and the corporate-military complex. Yet he shows the inability of a government research agency to remain innovative unless it is guaranteed political support. Independent government agencies are not models for research because they prove to be too dependent on outside interests. In making this observation, Roland points to a central paradox of scientific research in the Cold War era.

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Alternatives in the Workplace

Beyond Mechanization. Work and Technology in a Postindustrial Age. LARRY HIRSCHHORN. MIT Press, Cambridge, Mass., 1984. xii, 187 pp. $17.50.

About 100 million people work for wages in the United States, spending about 200 billion hours annually on their jobs. Aside from personal convenience or monetary rewards jobs differ in their psychological rewards, some being regimented and limited in scope and others being more flexible and autonomous and providing room for personal expression and growth. Jobs are not shaped entirely by technological demands or by economic imperatives. Ways of organizing work so that it offers the best rather than the worst of possibilities for the workers are important to workers and to humanistic technologists.

Since the 1930's industrial psychologists have developed several strategies that promise the elusive mix of cheerful workers and maximal productivity. One important approach, sociotechnical design, is the subject of *Beyond Mechanization*. Hirschhorn shares the common assumption of sociotechnical analysts that managers and workers can simultaneously benefit from workplace organizations that have certain properties. He stays within the sociotechnical tradition by emphasizing four features of sociotechnical job design: workers are trained in stages to do all the tasks assigned to their group; salaries increase as workers learn more skills; work groups take responsibility for the quality of their work; and work groups allocate people to tasks flexibly.

Beyond Mechanization is an engaging introduction to the basic concepts underlying sociotechnical designs and some of the dilemmas associated with them. Hirschhorn contrasts the assumptions underlying mechanized work organizations with those of sociotechnical approaches. His central theme is that feedback control systems *require* sociotechnical approaches for effective work as well as for good jobs. He views the control systems of capital-intensive continuous-process plants, which produce products like steel, plastics, cement, chemicals, and electric power, as exemplars of the key principles of "postindustrial work systems."

Some of these systems have been subject to dramatic system failures whereas others seem to work well. Hirschhorn attributes system failures to two causes: control system designs that maximize automation and take people "out of the loop" and work systems that do not adequately integrate sophisticated training with day-to-day work. He argues his case by examining the problems at Three Mile Island, adding useful detail from his own studies of several organizations that have implemented sociotechnical work systems. The book provides an easily accessible tour of work arrangements with complex control systems. It will appeal to a scientific audience because of its reliance on systems theory, its enthusiasm for advanced technologies, its subtle technological determinism, and its focus on ways to make routine jobs opportunities for continuing education. It is an important argument for taking the creative opportunities of work life seriously rather than letting the shape of work be a byproduct of technologies.

Unfortunately, the book suffers from some major problems. First, Hirschhorn uncritically accepts common sociotechnical categories for characterizing work life and the ways organizations behave. Sociotechnical designs raise productivity by having workers labor more intensively or by reducing staff size—often by 20 to 30 percent through flexible job assignments. With large savings in staff sizes, increased quality, and lower absenteeism and turnover, managers can afford significant pay raises for those who remain employed. Careful reviews of the sociotechnical literature have shown that workers are most attracted to these new arrangements when their increased work and learning are both rewarded with higher pay. Hirschhorn does not examine the extent to which workers are attracted to sociotechnically designed jobs because of higher pay rather than because of new learning, team spirit, status, or enhanced productivity. Nor does he consider whether workers are eager to control elements of work life that are not delegated to them in sociotechnical designs, such as pay scales, the rate of technological innovation, and working hours. These questions must be addressed in any analysis that promotes sociotechnical systems as a general work reform.

Second, the subtitle and general argumentation of the book tease us with a set of concepts that promise to help us understand a broad and varied world of work. Hirschhorn's analysis, however, focuses upon the control rooms of continuous-process plants and pays little attention to assembly lines, even though they have been the subject of extensive sociotechnical experiments. He emphasizes feedback control systems as the new workplace technology, as if every workplace should be designed like a chemical refinery or a power plant.

More seriously, "postindustrial" describes a society in which service organizations—restaurants, banks, schools, medical clinics, and the like—serve as a primary source of employment. Such organizations are usually labor-intensive and their wages are often lower than those in other economic sectors. Hirschhorn does not consider how his ideas about technology and work might be applied to them. Flexible work groups could run a fast food restaurant or perhaps sections of a hospital, but difficulties multiply when the work groups include mixtures of professionals and semiprofessionals—doctors, nurses, and technicians or faculty and graduate students. The workplace democracy that is easiest among peers is much tougher to bring to stratified organizations. Longer training periods make cross-training difficult, and the more advantaged professionals are likely to resist significant differentials of pay and status. Evidence for claims such as Hirschhorn makes for sociotechnical job design should come from studies of more diverse workplaces.

Third, Hirschhorn ignores the social and economic conditions in which sociotechnical plants have thrived. He mentions that 500 firms have implemented some kind of sociotechnical work arrangement. Most of these plants are relatively small, are located in rural areas, and are not unionized (although sociotechnical design was stimulated by research in Britain and Norway, which have relatively strong labor movements). Moreover, sociotechnical designs have been most readily adopted under the special conditions of continuous-process industries, where a bad chemical batch or a power blackout costs far more than the savings that can be achieved through

tight labor controls. In these cases, economic rationality can support loosely structured work. This book would be stronger if Hirschhorn explicitly characterized the conditions under which sociotechnical designs are most likely to be adopted and to succeed.

These problems limit the capacity of *Beyond Mechanization* to teach us something central about technology and work life in our economy as a whole. Influential professionals often underestimate the range of possible choices in designing jobs, however, and in providing a sympathetic introduction to sociotechnical design, the book helps expand one's understanding of the possibilities of improving jobs.

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(Continued on page 1065)