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"New Technologies and Work Organization" by Laurie Dougherty

INDUSTRIALIZATION ON THE MARCH

> The world is entering a new age - the age of total industrialization. Some countries are far along the road; many more are just beginning the journey. But everywhere, at a faster or slower pace, the peoples of the world are on the march toward industrialization. They are launched on a long course that is certain to change their communities into new and vastly different societies whose forms cannot yet be clearly foreseen. The twentieth century is an age of enormous and profound and worldwide transformation.[1]

Although these words, from the introduction to *Industrialization and Industrial Man* by Clark Kerr, John Dunlop, Frederick Harbison and Chartles Myers, were written in the early 1960s, they parallel the sense of onrushing change on a global scale found in the prologue to Manuel Castells' three volume discussion of the information age, published in 1996.

> Toward the end of the second millennium of the Christian Era several events of historical significance have transformed the social landscape of human life. A technological revolution, centered around information technologies, is reshaping, at accelerating pace, the material basis of society. Economies throughout the world have become globally interdependent, introducing a new form of relationship between economy, state, and society, in a system of variable geometry.[2]

Besides a vision of sweeping transformation, each of these paragraphs takes the method of production of goods and services as a system, an organizing principle for human life and society. The method of production situtates the society in time and space. What is different is the vision of the outcome. Although the earlier paragraph, written by several of the most renowned analysts of industrial relations, does not claim to predict precisely what the final form of an industrialized world will look like, the reader is left with the impression of a coming homogenized, *industrialized* world - something that is all of a piece, only awaiting the completion of a process undertaken "at a faster or slower pace" by people around the world. For Castells, however, the outcome is not a homogenized world, but one of "variable geometry" in

which differences are not dissolved, but rather linked up, played off against each other and incorporated into a complex global network.

In preparing this book on the changing nature of work, we have been faced with a need to come to grips with, not only the fact that work is changing, but that the direction of change is shifting and the discussion of work is changing. For two centuries work changed in the direction that Kerr and his co-authors perceived: spreading industrialization and the growth of large scale organizations - cities, enterprises, governments - which operated according to a "web of rules" to integrate and manage a complex system of social and economic relationships. Although the word web might seem to prefigure the free-wheeling information web we know today, for Kerr and his co-authors, this web of rules is a constraining one which holds together a hierarchical structure. In the workplace this structure contains a "few managers...and many to be managed".[3]

The industrial economy was essentially a manufacturing economy with clerical and service occupations integrated into a vast system for the assembly and distribution of mass produced goods. Work was organized around an ever-increasing division of labor within large enterprises regulated by large-scale government. As these enterprises absorbed more and more of the work once done in homes and farms and workshops, work relocated to mass production factories, vast complexes for processing chemicals and ores, and towering office buildings which centralized the bureaucratic administration of both firms and governments. The family shrank into a small mobile unit for consumption and cultural activity, able to move up with an advancing career or to absorb the shock of technological change. While new technologies might render a product or process (and therefore a particular job) obsolete, technology also opened up new opportunities which were easily grasped by a well educated workforce. New technology meant progress in the form of both products and production techniques, resulting in a better quality of life for all. With the spread of industrialization throughout the world, it could be imagined that all people would eventually come to share in the well-being produced by the industrial age.

For Kerr and his co-authors the march toward the industrial age was a campaign of the new against the old waged by elites (of various persuasions - capitalist, communist, nationalist, dynastic, etc.). Science-based technology was the basis for material progress and the source of its universality because science-based technology could be shared and understood across political boundaries and despite cultural differences. Management, by members of the industrializing elites or their delegates, was the pivotal process for coordination of complex organizations and subordination of the labor force to the "web of rules" by which the industrial enterprise operates.

THE LABOR PROCESS UNDER INDUSTRIALIZATION

The workplace came under intense scrutiny during the restless period of protest and rebellion that marked the late 1960s and early 1970s. Strikes broke out in many mass production industries and young black workers in Detroit began to display the the same resistance to the white-dominated establishment exhibited on a community level by militant civil rights organizations. The discourse around work turned toward a revival of interest in Marx's critique of capitalism. Harry Braverman's *Labor and Monopoly Capital*[4] stripped the Industrial Age of its grandeur and revealed a labor process marked by loss: loss of skill, of autonomy and of technical understanding of the production system as a whole. Workers in the factories and

offices were not participants in the march of progress, but cogs in the machinery of profit-seeking capitalism.[5]

What Braverman shares with earlier analysts of industrial relations is not their vision of progress, but rather the understanding that in industrialized society labor is situated within a hierarchical system which is emblematic of the organization of society as a whole. While Kerr, et. al., accepted the "inevitable and eternal separation of industrial men into managers and the managers"[6] as part of the structural of the industrial system, for Braverman the managers and the managed exist in an antagonistic relationship - one which is neither inevitable nor eternal, but rather the result of a particular historical process.

In the course of industrialization, technology became, in addition to a source of greater productivity, a tool which extended and intensified the reach of managerial control. Scientific knowledge was appropriated by industrialists and transformed into usable technology an educational establishment harnessed to the needs of industry.[7] This idea has been developed in detail in David Noble's discussion of the rise of the engineering profession in the late 19th and early 20th centuries and its integration with emerging structures of corporation management.[8] As engineering and management became entwined, innovation and productivity became more and more a matter of wresting control from workers and situating it in intricately engineered machines and the planning departments of large industrial firms.

Marxist analysts reinterpreted the construction of "industrial man" as a process of deskilling and disempowerment of workers. Their understanding was based both on empirical data from research on contemporary work sites, and on reveiw of books, articles and published presentations by late nineteenth and early twentieth century practitioners of scientific management, particularly its outspoken founder, Frederick Taylor. Taylor and his colleagues were quite open about their search for the "one best way" to accomplish any given task. They aimed to improve efficiency. Taylor felt that management should be willing to pay for productivity; one element of scientific management, as he conceived it, was an incentive-based system of compensation. However, he also thought that the skill of the craftsman, gained through years of experience and indoctrination into the customary knowledge and practices of the craft, was an impediment to a rational understanding of technique; and that the craftsman's control over the pace and sequence of tasks was an impediment to efficiency. Taylorism brought the stopwatch and the trained observer to the workplace, translating experience and skill into time and motion studies and specialized equipment. [9]

Henry Ford took this process even further when he arrayed rigidly specified and carefully sequenced jobs beside a moving conveyer to produce vast quantities of automobiles quickly and cheaply for a burgeoning mass market. Mass production spread to other industries and became one of the core institutions of the Industrial Age. But where some analysts saw an organization grand enough to lead the march of progress, others saw a bloated bureaucracy set up to coordinate a carefully engineered work environment and discipline a reluctant workforce which had been robbed of initiative and skill.

It is fair to say that work has been changing at a rapid pace since the earliest days of the industrial era, but the changes we are most concerned with in the summaries in this section are those sparked by computerized technologies and the transition in the last quarter of the twentieth century from the industrial to the information age. The mood at the end of the millenium is uncertain rather than triumphant, marked by both opportunity and risk - a loss of the sense that progress is inevitable.

NEW DIRECTIONS AND NEW TECHNOLOGIES

If the impact of industrialization proved not to be universally progressive, the drive toward industrialization proved not to be as straightforward as Kerr and his colleagues imagined. After World War II, the U.S. was the only industrial economy unscathed by the war. For twenty-five years, the U.S. played a hegemonic role in world economic and political affairs. U.S. military presence around the world enforced a *Pax Americana* in the face of a perceived threat from the Soviet bloc. An international monetary agreement signed at Brettton Woods, NH in 1944 established the U.S. dollar as the world's leading currency. U.S. corporations invested in overseas factories, mergers and joint ventures.

Eventually, the recovering economies of Europe and Japan began to compete with the U.S. for world markets. The Bretton Woods agreement broke down. Other political and economic factors, including falling profit rates (beginning in the late 1960s) and the oil price shocks of the 1970s contributed to spreading economic stagnation.[10] Competition led firms to seek greater efficiencies, lower costs and improved quality. Cheaper labor in developing countries induced many corporations to source production to low wage areas. The process of industrialization in developing countries shifted away from attempts to become self-sufficient in manufactured goods toward production for export. In the developed countries the confident, expansive discourse of the Industrial Age gave way to images of decay and uncertainty. Aging factories closed or cut back production; recession swept one country after another.

At the same time, computers and factory automation had increasing effects on the workplace. They enhanced the mobility of capital through improved communication and transportation capabilities. Bluestone and Harrison called them permissive technologies because they permitted or enabled "managers to shift capital (and products) across long distances, and to operate far-reaching networks of production facilities."[11] New technologoes used in this way fostered the emergence of regionally or even globally integrated networks of production and distribution.

Computer-based technologies also changed the conduct of work within the workplace. In his book *Work Transformed*, Harley Shaiken (who also has an article summarized in this section) investigated the impact of several forms of electronic technology, including numerical control and computer numerical control of machine tools, flexible manufacturing systems, robotics, and computer aided design\computer aided manufacturing (CAD\CAM) systems. He saw a disjuncture between the potential for these programmable technologies to reintegrate the mental and manual aspects of production and to relieve the worker of the more tedious or strenuous or dangerous jobs, and the actual uses of these technologies in the same controlling, deskilling manner promoted by the tenets of scientific management a century ago.[12] Shaiken's own experience working as a machinist under very different forms of work organization led him to understand that technology could be adopted in ways that either enhanced or degraded the work experience.

Like earlier researchers, the authors of summaries in this section are concerned with the relationships between technology, work organization, and skill and autonomy in the workforce. But those relationships are no longer sheltered within a well structured web of rules. Intense competition is pervasive, leading to drastic measures to cut costs and improve efficiency. When information technology combines with communications technology, not only is the individual workplace restructured, but the work is redistributed with little concern for time or distance. The

dynamic is not one which tends to homogenize societies under the steady march of industrialization, but one which exploits differences and sets workers in competition with each other as investors seek out lower costs and higher short term returns.

At the same time the competitive environment demands that firms command consistently high performance from their workers. As Peter Cappelli points out in an article summarized in the next section, these goals may come in conflict: one view sees workers as a liability, the other as an asset. The next section will take up the discussion of the tendency to detach workers from long association with employers. This section takes up the discussion of technology, skills and work organization in the context of computerization and global competition.

John Mathews, an industrial relations analyst from Australia leads off with an introduction to sociotechnical organizational change. The sociotechnical perspective is an historical one which holds that the effective use of technology and organizational form are mutually dependent. Eileen Appelbaum and Rosemary Batt analyze several work systems which exist as alternatives to mass production. It is worth noting that each one is associated with a different country, having evolved within a particular set of institutions and product and labor market conditions.

Two of those work systems are examined in more detail: lean production in the article by John MacDuffie and John Kracik; and Swedish sociotechnical design by Christian Berggren. Here the term sociotechnical is used in a more limited sense to mean a form of work organization which is designed with concern for the needs of the human worker. In the Swedish case, young workers at Volvo were so alienated by the tedium of mass production that the company dismantled the assembly line in its newer plants in favor of team based work units. (One interesting point made in a different part of Berggren's book is that Volvo's Belgian factory had no problems with turnover because unemployment was high and workers had few other opportunities. No efforts were made there to make working conditions more congenial.)

Lean production, a system which originated in Japan and can now be found in many parts of the world has been applauded for its ability to raise efficiency and reduce defects. Critics of lean production claim that it creates a very stressful work environment, while supporters claim that it eliminates wasteful procedures and involves the workforce in continuous improvement of tools and techniques. Its methods call to mind the X-efficiency theory of Harvey Leibenstein.[13] According to this theory, although economics is based on the assumption that efficiencies are maximized, in reality there are gaps between what is actually achieved and what could be achieved. The goal of lean production appears to be the closing of that gap by inducing the highest level of human effort and by incremental redesign of equipment and procedures.

Besides claims for high performance, supporters of lean production claim that it is the wave of the future and will come to dominate manufacturing on a worldwide basis in the way the Fordist factory dominated the mid 20th century. Harley Shaiken and Harry Browne investigated this claim at several Japanese owned factories in Mexico. They found little evidence of lean production techniques in these plants even though lean production had been effectively implemented at a Ford plant in Mexico and many factories in the U.S.

Sociologists Shoshana Zuboff and Stephen Vallas and John Beck undertook qualitative studies of the effects of computerization on the workforce, Zuboff at work sites in several industries including paper and telecommunications, and Vallas and Beck at several paper mills. Vallas and Beck found a reprise of the displacement of knowledge and skill away from workers and toward management and engineeers. Zuboff found a more complex process in which

workers were initially disoriented by the change, particularly the loss of physical contact with the product and need to rely on indicators rather than dierct experience of the process. But in some cases they achieved a new mastery over the high tech equipment and were able to integrate feedback from it into a new understanding of the work process.

Factories are not the only sites for new technology or forms of organization. Two studies summarized in this section were conducted of the effects of office technology. Appelbaum and Albin's study of the insurance industry found that computers could be used in clerical work and claims processing in ways that either enhanced the autonomy of the worker or rendered the work routine and repetitive. A major research project into the effects of computerization on the office, directed by Heidi Hartmann produced a number of case studies and a summary volume. The chapter summarized here is a thought provoking analysis of what makes a job good or bad and how various elements of job quality may be affected by technological change.

Technology has effects on individual workers as well as on the organizational framework within which work gets done. One recent concern of researchers has been whether and to what extent computerization has effected the skill content of jobs and how that effect, if any, influences wages by shifting demand for particular skills. After a detailed econometric analysis David Autor, Lawrence Katz and Alan Krueger found that the increase in computer use in the workplace is associated with an acceleration in wage inequality. John Dinardo and John-Steffen Pischke questioned whether this was in fact a real "treatment effect" (i.e., methodologically comparable to studies which measure the effect of treatment with one variable as oppposed to treatment with another variable or no treatment) or whether computer use was capturing the effect of unmeasured variables. They took advantage of a large German database with information on use of a number of tools from both white anbd blue collar jobs and found that writing implements also had a measurable and statistically significant effect on wages. Their conclusion is that the increased payoff to using pencils was probably accounting for some other, unspecified, variable. By implication, when other researchers found that computer use raised wages, they were probably also picking up some unspecified variable. DiNardo and Pischke presume that computers are having a profound impact on the workforce, but the efffect on wages is likely to be an indirect one resulting from the development of more complex, information rich work settings.

Stephen Barley reintroduces the idea of power, bringing an organizational theorist's point of view to his case stof workplace relationships. The final form of any technological or organizational change will depend on the relative bargaining strengths of workers and managers.

WHAT'S MISSING FROM THIS PICTURE?

What's missing is a sense of connection of work to some larger purpose. For all its inflated aura of destiny, the project of the Industrial Age was progress, in the sense of raising the general level of material prosperity. Material prosperity is best understood as an intermediate goal: wealth is not an end in itself, but a means to other ends (such as comfort, amusement, security, respect, etc.).

With the advantage of hindsight we can see that much economic growth has not been environmentally sound, has not been evenly distributed nor securely grounded, and may not have achieved its intended final ends. Along the way technology was used to externalize the environmental costs -- both by shifting it onto those whose voices were little heard, and by deferring it to the future. That future is now arriving; as the bills come due we may find that

progress, as it was understood in the Industrial Age, is inevitably slowed, stopped or even reversed.

As to whether the prosperity of the Industrial Age has been successful in improving general human well-being -- that is a large and difficult question. Aspects of it were addressed in the previous Frontiers volume, Human Well-Being and Economic Goals[14] At this point, it is enough to say that this is an issue that deserves much more attention than it has yet received within the debates on the issues discussed here. Lean production or the Swedish model? Open or restricted trade? Taylorist organization or workplace democracy? In order to make social choices that will go in one of these directions or another, we obviously need to understand the causal relationships among the relevant variables, including various management systems, legal regimes, and labor productivity. But such understanding is not enough in itself: we also need to have a clear idea of our final goals. Then, only, will we be able to probe further into the matter of which social choices will lead toward, and which away from the achievement of our goals.

Notes

1. Clark Kerr, John T. Dunlop, Frederick H. Harbison, and Charles A. Myers, *Industrialization and Industrial Man - The Problems of Labor and Management in Economic Growth* (New York: Oxford Universtiy Press, 1964) p. 3.
2. Manuel Castells, *The Rise of the Network Society* (Oxford: Blackwell Publishers, 1996) Vol. I *The Information Age: Economy, Society and Culture*, p.1
3. Kerr, *et. al., op.cit.*, p. 24.
4. Harry Braverman, *Labor and Monopoly Capital - The Degradation of Work in the Twentieth Century* (New York: Monthly Review Press, 1974)
5. Braverman gives scant attention to the labor process in the then socialist bloc, briefly mentioning that it mimicked the organization, if not the structure of ownership, of work in the capitalist world in order to achieve the benefits of modernization efficiently, a situation which he considered to be ultimately bankrupt.
6. Kerr, et. al., p. 15, 1960 edition as quoted in Braverman, p. 16. (In the 1964 edition, the following phrase carries the same meaning, without, however, quite the same resonance: "the inevitable structuring of the managers and the managed in the course of industrialization." p.8 In the introduction to the later edition, Kerr and colleagues claim that their most recent research leads them to downplay the influence of worker protest on the evolution of industrial society and to describe a generally collaborative relationship between managers and the managed.
7. Braverman, 156.
8. David F. Noble, *America by Design - Science, Technology and the Rise of Corporate Capitalism* (Oxford: Oxford University Press, 1977)
9. Ibid, Ch. 10. Noble
10. See Barry Bluestone and Bennett Harrison, *The Deindustrialization of America - Plant Closings, Community Abandonment, and the Dismantling of Basic Industry*. New York: Basic Books, 1982.
11. *Ibid*., p. 115.
12. Harley Shaiken, *Work Transformed - Automation and Labor in the Computer Age* (New York: Holt, Rinehart and Winston, 1984)
13. Harvey Leinbenstein, *The collected essays of Harvey Leibenstein. Volume 2. X-efficiency and micro-micro theory*. Kenneth Button, ed. New York: New York University Press; 1989.
14. Frank Ackerman, David Kiron, Neva R. Goodwin, Jonathan M. Harris, and Kevin Gallagher, eds. *Human Well Being and Economic Goals*. Washington, DC: Island press, 1997.