Studying *Industries* and Their People

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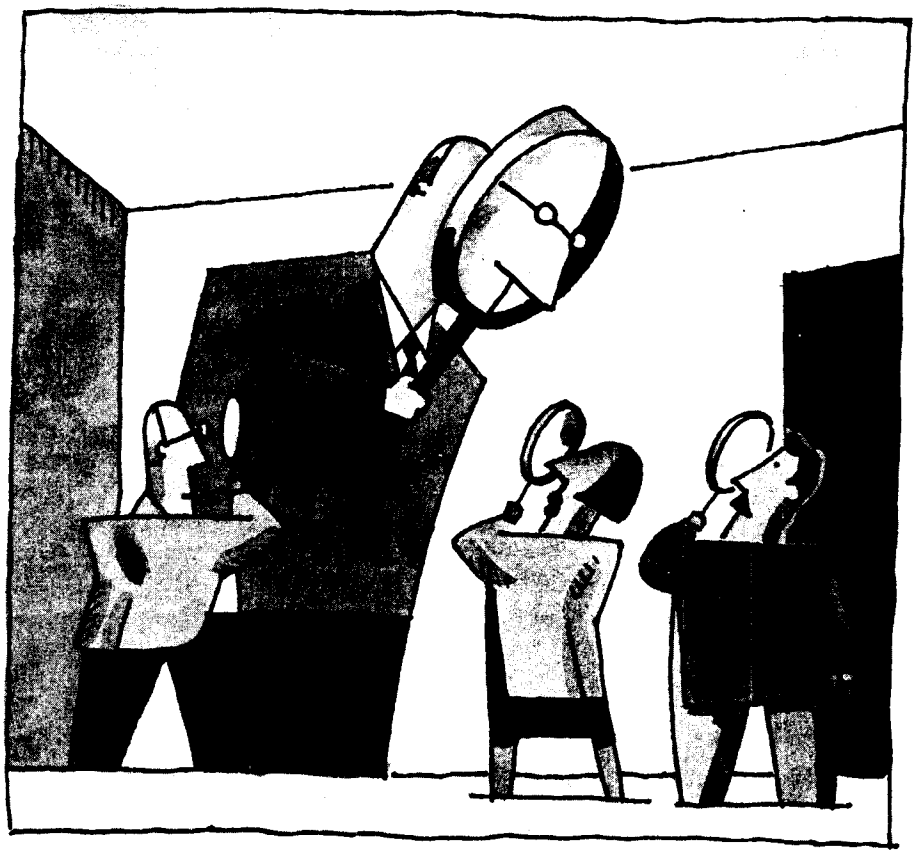
Industries Are Different

Almost ten years ago the Sloan Foundation began an experiment in education and industrial economics. The idea was to see if we could persuade American professors to concentrate their considerable abilities on particular industries, and if they did, could they learn enough about the workings of the industry—its companies, products, services, and people—to advance knowledge in their own disciplines and fields of study and be of use to the industry. We thought of it as an experiment because, unlike 14th century Italian art or condensed matter physics, there is no academic discipline that concentrates on whole industries. Business school scholars may study corporate strategy across several industries or engineering professors may tackle specific technical problems of an industry and similarly for labor economists and human resource specialists. Yet we think industries are different, one from the other and, as we came to see, even within the same industry, companies and people are at great variance in how they solve the problems of production and service, marketing, finance, and all of the other tasks that make an industry and an economy.

There are now 13 Sloan centers, each specializing in a particular industry, ranging from semiconductors and steel on the manufacturing end to managed health care and trucking on the service side.[1] We asked them to find out, by actually getting out in the field to offices, factories, loading docks and stores, what the key issues for each industry were and then to study those issues. We said they had to bring graduate students along on the visits who would write Ph.D. theses within their own disciplines on the issues and then go on to other universities to continue research and teaching on their industry. And we said that as they began to understand the industry and its problems they had to stay close to the companies, report back to them what they were learning, and discuss their results.

You should understand that when we started this experiment, the U.S. was in a depressed state of mind about its products, companies, workers, and managers. In the late eighties and nineties there was grave doubt that we would ever recover the lead in some industries like autos and semiconductors; some certainty that others, like steel, were gone, and worry that more would go off to the remarkable competition from the east, Europe, and the west, Japan and the rising tigers. Companies and their managers, unions and workers were trying to learn the secrets of the successes of the Japanese in auto making and semiconductors and of others in other products. Some rather spectacular work organization and human resource campaigns began to change the way American companies and their people worked.



We found early on that, although the numbers were not large on any one campus, there were some excellent academic people willing to turn their attention to the issues offered by an industry and to bring their good graduate students to the task. Depending on the industry, the centers have people from business schools, engineering schools, social scientists, and physical and biological scientists.

As the centers began their research by intensive pilot visits to companies, the early news was often surprising to us and especially to the faculty and their students. The semiconductor-manufacturing center at Berkeley began with three pilot visits to two American and one Japanese semiconductor fab in California. The center was initially composed of engineering and business school faculty and students. From the very first of the visits it became quite clear that the way operators, technicians, and engineers were managed and the ways in which they were selected, trained, and then performed were quite different. The center quickly added a team of labor economists and human resource faculty, headed by Clair Brown, which in the last six years has compiled a large and varied record of observations, data, and conceptualizations on the human resource issues in this industry. For the steel industry center, the team that looked into the application of new technology began to see that although impressive efficiency gains could be had with new hardware and with software control systems, some steel mills could make up for the lack of these technical upgrades by careful and thoughtful management of their workers.

These and other early results from the industry study centers together with other national work seemed to be forming a very positive view, first for the inclusion of human resources faculty in our industry centers and, second, for the ideas and practices that came to be called the high performance work system (HPW). These observations had a strong influence on us at Sloan. We set out to enhance the human resource part of our grant making.

The Human Resources Network

With these initial observations from the industry centers and reports from other studies, we at Sloan started a series of grants that were meant to examine the productivity implications of the high performance workplace approach. Projects were started for example, by Lawler at UCLA, Kelley at CMU and Appelbaum and colleagues at the Economic Policy Institute. At the same time Tom Kochan of MIT suggested that it would be useful to knit these and the human resource studies of the industry centers together in a network. The Sloan Human Resources Network began in 1992. It has had a number of workshops dealing with HPW, white-collar workers and wage inequality issues.[2] In addition there have been annual workshops for the graduate students and new Ph.D.s involved in the studies. The HR Network is now part of the IRRA.

Also in 1992, we asked Tom Bailey of Columbia to consider the excitement about the HPW in the light of earlier innovations in human resource management and theory. Bailey's historical and current appraisal sounded a note of warning by reminding us that movements such as the Mayo-Roethlisberger social needs and personal problems views of the 1930s and the socio-technical redesigns of the workplace itself in the 1950s and other approaches had all come with waves of enthusiasm and reports of success and then had faded or been replaced with a new set of practices and theories.

The High Performance Workplace

The high performance workplace (HPW) was the first major issue that the network and the industry studies groups dealt with. Over all, the research shows that if enough of the various elements that compose this kind of workplace are present, then productivity does improve in many cases. In automobile assembly plants, MacDuffie and Krafcik of the MIT International Motor Vehicle Program, showed that the combination of production reorganization (such as just-in time reduction of inventories, quality on the line rather than inspections at the

end, etc.) and human resource changes (teams, cross-training, fewer job codes, etc.) lead to higher productivity and better quality. They called this combination lean production and it has been used to revamp much of the auto industry and other industries as well. Another prime example is the steel finishing mill case that was done by Kathryn Shaw of Carnegie Mellon and Casey Ichniowski of Columbia as part of the steel industry center work. They measured the output of the mill as a function of the number of elements of the HPW that were employed. When the number was one or two—say, workers combined into teams or output- based incentive pay—productivity was far less than if a more complete set of the elements were in place. Shaw and Ichniowski found this was the case for both integrated and mini-mills, although slightly less robustly so for mini-mills. This has been an important result, that piecemeal applications of a single element of employee participation or work rearrangement has had little effect on productivity or quality and, in fact, not altered employees attitudes positively. Only when a systematic application of the HPW elements has been made do these improvements show through.

But even that may not be sufficient. At AK Steel, an integrated steel mill company that had been Armco before being taken over by Kawasaki and finally put into American management hands again, rather old-fashioned rationalization of products (dropping one product line and its production facilities and directive rather than employee participation, self-managing techniques) made AK into the country's most efficient producer. At the Harvard industry study on apparel, John Dunlop and David Weil have shown that converting clothing manufacture to the cell production system, introducing the necessary cross training and group compensation schemes, providing opportunity for workers to contribute to the production enterprise, and other HPW changes would only payoff if the retail demand had very short turnaround times and quick feedback with point of sale data on what was actually selling so that inventory and stock-outs could be minimized. Eileen Appelbaum and colleagues at EPI obtained similar results from their research in apparel manufacture and steel mills, but in a study of medical instruments (ultrasonic testing devices) they found that such workplace rearrangements and management changes were not used or called for because of the quickly changing nature of the technology itself and the customer specific kind of market that prevails for that kind of product. At a computer printer manufacturer, management rearranged long assembly lines into shorter cells but gave no voice or other participatory roles to the operators and little training and still managed to compete well with Japanese and Taiwanese manufacturers.

Thus the overall result seems to be that the high performance workplace improvements can, indeed, yield improvements in productivity, responsiveness, and quality but their application must be done with a careful eye to the particular production and market environment at hand. There is no overall application that guarantees success or even a pay back of the changeover investment, and there is always a need to tailor the application to the combination of production and market circumstances. As a sharp reminder, in a second run on the auto assembly plant study, John Paul MacDuffie and Frits K. Pil found that while many plants around the world have adopted the lean production prescriptions with good results, there are others that have improved productivity and quality by other less participative and less systematic organizational means who share leadership with the lean producers.

Wage Issues

As the competitive condition of American manufacturing industries improved during the nineties, it became evident that there was not a similarly encouraging improvement in the income of all of the workers involved in these industries and in the service sectors of the economy. In fact, male workers with only high school education lost ground. This was true not only in the U.S. but in others of the developed countries as well. Families fared somewhat better in that incomes slowly rose very much due to the fact that most families now had two workers. Employees with higher education levels did better, but across all education levels and especially across combined education levels and occupation or job types there seems to be growing larger variability. This issue became a next phase in the work of the Sloan HR Network and was accompanied by additional Sloan funding. Studies were initiated on the effect of outsourcing, downsizing, and other organizational changes on wages. A series of workshops and conferences were held, some at the annual meetings of the IRRA. The usually suspected factors included trade and globalization issues (relocating for cheaper labor), new technology that brought premiums for higher skills and education, the loss in power of organized labor, and the subsequent loss of labor's voice and share. All of these probably do play a role but at an aggregate level, looking at all workers across all industries it has been hard to see which, if any, dominates. This seemed to be the case at the meeting that was held in Madison in 1997. To look more closely, there will be another meeting in Madison in October 1998 in which a number of the Sloan industry centers will report for their industry what is the state of wage inequality and what are the leading causes using the detailed results obtained from the companies in their industry.

Globalization and Its Effects on Jobs

The related issue, globalization, has many dimensions. An important one is the effects on employment and wages. If

one asks, again within a given industry, what have been the changes of the location of production (or service provision), and why have the new locations been chosen, then we can also ask what have been the related changes in jobs, both the number of jobs and their quality. At present Sloan is funding studies in automobiles, semiconductors, computer storage, TVs and PCs, apparel, computer systems, and banking. As an example of the kind of insights that can be generated, in the computer storage study, it has not been hard to show that, for cost reasons, virtually all manufacturing has now left the U.S. and gone to southeast Asia. American companies hold 80 percent of the industry. So it would appear that almost all operator jobs have been lost to other countries. However, looking more closely, as manufacturing went off shore, the volume of this business was rising sharply, moving up with the PC industry. Back home in Silicon Valley, Massachusetts, and other locations where the higher end employment for computer disks was still in place (research into new head, disk and control software, design, development, and marketing), the number of more highly skilled employees was rising. At present American companies pay more in total compensation to Americans than they do to foreigners. Yes, jobs have been lost but better jobs have been gained, and the overall effect on the U.S. economy may not be negative.

To add on the effects of globalization on jobs, we at Sloan have formed another network of industry researchers. This group, led by Richard Florida of Carnegie Mellon, has begun holding workshops and conferences. Here, too, some of the participants have Sloan funding through the industry study centers or independently, while others have other sources. The emphasis is on the view by industry. The first of the Ph.D. conferences was held in May, 1998, at Duke, led by Gary Gereffi and organized by the students. Teresa Lynch, a Ph.D. candidate at MIT, showed that in spite of the closure of a number of auto assembly plants in the U.S. in the past 15 years with loss of jobs and the downsizing of others, the fact that there have been new jobs in the Japanese and German transplants and a large growth in jobs in domestic auto supply production, has more than offset those losses and the additional losses to Mexico and Canada. There has actually been growth in the entire U.S. industry. Other papers were given on the Irish and Indian software industries and their links to the U.S. and the off-shoring of higher level jobs such as chip design and other industries.

Technology, Skills, and Training

Finally to an effort that is just starting. Discussion and research on the effects of machines on jobs and the workplace are not new. For many, many years machines have worked alongside men and women. Now, of course, the machines rival in intelligence their abilities in force and energy so that the kinds of work that is being displaced is rapidly changing. Reading sales tags and inventory, recognizing cars and charging tolls, handing out money and swallowing checks are all commonplace. Similarly, scholars have studied these changes at many levels, from detailed participant observer ethnographies to aggregate statistical analysis of computer and other technology entry in the industrial and service workplaces. Very few of these, however, have normalized out an industry, looked at the key workplace activities, and analyzed the recurrent cycle in which new technology takes over some of the tasks, requiring new skills for some or totally new entrants and yielding job loss for others. Then with new skills and new technology the job itself may enlarge in scope, detail or size and as yet newer technology arrives to help as the cycle then repeats. A good example of this kind of research is a recent study by Frank Levy and Richard Murnane. The rapidity with which new computer and communication technologies appear and the alertness of the software providers has given acceleration to this process.

We would like to study this in detail for particular industries and key tasks within those industries and, again, we will ask our industry study centers to consider this issue as well as others in the academic community.

Industries Are Different and It Matters

While we have been trying to make the case that studying a particular industry can be valuable, we have observed that within an industry there is very large variability. For example, in manufacturing semiconductor chips, all plants start with the same materials and with essentially the same processing equipment. Yet the rate at which one company attains reproducible, profitable yields may be much faster than a competitor. Similarly, automobile assembly plants in the same country, using the same kind of labor supply have totally different productivity and quality records. And in the retail food business, some supermarkets in Minnesota can have double the revenue per square foot that their competitors do.

There is a lot to understand here within one industry and there is little choice but to isolate that industry and study the conditions—people, machines, demand, finance—from company to company. This approach seems to produce quite specific and secure knowledge. It adds to academic experience and leads to theoretical and useful conceptualizations. And it may often bring useful knowledge back to the companies themselves.

ENDNOTES

1. The Centers are automobiles, the International Motor Vehicle Program at MIT; steel, the Sloan Steel Industry Center at Carnegie Mellon and the University of Pittsburgh; semiconductors, the Center for Competitive Semiconductor Manufacturing at Berkeley; apparel, the Harvard Center for Textile and Apparel Research; pharmaceuticals, the Program on the Pharmaceutical Industry (POPI) at MIT; computers, the Stanford Computer Industry Program (SCIP); powder metal, the North American P/M industry at Worcester Polytechnic Institute; financial, The Center for the Study of Financial Institutions at the Wharton School of the University of Pennsylvania; food, the Retail Food Industry Center at the University of Minnesota; trucking, the University of Michigan Program on the Trucking Service Industry; health care, the Managed Health Care Center at Harvard; construction, the Program for the Construction Industry at the University of Texas; and computer storage disks, the Center for Study of the Information Storage Industry at the University of California, San Diego. For more information see web site www.sloan.org.
2. The workshops were: Measuring and Modeling Workplace Practices (1993), White Collar Employment Issues (1994), Workplace Innovation (1995), Economywide Earnings Trends (1996), and Labor Market Inequality (1997).

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11. Levy, Frank and Richard Murnane, 1996, "With What Skills Are Computers a Complement?" MIT IPC Working Paper 96–001 W P, Jan. 1996. MIT Industrial Performance Center

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