

Automation and the Employee

By WILLIAM A. FAUNCE, EINAR HARDIN,
and EUGENE H. JACOBSON

ABSTRACT: Field research suggests that the impact of office automation upon job satisfaction varies depending on whether affected job aspects are intrinsic or contextual, whether the employees are in electronic data-processing departments which gain work tasks or in other affected departments that lose tasks, whether the computer is of large or medium size, and on several other circumstances. Office employees think the broad impact of office automation is to eliminate jobs and regard the methods changes as temporarily disruptive, but they often welcome change and rarely reject mechanization as such. Attitudes toward change appear to depend on the ability of the individual to deal effectively with change and on the skill with which the organization manages the change. Studies of factory automation suggest that automated plants are preferred as work places to less advanced plants, although they provide important sources of dissatisfaction. The sources of satisfaction and dissatisfaction vary over the course of adjustment to automation. Automation may affect the significance of work in our society by changing job content, redistributing employment opportunities, or decreasing working hours. Its effect will probably be a decrease in the importance of work and a continuation of the trend toward a leisure-oriented society.

William A. Faunce, Ph.D., is Associate Professor, Department of Sociology and Anthropology, and Research Associate, Labor and Industrial Relations Center, Michigan State University. He has been a consultant on automation to the U. S. Department of Labor and is a member of the Bureau of Employment Security Task Force on Automation.

Einar Hardin, Ph.D., is Associate Professor, Department of Economics, and Acting Associate Director of Research and Planning, Labor and Industrial Relations Center, Michigan State University. He was Research Associate in the Industrial Institute for Economic and Social Research, Stockholm, 1950-1953, and in the Labor and Industrial Relations Center since 1956.

Eugene H. Jacobson, Ph.D., is Professor of Psychology and Assistant Dean for International Studies, College of Science and Arts, Michigan State University. He was Assistant Program Director, Human Relations Program, Institute for Social Research, University of Michigan, 1946-1955; Chief, Division of Applied Social Sciences, UNESCO, 1957-1959; and Research Associate, Labor and Industrial Relations Center, Michigan State University, 1956-1957 and 1959-1960.

THREE aspects of the relationship between automation and the employee are discussed in this article. First, how does automation affect the job satisfaction and material welfare of employees? Second, what are the attitudes of employees toward automation and toward the very process of change? Third, how does automation affect the role of work in the lives of the employees? Although automation has occurred in many thousands of factories and offices, there have been few field studies pertinent to these questions. Furthermore, the relevant studies differ considerably in focus and method, so that meaningful generalizations are hazardous to make.¹ Our aim is to illustrate the diversity of effects rather than to make a broad, over-all assessment.

EFFECTS OF OFFICE AUTOMATION

In one study dealing with automation and job satisfaction, attitude surveys were conducted before and after the installation of a small to medium-size computer (IBM 650) in an insurance company having about 400 employees.² Satisfaction with variety in work, accuracy requirements, importance of the job to the company, skill requirements, responsibility involved, and several other intrinsic characteristics of the work increased for most employees. At the same time, there was no clear trend of change in satisfaction with such con-

textual aspects of the job as pay, promotion chances, the way the company handled changes in organization and procedures, and the nature of the company's information program.

The changes in job satisfaction varied depending upon the extent to which the computer affected the work methods and work load. The computer-area employees, who were initially in the key-punching and tabulating jobs, showed more increases than decreases in satisfaction with intrinsic jobs aspects, while the reverse was true for contextual aspects. The employees in the underwriting departments, who lost tasks to the computer area and had to adjust their work methods to its requirements, showed a mixed pattern, with about the same number of increases as decreases in satisfaction for both intrinsic and contextual aspects. The employees in the rest of the company, accounting for more than two-thirds of total employment, had essentially unchanged work methods and work load. They became less satisfied with the company's way of handling changes and with the lack of accuracy and promptness of company information, and became more satisfied with virtually all other aspects of their jobs. The differences among the three department groups were frequently small enough, however, to be random fluctuations.

The employees were also asked, in the survey after the installation, how much the computer had changed fourteen aspects of their jobs, most of which were intrinsic. The computer-area employees felt the computer exerted a large and favorable impact on the variety, work load, and skill requirements of their jobs but influenced only slightly their job security, promotion chances, and pay. The employees of the underwriting departments felt the computer brought a great deal of change in variety, work load, and accuracy require-

¹ For guides to the literature, see Gloria Cheek, *Economic and Social Implications of Automation: A Bibliographic Review*, Vol. 1: *Literature before 1957* and Einar Hardin, William B. Eddy, and Steven E. Deutsch, *Economic and Social Implications of Automation: An Annotated Bibliography*, Vol. 2: *Literature 1957-1960*, published in 1958 and 1961, respectively, by the Labor and Industrial Relations Center, Michigan State University, East Lansing.

² Einar Hardin, "The Reactions of Employees to Office Automation," *Monthly Labor Review*, Vol. 83 (September 1960), pp. 925-932.

ments; lowered their job security and promotion chances more often than it raised them; and made for less variety in work, less work load, and lowered work interest in a number of instances. Employees of unaffected departments were not aware of much impact upon themselves.

While the preceding differences illustrate the employee perceptions of the role of the computer, the actual effect of the computer upon various aspects of the job is better reflected by a different set of findings. The employees were asked in the second survey what changes, regardless of cause, there had been in the job aspects. The computer-area employees continued to report more change than the other employees, but the differences between the two groups were usually smaller. The underwriting departments and the unaffected departments perceived much the same frequency of change, although changes were more often in the undesirable direction in the former group. Neither the computer nor other factors had materially altered the work methods and work load of the unaffected departments. This suggests that the effect of automation upon the fourteen job aspects, though real, was quite moderate, except in the computer area itself. The indication that the computer had only moderate effects on work environment and job satisfaction was corroborated in a study of another insurance company that had also installed an IBM 650 computer.³

Somewhat different findings were indicated in a preliminary report on a larger but less common computer. Mann and Williams found that the installation of an IBM 705 computer in a large public utility brought changes in or-

ganization, procedures, control, and job structure. They described the impact on the individuals by saying: ⁴

For many individuals this was a period of growth; for others a period of failure and disillusionment. The change severely tested marginal employees and supervisors, while at the same time giving the more experienced and able ones the opportunity to develop and to demonstrate their work potential. The dislocation and the loss of duties and jobs was a serious problem for some employees.

A Bureau of Labor Statistics study of office automation in twenty large business firms showed that, one year after automation, there had been increases in salary grade for more than four-fifths of the computer area employees, as compared with one third of the employees of other affected departments.⁵ Virtually none were lowered in grade or lost their jobs. That office automation may well lead to different long-run results, however, is suggested in preliminary reports by Ida Hoos on another study of about twenty organizations.⁶ Centralization of functions from branch offices to main offices occurring after a few years of automation reduced branch-office employment enough to necessitate layoffs or transfers with lower pay or poorer advancement opportunities and, hence, affected many employees adversely. Deterioration was not only found in the surviving routine, nonsu-

⁴ Floyd C. Mann and Lawrence K. Williams, "Observations on the Dynamics of a Change in Electronic Data Processing Equipment," *Administrative Science Quarterly*, Vol. 5 (September 1960), p. 255.

⁵ *Adjustments to the Introduction of Office Automation*, Bureau of Labor Statistics Bulletin No. 1276 (Washington, D. C., 1960), pp. 30-57.

⁶ Ida R. Hoos, "The Impact of Office Automation on Workers," *International Labour Review*, Vol. 82 (October 1960), pp. 363-388; *id.*, "When the Computer Takes Over the Office," *Harvard Business Review*, Vol. 38 (July-August 1960), pp. 102-112.

³ Einar Hardin, "Computer Automation, Work Environment and Employee Satisfaction," *Industrial and Labor Relations Review*, Vol. 13 (July 1960), pp. 559-567.

pervisory jobs, which appeared less interesting and more machine-paced than before automation, but also in the middle-management jobs outside the electronic data-processing area, which became fewer and, thus, reduced the training and advancement opportunities of supervisors seeking to rise in the organization. The highly skilled elite of programmers and systems analysts, who, according to other studies, tends to consist of young and well-educated men, was strongly prone toward empire building and likely to become involved in conflict with other departments because of its own autonomy, key position, stress on efficiency, and lack of social sensitivity.

EFFECTS OF FACTORY AUTOMATION

Several studies of factory automation have also been made. One of these dealt with the attitudes of workers transferred to an automated automobile-engine plant.⁷ Three-fourths of the workers preferred the new automated jobs to their old nonautomated jobs, and the strongest preferences for the new jobs were expressed by those whose jobs were the most automated. The substantial reduction in materials handling which accompanied automation was the major reason for preferring the new jobs. Physical working conditions seemed to vary considerably from one department to the next and were, on balance, no better in the automated plant than in the nonautomated plant. Changes in earnings, except those associated with general contract changes, appeared to be few.

The new technology, however, increased the distance between work sta-

tions, the amount of machine noise, the amount of attention required by the job, and the extent to which the workers were paced by the machines. In consequence, the workers were less able to talk with each other during the work, tended to confine their communications to work-related matters, thought they made fewer friends at work, and felt socially isolated. Because they were required to pay closer attention to their work, were supervised more frequently by the foremen, and felt a constant pressure to avoid machine breakdowns, they experienced greater mental fatigue and work tension. In fact, where it existed, preference for the old jobs could most often be attributed to the social isolation of the worker and the increase in work tensions.

Mann and Hoffman studied the attitudes of workers in two power plants at different levels of automation.⁸ The operators in the advanced plant liked their current jobs more than did those in the standard plant, when everything was considered. They felt they had more responsibility on their jobs, required more training, had to spend less time doing dirty jobs, learned more on the job, could move around in the plant, and had more contacts with the other workers than two years earlier, before the more advanced plant was completed and staffed. They felt more nervous and tense, however, which may have been caused by a feeling of greater dependence on others combined with the belief that they were inadequately trained and prepared for the automated technology. Because the two plants differed from each other in many respects in addition to level of technology, it is difficult to determine the exact role of the changing technology in the attitude

⁷ William A. Faunce, "Automation and the Automobile Worker," *Social Problems*, Vol. 6 (Summer 1958), pp. 68-78; *id.*, "Automation in the Automobile Industry: Some Consequences for In-Plant Social Structure," *American Sociological Review*, Vol. 23 (August 1958), pp. 401-407.

⁸ Floyd C. Mann and L. Richard Hoffman, *Automation and the Worker: A Study of Social Change in Power Plants* (New York: Henry Holt and Company, 1960), pp. 65-103.

differences of the two groups of workers. In particular, the careful selection of the work force and the use of job rotation, job enlargement, and a changed pattern of shift work in the advanced plant may account for much of the higher satisfaction of its workers. In so far as this interpretation is true, it underlines the importance of management practices to facilitate adjustment to automation.

A study by Charles R. Walker of an automated steel mill showed that job satisfaction may vary during the process of adjustment to the new technology. Automation increased the amount of attention and responsibility required, lessened the physical demands of the job, limited possibilities for promotion, and affected patterns of social interaction on the job. Response to these changes varied during the four-year period of the study. Walker summarizes this finding as follows:⁹

The majority of crew members, though not all, were able to move from semi-manual jobs to semi-automatic ones and derive personal satisfaction from the immediate job content of those positions. They did not derive this satisfaction at first but after a period of acclimatization and experience. The same job characteristics, all stemming from the automatic or semi-automatic operations of the mill which had at first been feared and hated, *were later the source of satisfaction.*

RESPONSE TO CHANGE

In addition to knowing how employees respond to work situations at different levels of technological development, it is important to understand employee response to the fact and prospect of change in the work situation. From the point of view of the employee, the work situation probably involves continuous

⁹ Charles R. Walker, *Toward the Automatic Factory* (New Haven: Yale University Press, 1957), p. 192.

change, more apparent and dramatic when new technologies are introduced rapidly, but always present in complex organizations.¹⁰ The normal pattern of change, like many constant influences, may not receive regular attention. But when one of the aspects of change is accelerated, as in the introduction of new technologies into relatively stable, well-established work procedures, change becomes the focus of attention. As an example, when even relatively small electronic data-processing devices are installed in established business offices, the consequences become a matter of concern to a large part of the work force, even though many employees may not be affected by the change. Employee response to innovation and change of this sort, as determined through questionnaire and interview studies conducted by the authors and their colleagues, will be examined in the following paragraphs.

Prominent among the initial effects of the installation of a computer is concern with the possibility that the new equipment will throw some people out of work. The employees we questioned were very much aware of the potential of the computer for replacing workers.¹¹ About three-quarters of them reported that machines were replacing workers in insurance companies. But, when questioned about their own job prospects, about four-fifths felt that it was very unlikely that they, themselves, would be replaced by machines. This reflected the actual work situation, in which no

¹⁰ Eugene H. Jacobson, "The Effect of Changing Industrial Methods and Automation on Personnel," *Proceedings of the April 1957 Symposium on Preventive and Social Psychiatry* (Washington, D. C.: Walter Reed Army Medical Center, 1959), pp. 235-252.

¹¹ Eugene Jacobson, Don Trumbo, Gloria Cheek, and John Nangle, "Employee Attitudes toward Change in a Medium Sized Insurance Company," *Journal of Applied Psychology*, Vol. 43 (December 1959), pp. 349-354.

employees had lost jobs because of the computer installation.

More than half of the employees felt that their jobs had changed because of the new equipment. They saw themselves as having been promoted or transferred or as having the content of their jobs altered. The company officials and the research team, on the other hand, estimated that less than one third of the work force was affected in any significant way by the change. Apparently employees were associating many aspects of their own jobs with this very visible new influence in their lives. Changes that would have occurred if the computer had not been installed could be interpreted as related to it. Changes of a small magnitude or of a kind not noted by management might loom large in the eyes of the employee.

An additional facet of technological change to which the employee responds is the readjustment that occurs no matter how effectively the change-over may be managed. While two-thirds of the employees we questioned felt that the change-over significantly interrupted their normal work procedures, most of them thought they had adjusted to the change relatively quickly, within a few weeks. About one quarter of the employees felt that developments in machines and methods for doing work in industry as a whole were taking place more rapidly than is desirable, and only a small proportion felt they were taking place too slowly. But, when asked about the kind of job that they themselves liked, 70 per cent expressed a preference for a situation in which the work process changed from time to time. Apparently, with too little change, the job would be routine and monotonous, and with too much change, change itself would be threatening.

The major characteristic of the office automation we studied was the shift from human to machine processing of

data. The employees anticipated that this shift would continue and would directly affect the jobs they were doing. Most of them liked to work with office machinery, would like to make more use of office machinery, and would be pleased to attend a training school to learn how to work with the new equipment, if job changes required this.

In general, then, employees perceived that the broad industry impact of automation and technological change was to eliminate some jobs. And many felt that these changes, at the industry and society level, were occurring too rapidly. But they distinguished these effects from the consequences of a particular adjustment in their own work situation which they judged on the basis of actual experience. When an abrupt introduction of a new technology was experienced, a larger proportion of the employees would see themselves as affected than might be anticipated by management on an objective basis. Usually, they saw the methods changes as being temporarily disruptive but quickly integrated into the system. They often welcomed change in their own work situations and expressed a preference for having some part of their work mechanized. We found no rejection of mechanization as such.

VARIABLES AFFECTING RESPONSE TO CHANGE

These generalizations about employee attitudes toward change should be understood in terms of some factors that are related to them and that are likely to vary considerably from organization to organization and within large organizations. These include the differences among employees in readiness for change and the history of the management of change in a given organization.

In Trumbo's analysis of readiness for change, employees that had better education, obtained better scores on person-

nel tests, were freer from job anxieties, and had benefited from past changes were more likely to indicate a readiness for change.¹² These variations in individual attitudes toward change seemed to reflect differences in ability to deal effectively with the demands of a changing situation and beliefs that the stress involved in change would be compensated by the opportunities that change offered.

It appeared that where change in the job implied change in the work group, those who attached higher value to social satisfactions in work had less favorable attitudes toward change. Another element of the social context, the supervisor-employee relations, also appeared to have a bearing upon attitudes toward change. The attitudes of the members of work groups were similar to those of their supervisors. Supervisors who were relatively authoritarian were less often in charge of employees who favored change. Perhaps authoritarian supervisors were usually put in charge of persons least likely to benefit from change.

The way in which the change is managed by the organization is a central concern of the employee. Mann and Williams used a case study of the introduction of a computer into an accounting division of a public utility to show that management skill in handling change has an important influence on employee response to the change.¹³ If the organization has a record of concern for the employee and manages change so that the employee is protected, and,

if possible, his situation is enhanced, employees are more likely to welcome change.

It is interesting to find, however, that employees who were better informed about the anticipated impact of technological change, as reported by Nangle, were not more favorable toward the change.¹⁴ A more important factor was the employee's attitudes toward the company and its policies.

Office employees with relatively high social status, from urban rather than rural backgrounds, and in high status positions in the organization, were found more likely to welcome change.¹⁵ This suggests, among other things, that a positive attitude toward change is likely to be associated with greater possibility of being involved in decision-making about the change.

AUTOMATION AND THE MEANING OF JOB SATISFACTION

Another important variable affecting both job satisfaction and attitudes toward job change is the significance of work to the individual. Satisfaction with an activity which is of major importance clearly differs in meaning and in behavioral consequences from satisfaction with an activity which is of little concern. Attitudes toward change in any activity can also be expected to be conditioned by the significance of the activity to the individual.

There is considerable evidence of variation in the function and meaning of work. Morse and Weiss found that a sense of accomplishment on the job, interest in a particular task area, and, in general, the assigning of importance to

¹² Don Trumbo, "Individual and Group Correlates of Attitudes Toward Work-Related Change," *Journal of Applied Psychology*, Vol. 45 (October 1961), pp. 338-344.

¹³ Floyd C. Mann and Lawrence K. Williams, "Organizational Impact of White Collar Automation," *Proceedings of the 11th Annual Meeting, Industrial Relations Research Association* (Madison, Wis.: IRRA Publication 22, 1959).

¹⁴ John E. Nangle, *The Effectiveness of Communications in Preparation for Change in an Insurance Company* (Doctoral dissertation, Michigan State University, 1961).

¹⁵ William A. Faunce, "Social Stratification and Attitude toward Change in Job Content," *Social Forces*, Vol. 39 (December 1960), pp. 140-148.

a specific work role were more characteristic of professional and managerial than of clerical and blue-collar workers.¹⁶ Dubin found that work and the work place were not "central life interests" for almost three-fourths of the industrial workers he studied,¹⁷ and Orzack, in a replication of the Dubin study, found that four-fifths of a group of professional nurses did regard work and the work place as "central life interests."¹⁸ In a study conducted by the authors, it was found that the importance of work to the individual varied considerably with the job level.¹⁹

This evidence suggests that the level of responsibility and skill required by the job has an important bearing upon the degree of significance of work to the individual. To the extent that automation changes these aspects of job content, it may affect the meaning of job satisfaction and job change.

Automation does appear to increase the proportion of the total operation for which the worker is responsible. The integration of separate operations into a continuous-flow production process means that a single worker observing lights or gauges on an automatic control panel may have responsibility for a large number and wide variety of production processes. The clerical worker who feeds stacks of cards into an elec-

tronic computer is also likely to be responsible for a larger share of information processing in the office. There is evidence that some workers regard their jobs as more important as a result of increased responsibility in this sense.²⁰

It is obvious, however, that technological integration of separate operations is not the same thing as job enlargement. Many jobs in automated plants and offices involve less personal responsibility in the sense that neither quality of product nor work pace are controlled by the worker. Automatic inspection, control, and information-processing systems are designed to supplant human judgment in the production process. The elimination of direct participation in the work process can be expected to have an effect upon the function and meaning of work. The following quotation from interviews with workers in an automated plant seems to illustrate the feeling of estrangement from work:²¹

[I don't like] the lack of feeling responsible for your work. The feeling that you're turning out more work but knowing it's *not yours really* and not as good as you could make it if you had control of the machine like before.

Irrespective of its effect upon the content of jobs, automation might result in an increase in the significance of work in our society if it increased the proportion of the labor force employed in more skilled, responsible, and prestigious jobs. Studies of effects of automation suggest that there is a higher proportion of skilled workers in plants where automated equipment is used. This does not result from the creation of many new skilled jobs, however, but from a reduction in the employment of semiskilled and unskilled workers. Such changes mean that the work force in the automatic factory may be com-

¹⁶ Nancy C. Morse and Robert S. Weiss, "The Function and Meaning of Work," *American Sociological Review*, Vol. 20 (April 1955), pp. 191-198.

¹⁷ Robert Dubin, "Industrial Workers Worlds: A Study of the 'Central Life Interests' of Industrial Workers," *Social Problems*, Vol. 3 (January 1956), pp. 131-142.

¹⁸ Louis H. Orzack, "Work as a 'Central Life Interest' of Professionals," *Social Problems*, Vol. 7 (Fall 1959), pp. 125-132.

¹⁹ Readiness to accept change in job content also varies with job level. Importance of work may be one of the variables affecting this relationship. See William A. Faunce, "Social Stratification and Attitudes Toward Change in Job Content," *op. cit.*

²⁰ William A. Faunce, "Automation and the Automobile Worker," *op. cit.*

²¹ *Ibid.*

posed primarily of skilled workers for whom work is intrinsically important and to whom job satisfaction means pride in workmanship, but this work force may be small. Automation may contribute somewhat to the increased demand in certain professional and technical fields. These fields, however, in spite of their current rate of growth, still employ a relatively small proportion of the total labor force. The primary effect of automation upon occupational distribution will undoubtedly be to decrease the proportion of semiskilled and unskilled factory operatives. A majority of new workers who might otherwise have been employed as operatives will probably be absorbed into expanding clerical, sales, and service occupations.

There is little empirical evidence regarding the function and meaning of work for people in these occupations. The existing evidence, however, along with an assessment of the nature of the tasks and social structural conditions of work in lower level white-collar occupations, would lead us to expect that work would not be regarded as a central life interest by people in these occupations. C. Wright Mills, in *White Collar*, concludes that for the "white collar masses," as for wage workers generally, the job is not intrinsically meaningful, and success, in the sense of technical craftsmanship, is not regarded as an end in itself.²² The substitution of what Daniel

²² C. Wright Mills, *White Collar* (New York: Oxford University Press, 1956), pp. 215-238.

Bell has called the new "salariat" for the proletariat as comprising the bulk of the labor force in industrial societies could not be expected to reverse the apparent tendency in these societies toward de-emphasis of work and an increasing leisure orientation.²³

In the long run, a reduction of working hours made possible by automation may have a greater impact upon the importance of work than will any of the other factors we have considered. Productivity increases in the past have always resulted in a decrease in the average number of hours worked per week. There is little reason to suppose that increases in productivity attributable to automation will not sooner or later have the same effect. Where work requires a diminishing proportion of time and energy, activities unrelated to work will probably assume increasing importance. So long as professional, technical, and upper-level managerial positions employ less than a majority of our labor force, most people can be expected to use their increased leisure to seek meaningful activities which provide some relief from the functionally specialized nature of their work. The net effect of automation would appear to be a continuation of the already existing trend toward a leisure-oriented society in which work is viewed as an exclusively economic activity and in which activities other than work serve to provide meaningful experiences for the individual and to relate him to his community.

²³ Daniel Bell, *Work and Its Discontents* (Boston: Beacon Press, 1956), p. 50.