infinite opportunities for individual self-actualization, labor economists and workforce demographers – whose visions of the future must be more constrained by actual data – are much less sanguine. In essence, the authors of the data-based scenarios are all saying, ***What we see now is what we're going to get in the future; commoditized jobs in a highly competitive, global mass marketplace that will increasingly pay comparable wages for comparable work.***

These gloomy extrapolations notwithstanding, a more promising possibility for the future of work in America has now presented itself for our consideration. Specifically, just as outsourcing – the new mode of organizing enterprise – arose spontaneously in the marketplace in response to new competitive and technological realities, an entirely new way for ordinary employees to create economic value has recently appeared in the marketplace, promising even greater potential to improve economic performance than outsourcing: it's called "open sourcing." But

outsourcing is merely changing the structure of enterprise; *open sourcing will change the culture of enterprise.*

INFORMATION CONSTIPATION

Computers are clearly very good at sharing information, but most organizations aren't. A recent Korn/Ferry International survey of managers in ten high-tech firms, for example, found that:

- only 25% of respondents said that knowledge is ever re-used across the company, and
- only 10% said they had access to lessons learned elsewhere in the company.

So many studies have confirmed that such “information constipation” is common to all large organizations that it was long assumed that this phenomenon arose naturally out of the self-serving competitiveness of **all** employees. But the experience of firms that have made formal efforts to “manage” their intellectual capital in recent years suggests that the problem arises primarily from *a desire to restrict information flow by the managers who are supposed to implement and enforce corporate knowledge-sharing policies*. Indeed, a growing number of chief information officers (CIOs) and management experts have come to believe that “information constipation” is **not** a natural consequence of intra-organizational compartmentalization and self-serving employee competition, but is more likely the result of *management culture*.

INSULAR “A’S” VS. COLLEGIAL “B’S” IN THE WORKPLACE

Since the 1970s, behavioral scientists have routinely (if simplistically) divided society into two personality types. In the workplace, “Type A” personalities are depicted as primarily motivated by *extrinsic* rewards – status, power, and money, etc. – to compensate for their supposed feelings of inadequacy and insecurity. “Type B” employees, by comparison, are characterized as more motivated by the *intrinsic* rewards of work life – personal growth, collegiality, professional integrity, and peer recognition, etc. – all of which re-enforce the Type B’s putative sense of self-worth and sociality. Over the decades, workplace surveys have found that the great majority of managers in large organizations reflect Type A personalities. There is, as yet, no data linking insecure “control-freak” Type A managers, as a class, to constricted in-house information flow. But there is clear evidence that the Type B employees, who make up over 75% of the workforce, rely heavily on collegial knowledge-sharing to do their jobs well.

In his 1999 book, *Smart Business*, Harvard Professor Jim Botkin shows that highly-productive knowledge workers in all fields maintain “communities of practice;” collegial networks of past and present co-workers, former class-mates and instructors,

current and past customers and suppliers, etc. These “worker B’s” use their colleagues as a readily-available, trustworthy source of technical-professional information, guidance and mutual assistance. *In general, employees do this without the knowledge or approval of their employers!*

COMMUNITIES OF PRACTICE

Until recently, “communities of practice” have typically been informal. But the unexpectedly successful open source software (OSS) movement has provided the world’s ordinary rank-and-file workers – in every industry, trade and profession – with a formal process that will enable them to establish their own on-line communities of practice. The world’s largest community of practice is the collaborative on-line network at <sourceforge.net> that develops and improves Linux open source software. With more than 300,000 registered members working on over 10,000 projects, the open source community has demonstrated the enormous productive capacity of a self-policing volunteer meritocracy based on peer collaboration and intrinsic rewards. As a consequence, the open-source model is quickly being adopted as a new social technology for generating streams of productive innovations in a growing number of fields – ranging from semi-conductors, pediatrics and communications equipment to pharmaceuticals, automotives and consumer goods. What’s more, John Seely Brown, former Director of Xerox PARC, echoes the judgment of many experienced in workplace technology when he asserts that a new family of on-line *groupware* tools (physical technologies) is about to supercharge the way *communities of practice* (social technologies) solve problems, answer questions and push forward the frontiers of knowledge.

GROUPWARE

The principal new groupware tools include:

- **Peer-to-Peer file-sharing (P2P)** – Invented for on-line workplace collaboration, but first used by 37 million teenagers around the world to nearly bankrupt the global music industry; now a mainstay of project management throughout business, and gaining currency in government, especially for inter-organizational work.
- **Instant Messaging (IM)** – A real-time variation of e-mail for immediate communication among two or more people on-line; use of IM has dramatically reduced long-distance business telephone call volumes and is quickly turning cyberspace into a virtual bull pen. Since 2000, IM has become the **fastest-adopted technical innovation in the history of U.S. business**; 84% of large North American firms report making formal use of IM by December, 2003. Strikingly, it is the rank and file employees who bring IM into the workplace, not management. Some managements have banned employees from using IM, since the groupware breaches the firewalls and

filters of corporate information systems. It also cuts across official channels and violates lines of authority. On the other hand, employees have threatened job actions when prohibited from using IM. The technology is so productive that almost all large employers are regularizing its use.

Five years ago, the U.S. military began using IM to enable scattered battlefield units *from differing services* to “swarm” an enemy. Today, management consultants and advertising account executives use IM to gather “posses” of diverse experts on-line to quickly assess the threats and opportunities posed by fast-breaking, unexpected developments. IBM uses its IM system to provide instant authoritative answers to technical questions from sales engineers, by permitting KWIC Web-searches of 220,000 IBM employees worldwide to find in-house subject-matter experts who are on-line and available **at that moment**. IM is greatly empowering first tier technical and professional employees.

- **WEB LOGS (“Blogs”)** – Originally an on-line platform for IT wonks, Blogware is now used to host on-line experts as to serve as information sources for customers, employees, and the media. Available both as software and as an on-line service, Web logs also loom large as future gatherers of market research, as a powerful news medium, and an unusually effective teaching/training tool.
- **Wi-Kis** – Freely down-loadable software for collaboratively creating new knowledge bases – dictionaries, glossaries, encyclopedias, etc. – for previously un-examined issues, problems or fields of study (TWiki.org; Wikipedia.com). The need for such systems will increase exponentially throughout the foreseeable future, as the accelerated advance of human knowledge – made possible by our rapidly-spreading use of IT – forces us to study new problems, apply new technologies and explore new options.

Together – P2P/File-Sharing, Instant Messaging, Swarms and Posses, Blogs and Wi-Kis – now provide the means for quickly establishing on-line “open knowledge” and “open innovation” systems to mobilize information and knowledgeable practitioners with respect to any topic, project or problem in any field of operation. But how many encyclopedia’s full of new knowledge will we need to create in the future? The answer is.....

MILLIONS!

NEVER-ENDING AVALANCHE OF INNOVATION

While the dot.com bubble has begun to fade into memory, the mass-market innovations introduced during the late-90s' technology boom were sufficient to convince a majority of Americans that the computer really is a revolutionary technology that will ultimately transform daily life and work in unpredictable ways. And, now that most people have accepted the idea that we are presently living through the "Information Revolution," a question that is asked of futurists with increasing frequency is: "What's the NEXT revolutionary technology going to be? Will it be Bio-tech, or Nano-tech, or Hydrogen-based energy, etc?"

The Information Revolution will almost certainly **not** be followed by a similar period of socio-economic transformation driven by a *single dominant technology*. Rather, the coming decades will witness an avalanche of scientific discoveries, technical breakthroughs and real-world applications throughout the workplace, the marketplace and our lives, as IT enables us to **lift the veil of ignorance from every frontier of knowledge all at once!** Techno-futurist Ray Kurzweil calls this moment in time not just a "revolution," but a "singularity" in the history of humankind. Whatever we end up calling our current moment in history, for each new frontier we explore – immune systems, food chains, computer networks, nosocomial infections, geologic faults, fabrication materials, etc. – we will discover new complexities and subtleties. For every new technology we put in place, for every new regulation enacted, there will be new questions to answer, new problems to solve, new linkages to understand – all of which will create new fields of study, new multi-disciplinary professions and hybrid technical specialties in the workplace, plus a demand for more new technology.

This future will call for a workplace in which **everyone** must be attuned to the consequences of innovation, and where rank-and-file workers must be encouraged to share their experiences and insights with their peers **both inside and outside their firms**. Only in an environment of open collaboration can we possibly expect to constructively assimilate such pervasive innovation and change without disastrous consequences. (Remember Edward Tenner's "law of unintended consequences"!) And, it is only in an environment of open collaboration – where individual employees are empowered to "learn locally and share globally" – that ordinary workers – nurses, farmers, machinists, janitors, bus drivers, etc. – will be able to add "incomparable" value on the job, and thereby merit compensation that is **incomparable** with the global market wages earned by their counterparts for comparable work elsewhere in the world. Such arrangements will be more substantive than "participatory management;" it will be **participatory R&D**. Unlike participatory management, participatory R&D taps the particular and unique productive competencies of rank-and-file employees.

OPEN SESAME!

In all hierarchical, compartmentalized institutions, the standard default rule governing the distribution of information has traditionally been “need to know.” It is a fundamental canon of classic management theory that every employee in every position should be given all of the information they **need to know** to do their jobs, nothing less. But nothing more, either! Until recent years, management practice has strongly discouraged “unauthorized” transmission of information among different branches, divisions or departments of a single firm or government agency. Typically, only a handful of senior executives ever got to see a comprehensive picture of the entire enterprise – presumably because theirs were the only positions whose job tasks gave them a **need to know** the whole picture.

Clearly, encouraging employees to directly share experienced-based knowledge or performance data with their co-workers will be a dramatic departure from long-standing management practices. And the idea that employees be permitted to share in-house experience with their counter-parts **in other organizations, including competitors**, would be rejected out-of-hand by every corporate counsel on six Continents. In fact, the widespread adoption of open source communities of practice (OSCPs) would be highly problematical were it not for the fact that an *open knowledge movement* is rapidly spreading throughout the institutional world. The Federal government, for example, is taking action to make the results of all Federally-funded research freely available to the public, and the Public Library of Science (PLoS), have already begun to publish peer-reviewed research findings in their free scientific journals.

MIT has begun to post its entire curriculum – syllabi, video-taped lectures, texts and assignments – free of charge over the Internet. In the business world, openness in the corridors of corporate power is being coerced by regulatory reforms in the U.S. and worldwide, taken in direct response to massive malfeasance by executives in a still-broadening list of industries. A similar openness is beginning to establish itself among pharmaceutical industries, where failure to publish negative drug trial results have led to embarrassing and costly disclosures. Likewise, in the famously secretive healthcare profession, mounting estimates of medical errors and error-related deaths have provoked a range of responses revolving around the open sharing of experiences among hospitals, permitting the rapid spread of standard diagnostic and treatment protocols, (called “Evidence-Based Medicine (EBM) by proponents, and “cook book medicine” by critics.) EBM has already established a solid track record for dramatically improving hospital performance.

An unexpected manifestation of institutional openness has been the adoption of “open innovation” by a growing number of corporate R&D operations. During the Industrial Age, in-house research was seen as crucial to competitiveness. The superior quality and quantity of research conducted at the great industrial laboratories – like Bell, IBM, GE, DuPont, etc. – conveyed so much tangible competitive

advantage – and often, marketplace dominance – to their companies’ products that the labs were often referred to as a firm’s “crown jewels.” But, as Harvard’s Henry Chesbrough describes in his 2003 book, *Open Innovation*, the success of firms like Cisco, Nokia and Genentech – that have prospered largely by purchasing or licensing technologies developed by others – is leading major firms in industries ranging from copiers and computers to banking, healthcare and mass-produced consumer goods to do the same. Over the past century, Proctor & Gamble’s formidable array of market-dominating products have been entirely the creations of P&G’s in-house R&D laboratories. But, in 2003, 10% of its new products were created outside of the company, and under a program called “Connect and Develop,” P&G intends to buy or license 50% of its innovations from outside sources within 5 years.

INFO-PRENEURSHIP

Trans-institutional collegiality is scarcely limited to academics, professionals and corporate R&D. As industrial products like automobiles, appliances and aircraft incorporate increasingly sophisticated specialized features, manufacturing processes must involve growing numbers of specialized suppliers. Lockheed-Martin’s \$200 billion contract with the U.S. Department of Defense to build a new generation of stealth aircraft – the “Joint Strike Fighter” – involves 80 independent suppliers operating in 187 different locations, all of whom rely heavily on groupware to collaborate with each other, and with the 75-member “Aeronautics Tech Group” who are co-ordinating the project with the 4 U.S. armed services, the U.K. Defense Ministry and 8 other allied militaries. In work environments like this, behavioral scientists expect “project teams” – made up of multiple disciplines from multiple employers – to become the primary work group, bound together by common goals and common rewards, in the form of team performance bonuses. Some employment experts also believe that teams who become particularly adept at turning out generically valuable information products – e.g. resource allocation algorithms, dynamic relational data bases, non-destructive materials testing, etc. – will collectively leave their salaried positions and form new information service enterprises.

A number of such *info-preneurships* are expected to spin themselves off from their employers in the coming decade. This movement will be in direct response to a rising marketplace demand for the powerful but scarce productivity-enhancing competencies of math modelers and statisticians from small and medium-sized enterprises (SMEs) that could otherwise never afford to employ such skills as salaried in-house staff. The BLS projects that 1 million new jobs in “Mathematics, Statistics and Computer Design Engineers” will be created through 2012. Jobs like these inspire the apostles of free agency. But such high value information services will make up less than 5% of the new jobs created in the current decade, amounting to just 2.5% of the total U.S. workforce by 2012. The entire “Professional, Scientific and Technical Business Services” sector – slated to add a total of 1.86 million new

positions – is the brightest feature of the current 10-year U.S. employment forecast, but it clearly does not represent a rising tide that will lift all the boats.

The proto-type social technology whose success has helped to inspire the general spread of open collaboration – the open source software movement (OSS) – remains in a league by itself. In North America alone, an estimated 1.1 million software developers report that they voluntarily spend some of their on-job time working on one or more OSS projects. While these programmers charge no one for their services, they are none the less compensated for their time, since many (perhaps most) of them work on OSS during their hours of salaried employment for a corporation or government agency, *often without their employer's knowledge or approval*. This apparent “theft” of production time from their employers is most often justified by arguing that the employee and his/her open source colleagues were engaged in solving a problem or improving a system in the employer's operation.

The degree to which such explanations are true almost certainly varies widely from case to case, but the underlying question remains unanswered: Why do more than one million programmers voluntarily contribute their professional time and skill – and in some cases, jeopardize their jobs – to help develop open source software for which they will never receive any tangible compensation? Economic decision theory tells us that either the OSS process must involve less effort on the part of the employee **or** that the employee must be receiving some form of INtangible reward. This is, of course, what the behavioral scientists say about the Type B employees who make up an estimated 2/3 to 3/4 of the workforce; that they are substantially motivated by the intrinsic rewards of their work: personal growth, peer recognition and collegiality, professional mastery and integrity.

While software writers have become the most numerous practitioners of on-line open source collaboration, they are by no means the oldest. The Internet has been used for scientific collaboration since it was first created by NSF and DARPA in the 1970's for that very purpose. The net has played a major role in a growing number of scientific breakthroughs over the past 20 years, most notably, chaos theory. Scientists and engineers are absolutely rhapsodic about the potency of today's groupware, which not only facilitates on-line collaboration, but keeps track of who contributed what to the final product.

While the readily apparent examples of workplace collaboration all arise in professional, scientific and technical fields of endeavor, this should not be taken to mean that only people with post-secondary degrees are motivated by intrinsic rewards. After all, fewer than 1/3 of U.S. workers possess a post-secondary degree, but 2/3 of all workers are estimated to reflect intrinsically-motivated Type B personalities. This would suggest that there are millions of factory, transport and service workers, etc. who would also be motivated by the intrinsic rewards of personal growth, peer recognition and collegiality associated with on-line collaboration *were they given the opportunity*.

OPEN COLLABORATION FOR THE MASSES

The absence of open knowledge-sharing networks among blue and gray collar workers can easily be explained. To begin with, many rank and file employees – e.g. bus and taxi drivers, janitors, assembly line workers, etc. – have no on-the-job Internet access. But, this circumstance will change dramatically over the next 5 years, as telephone service is merged into the Internet, and every cellular phone becomes a Web-enabled terminal. Internet access will be mobile and universal before 2015, reaching every back-hoe operator, machinist and insurance agent wherever they may be.

Another common explanation for the failure of ordinary production and service workers to form collaborative networks is that their jobs are neither “high tech” nor involved in knowledge work. But the knowledge management movement (KM) of the 1990’s has established that **all** enterprises are based primarily on organization-specific knowledge, including the work practices, data-bases, and experience-based know-how of their employees. By mobilizing their “institutional capital,” for example, firms such as Holcim, the world’s largest cement maker, and Highland Supply Corp., America’s principal producer of packaging for florists, have dramatically increased the market share and profitability of their distinctly non-high-tech businesses. Most KM programs, however, have been costly failures, victims of their firms’ information constipation and the costly, ill-conceived computer systems designed to mine corporate data bases for strategic management insights. But, the rapid rise of extra-preneurship has made trans-organization collaboration a necessity, and the management default policy for in-house information has shifted from the “need to know” to a “need to share.”

A third reason why rank-and-file workers have shown little inclination to form collaborative networks is that, while they may be equally motivated by intrinsic rewards as are their professional and scientific co-workers, front-line employees are much less likely to have discretionary on-the-job time to devote to uncompensated work. Moreover, the shattering of the industrial era social contract – falling rank and file wages, shrinking benefits and the loss of job security, etc. – have combined to reduce worker loyalty and their propensity to give their time and creative energies to their employers. As managers struggle to adapt in the face of the twin revolutions of info-mation and globalization, rank and file employees’ contribution to corporate survival has largely been reduced to the sacrifice of their wages and benefits.

Now that many managers have come to regard labor primarily as a cost to be eliminated rather than an asset to be nurtured, they are even less likely to make the investments necessary to provide their rank and file workers with Internet access, or to enlist them as allies in their efforts to cut costs and increase productivity by empowering them to participate in on-line communities of practice. And, of course, there are no such on-line collaborations for the vast majority of rank and file workers to join. But, if America’s front line employees are not given the opportunity to

mobilize their job-specific, experience-based intellectual capital to improve the productivity and the quality of their output, they will have lost any hope of outperforming their global competitors. And so will their employers.

Research by the National Science Foundation (NSF) has shown that the average return on investment (ROI) from *new product R&D* is 15%, while the ROI from *new process R&D* is 25%. New product R&D, on which corporate America spends most of its research budget, is crucial to creating and dominating new markets. New process R&D, on which much less money is spent, is crucial to maintaining and expanding market share for existing products. Moreover, in his research into R&D efficiency, Eric von Hippel at the Wharton School has found that outsiders – e.g. software engineers, management analysts, etc. – have difficulty in designing process improvements largely because, in order to fully understand the “sticky” details of an operation, the analyst must “dwell in the context of the (system) user for a prolonged period.” Employees, of course, already dwell in the context of their own jobs, and are intimately familiar with the sticky details.

While thousands of on-line collaborative networks have sprung-up spontaneously among scientists, scholars, software writers and artists, similar systems for rank and file workers will almost certainly have to be sponsored and operated by large institutions with a nationwide presence. Three institutions would be well-suited to such a task:

1. Trade and industrial associations could establish on-line open collaboration networks for the employees of their members. Association sponsorship would be especially beneficial for industries with a large number of small firms which have no resources to spend on R&D.
2. Labor unions could offer an open-collaboration capability in addition to the other on-line services that many already offer their members. Unions also have standing to promote employer adoption of worker-initiated productivity-enhancing process innovations and the concomitant wage increases.
3. Employment agencies, like Kelly and Manpower, Inc., who provide rank and file employees to factories, stores and offices, have recently developed massive on-line training systems to permit the millions of workers they handle to continuously up-grade or change their skills to meet the demands of the labor market. These agencies could also train and equip their workers to share workplace experiences and develop productive practices for common operations or using common types of equipment.

Once such collaborative on-line networks are in use, they could also be tapped by equipment manufacturers and service providers for help in improving their products. Researchers and consultants could also use the networks to conduct studies on a wide range of workplace issues. Most important of all, workers themselves would use

open collaboration to speed up their mastery of new equipment and fabrication materials, and to solve common logistics problems. Once employee collaborations become well established, firms will increasingly contract with them for evaluations of competing types of equipment or software, or to help redesign production facilities.

Eventually, as labor and management each increasingly concentrate on improving their own components of enterprise, the management of growing numbers of enterprises is likely to contract out their production operations to their own rank and file employees. Freed of high cost management overhead, such self-improving employee-owned enterprises are likely to be highly competitive in the global marketplace. The outsourcing of production would be the logical final step in the process of disaggregating our integrated industrial era organizations into individual components, each specializing in their individual core competencies. The IT-based transformation of enterprise would be complete.

KEEPING THE WAY TO THE FUTURE OPEN

In two revealing analyses, *The Lever of Riches* (1990) and *The Gifts of Athena* (2002), invention were the same during the Middle Ages and the Industrial Era, cultural changes produced by the 18th Century intellectual “Enlightenment” fostered the rapid development and adoption of technical innovation during the Industrial Revolution *that did not occur in Medieval times*.

Prior to the Enlightenment, Mokyr argues, the understanding that knowledge was power led most knowledgeable people to keep their discoveries secret, and to personally monopolize their technical capabilities. After the Enlightenment, knowledgeable people collaborated with each other and breakthrough discoveries were quickly made public. As Eric Raymond observes in his prescient 1999 book, *The Cathedral and the Bazaar*, “Alchemists turned into chemists when they stopped keeping secrets.”

The current battles between open source and proprietary software and between free and fee scientific journals, plus the worldwide movement for corporate transparency, the legal struggles over the patenting of business processes and the fair use of copyrighted materials all reflect the crucial historic differences between Medieval and Enlightenment cultures. To fully realize the splendid potential of information technology, our management culture must embrace the confident, competent openness of the Enlightenment, not the secretive proprietary entitlements of the Dark Ages. The workplace culture we create in the decade ahead will open – or foreclose – the path of socio-economic progress for America and the world in the Information Age.