Effects of Mechanisation and Automation in Offices: III[1]

Changes in Physical Environment and Working Conditions

Physical Changes

Material working conditions in offices have undergone a considerable alteration in many cases during the last 40 to 50 years. As the office gradually ceased to be regarded as an unimportant adjunct to managerial activities, and as the size of the clerical staff increased and the growing importance of their functions was realised, it became necessary to allocate more and more space to their expanding activities. The tendency to crowd office clerks into small, dark and dusty rooms, where they pored laboriously over their copying or arithmetical tasks, has steadily if reluctantly given way before the increased demands of clerical workers for larger, better aired and better lighted offices. In a number of countries legislation has set up minimum standards for office premises compatible with the health and working comfort of the employees. Such standards are not, it is true, always very high, but they do offer the clerical worker some guarantee against an unsafe or unsanitary working environment. Private and state undertakings have in a great many cases considerably exceeded the standards laid down. Many modern offices in industrialised countries now offer a degree of comfort and facility to the workers which was inconceivable a few decades ago.

Such conditions are not everywhere attainable, however. Old buildings are difficult and expensive to transform, new ones sometimes have constructional faults, or become quickly overcrowded. In large cities and towns especially, office space is at a premium, overcrowding is common, and light, ventilation and other facilities in offices in the business areas often leave much to be desired. It is significant, however, that a great deal of research is being done in many countries concerning the various technical problems that arise in connection with physical working conditions in offices.[2]

The advent of mechanisation in offices has had a profound effect on these developments. In some cases the introduction of machines had a favourable influence on the physical environment. Adequate lighting,

[1] The first two parts of this article appeared in Vol. LXXXI, Nos. 2 and 3, Feb. and Mar. 1960, pp. 154-173 and 255-273 respectively.

[2] The I.L.O. dealt at some length with the problems connected with physical working conditions for office workers in a report prepared for the Second Session of the Advisory Committee on Salaried Employees and Professional Workers in 1952 (see *Hygiene in Shops and Offices* (Geneva, 1951)). The Committee, in the course of that session, adopted a resolution setting forth desirable international standards on the following points: design and structure of workplaces, space, cleanliness, ventilation, lighting, temperature, noise, drinking water, seats, accommodation for clothing, and other matters including facilities for meals, sanitary accommodation, and safety precautions. A second resolution dealt with forms of action for the improvement of hygiene in shops and offices (see *Official Bulletin* (Geneva, I.L.O.), Vol. XXXV, No. 3, Dec. 1952, pp. 105-108).

space, cleanliness and tidiness were minimum requirements to ensure operational efficiency and low maintenance costs. The machines were, moreover, a symbol of progress, and they often inspired a modernisation of other office equipment. Desks and chairs, for instance, had to be adapted to typewriters and calculators, and the latter thus contributed to the creation of a more harmonious and comfortable working place in some instances. Employers who had invested large sums in mechanical equipment were inclined to show a greater interest in creating a proper environment than when the same work was performed manually.[1] The introduction of electronic computers in offices has emphasised this tendency. The technical requirements of these machines are such that they are generally installed in a specially equipped separate room or reserved area, where temperature control and sound-absorbent coating on walls and ceiling create a calm, cool atmosphere more akin to that of a scientific laboratory than to that of a bustling office.

Of far greater importance, however, were the negative effects of mechanisation in this field. Long before the computer appeared it was recognised that the introduction of machinery in offices created an entirely different atmosphere from that which had prevailed before. This is particularly true in large punched-card machine installations, where several hundreds of machines may be functioning together, and the factory-like environment created is a far cry from the traditional office. Desks, chairs, shelves and filing-cabinets are replaced by metal-encased machines of varying dimensions, and racks of drawers containing the cards. Instead of working seated at a desk or table the machine operators are for the most part standing, or moving about if they have to supervise the operation of more than one machine, or perched on high stools where this is practicable. A certain amount of dust and grease is inevitable where machines are involved ; the noise of the machines in constant operation is a source of strain ; the speed at which they function imposes a rapid working rhythm comparable to assembly-line production, which again creates increased nervous tension for employees; while the routine mechanical operations involved are often more monotonous, if less arduous, than former manual methods of work. The widespread attention that has been devoted during the last few decades to the creation of an agreeable physical environment in offices has been to a great extent an attempt to attenuate the harmful effects of mechanisation on the physical and mental health of the employees.

Fatigue

Even before the beginning of the Second World War the I.L.O. Advisory Committee on Salaried Employees had already devoted considerable attention to the effects of mechanisation in offices on the employees concerned. In 1936, in the course of its Fourth Session (Geneva, 18-19 November 1936), the Committee adopted a resolution concerning the social consequences of the use of office machinery and measures to alleviate them [2], which was based on the findings published in a report prepared by the I.L.O. on " The Use of Office Machinery and Its Influence on Conditions of Work for Staff".[3] According to these

[1] See I. W. SPIEKMAN (International Federation of Commercial, Clerical and Technical Employees, the Netherlands), in E.P.A. Trade Union Seminar : *Final Report*, op. cit., p. 112.

[2] Cf. *International Labour Code 1951*, Vol. II : *Appendices*, op. cit., pp. 173-176.

[3] *International Labour Review*, Vol. XXXVI, No. 4, Oct. 1937, pp. 486-516.

two documents, increased fatigue from a variety of causes was the first physiological hazard from which workers suffered as a result of the introduction of office machines. In contrast to mechanisation of production processes, which often relieved workers of physically tiring jobs, mechanisation introduced work of this nature into offices where it had not existed before. In the early years of mechanisation a considerable effort was required of operators using some types of machines. The mere depression of the keys of a typewriter or an adding machine, for instance, brought into play muscular action that often proved tiring for the workers. Sometimes they were obliged to take up an awkward position, as for example in bending over a table to make entries when using a flat-bed type of book-keeping machine. Clerical workers often complained of muscular fatigue, backache and other such ills as a result of the unaccustomed strain of operating machines. As time went on, however, the workers' comfort was increasingly taken into consideration in the design of the machines, and later models required very little physical effort in their operation. Keyboards now respond to a light touch and have been carefully adapted as far as possible to easy and natural movements of the hands ; levers are fixed in the most convenient places and efforts have been made to reduce operating fatigue to a minimum.

The fact remains, nevertheless, that machine operation is still more tiring for many workers than straightforward manual methods of copying or calculating, and can in some cases be a serious drain on their physical resources. It has been found in practice that operators of punched-card machines should be young—preferably in their twenties—and that no one of over 50 should be required to operate such equipment. The necessity of standing up to the work, and lifting and moving heavy metal drawers of punched cards, are among the aspects of this work which make it suitable only for the young and fit. And even among these, a careful selection for physical aptitude is important. The appearance of certain occupational diseases, such as painful nerves in the hands of punched-card perforators, has high-lighted the serious physical consequences which the new mechanised jobs can have, even for young workers.

Fatigue induced by the increased speed of output which the machines imposed is difficult to evaluate. It is beyond doubt, however, that the gains in facility through mechanical as opposed to manual methods of work were largely offset by the greater tension imposed by a more rapid working pace. The experience of factory workers who found themselves obliged to adapt the speed of their movements in handling materials or parts to the increased speed of the machines has been duplicated to some extent in offices—in feeding in the cards, for instance, to keep machines operating continuously.

Where electronic equipment is used, however, the operating speeds are so fantastic that the problems of accelerating the input and output of data are, as has been shown, of a technical nature, and do not necessarily bear directly on the rhythm of the workers concerned. But, in every kind of semi-mechanised, fully mechanised or automatic data-processing installation, the profitability of the machines depends on the higher productivity achieved ; and there is therefore bound to be pressure for speed in the preliminary preparation of data for processing so that the volume of work will correspond to the machines' capacity and make their use economical. While work measurement has not been as extensively used in offices as in industry, clerical employees are often under compulsion to produce at a certain rate of speed in order to make the

most efficient use of the equipment. This pressure may be an important factor in the fatigue accumulated at the end of the day, and may even result in nervous disorders in some types of workers. For example in a highly mechanised and centralised accounting office the work is staggered throughout the month in order that the accounts for each regional office may be dealt with promptly on a fixed date. This system avoids peak loads and slack times, but does impose a steady pace of work in order to get through one batch of work in the appointed time so that the machines are clear when the next load arrives, and this may create continuous tension for both operators and supervisors.

On the other hand, a fully automated data-processing system is capable of absorbing additional work loads without overburdening its operating staff; in many cases such an installation has eliminated the overtime hours and fatigue-generating tension that were formerly connected with such operations as the closing of bank books at the end of the year, or annual stocktaking and inventories. Proper organisation of the work and careful attention to working hours and rest periods are, however, essential if the pressure for higher productivity is not to have grave consequences for the health of workers. In one French office 72 per cent. of the workers questioned, all of whom were working on routine mechanical operations, complained of fatigue in some degree, and 4 per cent. stated that they had suffered nervous troubles caused by the work. Only 24 per cent. said that the work was not at all or only slightly fatiguing.[1]

Another source of fatigue, which has been referred to above, is the noise of the machines. This can be intense in large offices where as many as 50 or more typewriters or hundreds of multi-copying or punched-card machines are in operation at once. Simple methods of reducing the noise have been worked out and applied with widespread success—felt pads under typewriters, carpeting and partitioning of rooms where machines are used, application of sound-absorbent materials to walls and ceilings, and so forth—and these have helped to diminish the importance of noise as a fatigue factor. In one analysis of employee reactions to mechanised office work in a large public administration only a small percentage of the employees questioned mentioned the noise as a source of discomfort or dissatisfaction, although the office premises described were far from modern and in the services which were the subject of study hundreds of machines were in continuous operation. It is a well-known fact, however, that noise in the workplace can have a detrimental effect on the nerves of employees, even though they themselves are unaware of the fact and appear to be accustomed to it. This must therefore not be considered a negligible factor in the fatigue engendered by the office environment.

Eyestrain has always been an occupational hazard in office work, and it is hard to say whether or not mechanisation has increased this danger. The importance of adequate lighting in offices is, however, being increasingly realised, and scientific studies have been made concerning the proper degree of diffusion and intensity of light necessitated by different types of clerical work. Similarly, attempts to improve the general hygienic conditions in offices, such as ventilation and temperature control, were often prompted by mechanisation, in order to create a healthier working atmosphere where the effects of fatigue would be less intensely felt. On the whole clerical workers in modern mechanised offices are generally better off as regards the material aspects of their

[1] CROZIER, op. cit., p. 41.

working conditions than their predecessors, who often had to work in cramped quarters where little thought was given to their physical well-being. But in spite of improved physical surroundings, office workers have had to pay a price in adapting themselves to a type of work which made considerably greater demands on their nervous strength.

Nervous Tension

Of even greater importance than direct physical fatigue, from the viewpoint of the health of workers, is the nervous tension engendered by the monotonous, repetitive nature of mechanised tasks and the attentiveness required in their performance. The machines themselves cannot be held entirely responsible for the monotony of office jobs, since even before mechanisation many clerical workers had been obliged to perform routine and uninteresting tasks, but work of this type became more frequent as the machines took over more and more of the mental operations required of the clerks, leaving them the purely routine jobs or auxiliary operations such as classifying and preparing the data for the machines to work on. The uniformity and excessive simplification of the work of many machine operators, the extreme subdivision of functions which further limits their area of activity, can induce in employees the feeling of being simply an unimportant cog in the machine. This is a difficult situation for workers to accept, and may have serious psychological and even physiological consequences ; cases of nervous breakdown have been known to occur among workers who had difficulty in adapting themselves to such simplified, repetitive work performed at a rapid pace. " In my opinion, it is not professional pride which makes the service function properly " stated one worker questioned in the above-mentioned French inquiry. " We are like trained animals ; the work has become completely mechanical . . . we function from habit." [1] Reactions of a considerably more violent nature, expressing the boredom and frustration engendered by the monotonous nature of mechanised tasks, were also noted.

In addition to the uniformity and lack of technical interest, workers have suffered from the close attention required of them as machine attendants. Tabulating-machine operators, for instance, even when the controls are set for them and an automatic device stops the machine when something goes wrong, cannot let their attention flag ; they must keep careful watch that the cards are fed in in the proper sequence, in order to keep the machine functioning smoothly and accurately. Similarly, the rapid translation of the written data into perforated codes by key punchers requires close attention to detail, however simple in content such operations may appear to be.

The strain of this kind of close attentiveness to a repetitive operation has resulted in a rising number of cases of mental and nervous disorders among clerical workers in automated offices. Trade unions, mental health institutions and other bodies have studied this phenomenon, and are continuing to seek ways of averting such effects, which, according to one report, are affecting an alarmingly high proportion—about 40 per cent.—of workers in mechanised undertakings.[2] The symptoms of this

[1] CROZIER, op. cit., pp. 68-69.

[2] Memorandum presented to the World Health Organisation by the Union internationale des Syndicats des travailleurs de la Fonction Publique et Assimilés (Département Professionnel de la F.S.M.) concerning the medical and social consequences of mechanisation and automation.

type of neurosis induced by work that is both monotonous and exacting, as described in this study, include : physical and intellectual debility ; disturbances of an emotional nature such as irritability, nervousness, hypersensitivity ; insomnia ; various functional disturbances—headaches, digestive and heart troubles ; state of depression, etc. All such symptoms may lead to an increased tendency to ill health, sensitivity to infections, proneness to accidents, and illnesses such as stomach ulcers or high blood pressure. The far-reaching social consequences of such disturbances for the individual and his family through the general lowering of the professional usefulness of the worker concerned, the deterioration of his social and intellectual possibilities, and the difficulty of effecting a cure, have been the object of investigation and study by interested international and national organisations.[1]

Workers' organisations have shown direct concern with practical preventive measures for the health problems arising from the changing physical environment in offices, and the demands of the new jobs. Among the various suggestions made, the reduction of hours of work and increased frequency of rest periods for workers in monotonous and fatiguing jobs are particularly advocated. Careful selection of personnel from the standpoint of physical suitability is another point which has frequently been emphasised ; and in this connection the workers' organisations are laying considerable stress on the importance of medical and psychological examinations for workers assigned to mechanised operations. This is a procedure which has already been recognised as a necessity by management in some cases ; in the Austrian case study already referred to, for example, it is stated—

> The choice of workers for the punched-card section is made very carefully. Tests by the firm's psychologists, examination of the person's physical health by the factory physician—nerves, heart, and lungs being subjected to special tests—are carried out to ensure that these workers really are, physically as well as technically, up to their job. Quickness of perception, lively reactions, a faculty for logical thought—all these are a *sine qua non* for work in this section.[2]

Emphasis has also been laid on the necessity for a proper physical environment, including prevention of noise and adequate lighting, and good layout of machines in order to avoid inconvenience ; another point frequently stressed is the avoidance of incentive payment methods which, through the pressure for higher productivity, may prove an additional source of fatigue.

The problems of fatigue and tension do not follow quite the same pattern as far as the personnel directly connected with the operation of an electronic computer system is concerned. For these workers no physical strain or high-speed operations are involved ; noise and dust are absent ; but a considerable amount of mental tension may be engendered by the exactitude required in programming work, the responsibility for the functioning of delicate mechanisms, and the urgency of avoiding interruptions in the work through errors or malfunctioning, because of the high cost of " down time ". For these reasons great importance is attached, in the selection of computer staff, to mental and physical qualities which enable them not only to assimilate the

[1] For example World Health Organisation, Study Group on the Mental Health Problems of Automation, Geneva, 10-15 November 1958 ; and the Second International Conference on the Influence of Living and Working Conditions on Health, Cannes, 27-29 September 1957.

[2] KABESCH, loc. cit., p. 37.

specialised training needed but also to dominate such a situation. In actual fact, real enthusiasm for their work is often encountered among this type of personnel, who feel that the new techniques have freed them from arduous and boring tasks, and who find the new work much more varied and interesting. It must be emphasised again, however, that only a small proportion of workers in automated offices are included in this group.

Reactions to Change

A factor of great psychological importance in evaluating the effects of mechanisation on health of workers is the reaction of employees to the fact of change itself. When new machines are introduced workers have to discard old working habits and learn new methods. As a result of structural changes in the office organisation many employees find themselves obliged to adjust to a type of work in different surroundings; the routine to which they have become accustomed may be completely changed, their own functions entirely altered. Although the functions, skills or work routines which they are required to learn may not in themselves present great difficulty, and in many cases offer greater facility than previous methods, the fact of change is a psychological obstacle which may have to be overcome. "Perhaps more important than learning a new skill or responsibility is . . . the psychological adjustment involved in overcoming fears and anxieties associated with new skills or responsibilities" writes one authority. "Such a psychological adjustment may be difficult even though in a formal sense the worker had already learned the new skill." [1]

It is not difficult to imagine the feeling of futility which some older workers may suffer in watching a machine sort rapidly and accurately hundreds of punched cards containing data which they had faithfully kept in order by manual methods over a period of many years. Some, especially the younger workers, may derive a considerable satisfaction from the greater facility and speed of production of the machine itself. Many, however, will miss the sense of accomplishment which they derived from the devotion to detail, scrupulous striving after accuracy, and conscientiousness which they brought to their former duties. Their sense of responsibility and pride in their work may be badly shattered when their functions are transferred to an automatic machine. A loss in social status is also frequently felt by workers in transferring from a semi-skilled occupation, which had a name, to functions which amount to merely those of a machine attendant. These people will instinctively resist the change, and their problems of adjustment may affect both their mental and physical health. Workers faced with such a situation have been known to become ill, to complain of persistent headache, or to have undue difficulty in learning the new skills and routines.

Problems of a similar nature may arise in the case of supervisors. Many such employees are older men or women who have devoted their resources of patience, tact and human understanding to handling the day-to-day problems which arise among a large staff of younger workers. Getting the work done accurately and on time has been primarily, for them, a psychological problem. When a group of automatic office machines requiring a much smaller number of operators takes over the burden of the routine operations, the nature of the supervisor's job

[1] "Proceedings of the Carnegie Study Group on the Basic Principles of Automation, Geneva, 1957", in *International Social Science Bulletin* (Paris), Vol. X, No. 1, 1958, p. 100.

changes considerably. He finds himself responsible for the smooth functioning of costly equipment, while human questions are inclined to take second place. Such people may be faced with difficult problems of adjustment. More technical knowledge may be required of them, they may miss the human contacts of a busy non-mechanised office, and they may suffer a sense of inferiority in being responsible for machines whose functioning they do not really understand.

The anxiety-producing impact of automation on clerical workers has an even deeper cause in the underlying uneasiness engendered by the nature of the change itself. This has been described by one authority as follows :

> The white collar worker . . . is now being affected. . . . It is quite sufficient to talk with anyone in those professions to notice the unrest and the anxiety which is being awakened by the fact that automation seems to enter their lives. . . . Here, for the first time, we have to do with a machine which not only replaces human muscle but which actually replaces the human brain and which, therefore, has a considerably deeper impact on human pride, on human ability of identification, on the whole situation of man in his cosmos, so to say. In other words, there is something far more uncanny about automation than there has been about the ordinary type of industrialisation. That all this has an immediate and direct influence on psycho-pathology can be proved by fairly recent experience. It has been shown that workers who work for machines have a far higher incidence of neurotic pathology than workers who work for other men.[1]

There is no obvious solution to this type of problem, which inevitably occurs wherever far-reaching changes are introduced. Much can be done, however, to assist individuals to make a satisfactory adjustment. A carefully planned campaign of information preceding the introduction of new techniques has frequently proved a successful antidote to unfavourable reactions on the part of employees, particularly where it is carried out in co-operation with workers' organisations or other employee representatives. While management can keep its personnel fully informed and reassured by a clear statement of plans and employment policy, workers' organisations may demonstrate that they are actively concerned that employees' interests should not suffer. Early and complete information is the surest way to dissipate fears ; clerical workers will accept changes more readily if they are informed about them in advance, if the purpose of the new equipment and the new routines is explained to them and its advantages driven home, and if they are given an opportunity to express their opinions and ask questions about aspects of the change that may be worrying them. It is also of the greatest importance to inform employees as early as possible of changes in their own jobs, and to provide for retraining where necessary. In some cases, as noted above, management has been at pains to interview and test employees individually with a view to finding out how far their present training and aptitudes are suited to the new jobs and what their own preferences are with regard to the new types of work offered. When the employee is made to feel that his own personality is taken into account in work assignments he is more apt to adapt himself to the new procedures, and both morale and efficiency will benefit. Any measures to facilitate a smooth change-over in work procedures are well worth the time and trouble spent on them.

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[1] From a talk given by Dr. Eduardo Krapf, Chief of the Mental Health Section of the World Health Organisation, at the Carnegie Study Group on the Basic Principles of Automation, Geneva, April, 1957.

Information is, moreover, an important element in maintaining good morale in an organisation, and as such can usefully be provided continuously, and not only at times when radical changes are introduced. The dissatisfaction engendered by lack of information is shown by the study of one public administration where 77 per cent. of the employees interviewed felt that they were kept insufficiently informed concerning the organisation and its work, and resented this fact. Many large undertakings have recently made efforts to combat the unfavourable reactions of employees to the restriction of their area of activity that results from the subdivision of work in specialised departments. Lectures are organised explaining how the undertaking functions and the importance of each different department. The employees' interest is aroused by discussion groups where they are able to ask questions; and such devices as suggestion boxes, when effectively managed, give them a feeling that their opinions and ideas are valued by the management. Some other aspects of personnel management, such as employee counselling, have also proved a useful outlet for dissatisfaction and complaints, while offering encouragement and guidance for the most promising candidates for promotion. The induction of new recruits is another occasion when information concerning the whole organisation, added to an explanation of their own duties, can be of service in helping them to start the job with an attitude of interest and understanding.

Changes in Hours of Work

There is little evidence at the present time that mechanisation and automation have directly affected hours of work in offices where they have been introduced ; no change has been made as a rule in the number of daily or weekly hours worked by clerical staff. This is partly the effect of management policy, its desire to avoid making unnecessary changes in working habits and differentiating too markedly between automated and non-automated departments, and its uncertainty whether the cost returns on equipment make a reduction of working time economically feasible. It is also due to the fact that hours of work are often fixed by industry-wide collective agreements or statutory rulings which go far beyond the limits of a single undertaking, and to the prevalence of a comparatively shorter work week in offices than in many other sectors of business and industry.

Nevertheless a wide-spread belief persists that a shortening of the work week will become essential as a result of automation in general, in order to take up the slack in employment (a dubious assumption according to some authorities [1]). Much of the optimistic talk of increased leisure for workers and a richer life of enjoyment made possible through the higher productivity of machines is based on this assumption. At the present moment, however, there would appear to be no immediate prospect that working hours will be appreciably shortened, on a general scale or even in particular cases. Workers' organisations are pressing such claims, but opposition has been encountered among employers on the grounds that automation so far only affects a limited number of workers, and that to favour the latter would amount to an unjust distribution of the benefits of automation. It is felt that these benefits

[1] See, for example, Royal Commission on Canada's Economic Prospects: *Probable Effects of Increasing Mechanisation in Industry*, by the Canadian Labour Congress (September 1956), pp. 47-48.

could be more equitably distributed through a lowering of consumer prices. In the long run it appears likely that changes in working hours in offices will be influenced by the general economic situation and the evolution of the employment market, in which automation is only one of a number of factors, rather than by the local effects of automation in any one undertaking or department.

In one important aspect automation has already affected the working conditions of clerical personnel on a local level; that is, by the introduction of shift work in a sector where it was seldom customary before. Although this trend is by no means universal, and many undertakings which have introduced electronic data-processing installations have found it economic to operate them only during the regular number of hours per week worked by the staff, a large number of cases have been noted where shift work has become necessary in order to use the new equipment to capacity. This development affects to some degree all classes of personnel—specialists, supervisors and maintenance men as well as machine operators. An indication of how shifts have worked out in practice is given in the following description of the experience in a large number of United States federal government agencies:

> Because of the great expense of computers, it is common for [automatic data-processing] installations to keep their computers running for more than one standard shift a week. Some installations run the entire 168 hours a week with regularly scheduled time of at least 16 hours for preventive maintenance. Quite a few run two full shifts of 40 hours. Some installations count on using a third or fourth shift only for emergency work.
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> A work schedule of more than 40 hours a week requires various personnel adjustments. Some agencies rotate their employees among shifts. Some make the regular day shift a reward for seniority. An effort is usually made to run routine work at night or on weekends so that a skeleton crew can keep the machines going. In some installations the subject-matter specialists arrange to be on hand when the work for which they are responsible is run on the machine. This is awkward if the run takes place in the middle of the night. Arrangements must be made for a troubleshooter repairman or engineer to be on hand or within easy call whenever the computer is running. This situation has resulted in extreme demands on qualified personnel, who in effect are on call at all hours, and greatly complicates operations generally.[1]

The extension of shift work is also likely to affect the composition of the clerical work force; since men are usually employed on night shifts, the job opportunities open to women may be reduced through this development.

The mechanisation and automation of office work has also had a significant effect on the length and distribution of rest periods during working hours in some cases. As noted above, the need has often been felt for more frequent short breaks where monotonous, repetitive work on mechanised installations has replaced manual methods, especially where other fatigue factors such as physical effort, noise or eyestrain are also involved. On the other hand no noticeable changes appear to have occurred with regard to meal breaks, holidays or annual leave, as a result of technical innovations.

It is no doubt much too early to reach conclusions concerning the effects of mechanisation and automation on such conditions as these, since they will only become apparent as the movement spreads and its economic effects are more clearly discernible. Trade union policy is

[1] *Personnel Impact of Automation in the Federal Service*, op. cit., p. 17.

firmly oriented towards reducing hours of work per week, shortening the working year by longer vacation allowances and more holidays, and decreasing the length of the working life through longer preliminary training and retirement at an earlier age. These are long-term objectives, in line with the continuous trend in working conditions over the past few decades. Automation may well turn out to be a decisive factor in accelerating progress towards the realisation of these ultimate goals; but there are few signs that the immediate perspective of working conditions for office personnel will be greatly changed in this respect by the introduction of new techniques.

Effects on Labour-Management Relations

The fundamental changes entailed in the introduction of mechanised or electronic data-processing systems in offices—changes in work organisation and methods, job classification and occupational structure, and in the size and distribution of staff—appear to have had so far surprisingly little effect on the traditional pattern of labour-management relations in the undertakings concerned. The problems of adjustment to new situations have apparently not overtaxed the existing relationships between clerical employees and their employers, since there is little evidence indicating that unusual difficulties have been encountered in this field. Clerical workers' organisations have expressed no opposition to automation, although they are well aware of the new problems and new aspects of old problems facing them as automation becomes more widespread. On the other hand, many managements are also fully cognisant of the difficulties involved for the staff in a conversion to automatic methods; and they realise, moreover, that since no system of this nature can function successfully without the full co-operation of all employees concerned, it is in their own best interests to smooth out these difficulties as far as possible. In a number of cases, as a result of a basically co-operative attitude on both sides, the change-over has been effected with a minimum of disruption and hardship. Full information of employees concerned and careful advance planning have, as outlined above, played an important role in achieving this result. Moreover, the absence of any appreciable effects on clerical employment generally, up to the present, has contributed to the maintenance of good relations both within the undertakings and on a broader scale.

A considerable amount of uneasiness is nevertheless apparent in trade union statements on the subject, however broadly optimistic they may tend to be. This underlying anxiety stems not only from a clear understanding of the dangers inherent in the movement from the employee's point of view, but also from the fear that automation may have an adverse effect on trade union strength. Alarm has been expressed on this score by representatives of the big industrial unions in the United States where the "white collar" work force has expanded very markedly in proportion to the production workers during recent years, partly as a result of automation in industry, while organisation among clerical workers has proceeded very slowly. Similarly, a United Kingdom spokesman foresaw a threat to trade union power in the proportionate increase of professional and technical staff in automated undertakings, since these categories are traditionally resistant to organisation.[1] The

[1] Association of Supervisory Staffs, Executives and Technicians: *Automation, a Challenge to Trade Unions and Industry* (London, 1956), p. 25.

urgency of adapting trade union programmes to the interests and needs of clerical workers is strongly emphasised; but some authorities have expressed pessimism as to whether automation will facilitate organisation among these workers, since those who remain employed in automated offices sometimes have better-paying jobs and other advantages.[1] Employer opposition may also hinder the spread of organisation among clerical employees in some countries where management has an openly expressed policy of taking measures unilaterally to keep workers satisfied.[2]

Among the clerical workers' organisations, particularly in European countries, it is felt by some authorities that automation in offices will encourage clerical staff to organise. On the one hand, it is pointed out, the introduction of machinery in offices has largely effaced the line of distinction between manual and non-manual work, and operators, whether they contribute directly or indirectly to production, tend to have common problems which should lead to united action. At the same time, because of the threat to their security, advancement, and acquired skills which automation represents, " salaried employees are increasingly coming to understand and appreciate from experience the necessity and efficacy of trade union action ".[3] Changes in working conditions, such as the introduction of shift work, will, it is felt, make even professional staff more conscious of the benefits of collective bargaining. Practical action with regard to the improvement of physical surroundings is believed to have strengthened the union's position in one instance.[4] There is, however, no evidence of an appreciable increase or decrease in union membership as a result of automation in any case.

Trade unions have strongly emphasised the need for a positive attitude towards the development of automation, with a view to eventual long-term benefits for society as a whole, and a vigorous programme of action to protect workers' interests during the transitional period. " The problems which this evolution will raise in economic, trade union and labour market spheres cannot be solved without trade union participation. The unions must be on their guard and have a strong policy " states one Swedish representative. " Office employees . . . must abandon the outmoded idea that they are a privileged class, and prepare themselves for their new role by actively participating in the union's activities. Far from reducing the tasks of the unions, coming developments will increase and complicate them." [5] A few examples may be cited of the type of action already taken. The International Federation of Christian Trade Unions of Salaried Employees, Technicians, Managerial Staff and Commercial Travellers set up in September 1956 a permanent committee within the federation to study the problems arising from mechanisation and automation in offices. A resolution adopted at that session emphasised the need for close co-operation between employers and workers, in collaboration with works' councils and trade union organisations, where new techniques were to be introduced. A later resolution adopted in September 1958 drew up recommendations concerning vocational

[1] STIEBER, op. cit.

[2] See, for example, *Management and Business Automation* (Chicago), Vol. 1, No. 1, Jan. 1959, p. 50, and ibid., Vol. 1, No. 3, Mar. 1959, p. 10.

[3] SPIEKMAN, loc. cit., p. 116.

[4] MERLI-BRANDINI, loc. cit., p. 60.

[5] A. JÖNSSON (Landorganisation, Sweden): " Change of Function in Office Work ", in E.P.A. Trade Union Seminar: *Final Report*, op. cit., p. 28.

guidance and training, measures for the prevention of unemployment, relocation of displaced personnel, protection of older workers, remuneration and promotion, fatigue and nervous strain, and advance consultation of personnel concerned in the changes. Similarly, the Clerical and Administrative Workers' Union in the United Kingdom initiated as early as 1955 an inquiry into the effects of mechanisation and automation in offices, and established the outline of a broad policy concerning the problems of redundancy, training, reclassification of jobs, promotion, working conditions and so on. The National Union of Bank Employees in that country has also shown awareness that " bank staffs will be vitally affected by the introduction of electronic devices ", and that problems such as a shorter working week, lower retirement age, recruitment and redundancy, new skill requirements and status of machine operators will have to be closely examined by the Union, which should keep itself fully informed on the " far-reaching changes which are bound to come in the wake of electronics ".[1] A spokesman for the International Federation of Commercial, Clerical and Technical Employees emphasised the need for effective action both at the level of the undertaking and on a broader scale, since the effect on the whole working life of the worker must be taken into account ; the policy he formulated included such broad questions as educational reforms, measures for securing full employment, social security changes, and reduction of hours of work and lengthening of vacations and holidays.[2] The French General Confederation of Labour—*Force Ouvrière* (C.G.T.-F.O.) betrays similar preoccupations ; automation in offices presents the gravest problems which the trade union movement has faced for 30 years, in their opinion, and in addition to the subjects mentioned above, particular emphasis is laid on the importance of improving training opportunities for young workers and retraining of displaced workers.

On a more practical plane, agreements at the level of the undertaking have, in a number of cases, dealt with specific problems arising out of the introduction of automatic methods. This is notably the case in several railway companies in the United States which have set up data-processing centres for their administrative work. The terms of these agreements, concluded in advance of the actual installation of equipment, cover in particular such questions as classification and remuneration of new jobs created, selection of personnel for work at the centre—preference being given to persons already employed by the company, who are given the opportunity to apply for the new openings and volunteer for training—provision of training facilities and inclusion of training in company time, maintenance of seniority rights on a company-wide basis, protection of wages by guarantees against loss of earnings over a specified period for workers whose jobs are changed in the conversion, payment of removal expenses and compensation for financial losses in sale of property, etc., for workers obliged to move to the site of the centre, period of notice to be given to displaced and reclassified workers, and separation allowances, calculated according to length of service.[3]

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[1] *Bank Officer* (London, Journal of the National Union of Bank Employees), May 1956, p. 7.

[2] SPIEKMAN, loc. cit., p. 117.

[3] See " Agreement between Union Pacific Railroad Company and the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees ", in *Brotherhood of Railway Clerks' Bulletin*, Vol. XXII, No. 10, Oct. 1958, pp. 260-264.

From these and further examples mentioned throughout this study, it is plain that trade union action in this connection covers a very wide field, and that while many of the problems are old ones which have previously been dealt with through collective bargaining (although they may appear in a more urgent form in this new context), some new problems have also emerged. There are nevertheless certain main themes underlying the policies so far formulated, on which no divergence of opinion exists between the workers' organisations concerned, although the emphasis may differ in regard to specific forms of action in different cases. Five main areas of co-operative action are distinguished—

(1) *Job security.* While the maintenance of full employment through government measures on a national scale is considered a basic necessity, the protection of workers against unemployment as a result of redundancy may be assured at the level of the undertaking by such measures as—

(a) a policy of no lay-offs, every effort being made by management to absorb staff cuts by transfers of redundant workers within the undertaking or through normal attrition ;

(b) utilisation of existing staff for new jobs created by automation ;

(c) assistance to displaced staff in finding alternative employment, through joint efforts of management and the unions.

As shown above, these and related subjects have already been included in collective agreements.

(2) *Protection of wages.* This includes both the protection of redundant workers against loss of earnings through transfer to a lower-grade job, and the establishment of satisfactory methods of evaluation and classification of the new jobs, in order to ensure that workers are adequately remunerated for work requiring increased technical skill or responsibility, or involving mental or physical strain. Such questions can also be appropriately dealt with through collective bargaining.

(3) *Conditions of work.* Reduction of hours of work is almost universally claimed as necessary, both as a means of preventing unemployment and to enable the workers to share in the benefits of automation through enjoyment of increased leisure. It is also included among measures essential for protection of the health of workers, such as proper physical surroundings, good layout of equipment, lighting, ventilation, etc., in addition to adequate rest periods and longer holidays. Closer medical supervision and examination of workers assigned to mechanised and automated jobs is another factor which has assumed growing importance. Clearly, trade union organisations and works councils can play a very useful role in this area by bringing such problems to the notice of management and co-operating in their solution.

(4) *Training.* Trade union action in the field of training is limited in practice, but continued insistence on the necessity for expanded training facilities, both at the level of the undertaking and on the broader scale of organised vocational training, can play a part in encouraging this movement. Workers' organisations are also prepared to co-operate in surveys of employment opportunities and vocational guidance schemes.

(5) *Joint consultation.* Above all, the need for joint consultation between employers and workers at an early stage in the planning of new procedures and throughout the period of conversion is universally

emphasised by workers' organisations. " If the interests of workers are to be protected in firms lending themselves to technical improvements in their office work, the trade unions should make every effort to ensure that all the measures planned are discussed and considered jointly by themselves and the firm's management or employers' organisation, so that no ill-considered or ill-advised reforms are introduced, liable to jeopardise the workers' position." [1] It has been suggested that special joint committees composed of representatives of employers and workers, or of their respective organisations, should be set up to discuss the introduction of new methods and the problems likely to arise ; and that such committees should, in collaboration with the works councils, ensure that the worker is not placed at a disadvantage with regard to his economic status or working conditions.

It would appear from available evidence that, where workers are strongly organised and adequate machinery exists for consultation, the majority of employers have informed and consulted them through their representatives at some stage during the planning of new installations. Examples have been given of how early consultation and negotiation have resulted in detailed agreements through which the risk of insecurity for employees is reduced to the minimum.

In a great many cases, however, clerical employees are not represented by a union, although works councils or other machinery may exist through which consultation could be carried on, while in other offices avenues of communication are practically limited to individual contacts between employers and their staff. It may be said, on the basis of known cases, that management appears to have recognised the need for advance consultation of employees to a large extent, and to have made use of traditional communication channels where these exist, or initiated new methods unilaterally. Such consultation has, however, on most occasions, taken the form of information transmitted by management, either directly to the employees or through their representatives, when the plans were already fairly well shaped, the employees being given the opportunity subsequently to express their opinions or make inquiries about the changes affecting their jobs. These methods, when carried out thoroughly and completely in conjunction with a policy of avoiding dismissals or down-grading of workers, would appear to have worked out successfully in practice. Undoubtedly cases have occurred where consultation and information of employees was insufficient, with unfortunate effects ; but little is heard of such cases since employers emphasise the positive aspects in their reports, and the workers, where unorganised, are inarticulate.

Some technical difficulties are involved in consultation at an early stage in planning ; for instance, management may not for some time itself know what it intends to do, until considerable research by experts has been carried out, and no useful purpose can be served by consulting with employees until the possible innovations, and their effects, have emerged in understandable terms. Workers and their representatives would be at a disadvantage in such discussions through a lack of technical knowledge. There would appear, however, to be a time when the plans are not yet completely finalised, or when several alternatives are being considered, when the workers' opinions and attitudes could be usefully taken into account in making a final decision. The workers, moreover,

[1] KABESCH, loc. cit., p. 46.

are in a better position to understand exactly what is being proposed if they have the opportunity to study the evolution of the planning, rather than being simply confronted with a final proposal for their agreement.

Joint consultation, information, and co-operation between employers and workers are basic elements in maintaining good human relations in an undertaking where technical changes are taking place. It has been pointed out in a number of case studies that automation in offices has in fact resulted in a happier and more enthusiastic attitude on the part of the staff to their new work. This is an achievement resulting from a sustained effort of full information, careful consideration of the interests of individual employees, and the maintenance of a basic policy that no employee should suffer through the introduction of the new systems; it is by no means an invariable consequence of automation. The need for such policies and methods is always present in any office, but it has been brought into particular relief through the impact of mechanisation and automation on office staffs.

To sum up it may perhaps be stated with some certainty that, up to the present time, the introduction of mechanisation and automation in offices has had no noticeable effect on the machinery or methods of labour-management relations, nor on the general feeling which permeates these relations. There is no reason to believe that a situation of special strain has developed in the relationships between employees and employers, except perhaps in some individual cases. Nor has the movement so far had any appreciable effect on the strength of clerical workers' organisations or the numbers of office workers organised. It has, however, given rise to a vast number of problems affecting such workers and demanding a co-operative solution. In view of the number and variety of these problems, which occur with varying intensity in different cases and places, it may be said that the main effect of this movement on labour-management relations has been to intensify the need for joint consultation at all stages and in all areas likely to be affected by a conversion to modern techniques, and for an enlightened and co-operative attitude on the part of both management and workers and their organisations. Automation can only succeed in any individual case if a high degree of maturity exists on both sides. Management has on the whole shown itself prepared to assume the social responsibilities of automation. Workers' organisations, on both a local and international scale, are aware of their task of pointing out these responsibilities, of informing themselves as fully as possible concerning coming developments and their potential effects, of protecting the worker through negotiation from possible harmful effects, and of assisting him as far as possible in adjusting to the changes. Only the future will show how far the interweaving of responsibilities can be carried out smoothly, without changes in the present techniques of labour-management relations.

Conclusions

In concluding this by no means exhaustive survey of the effects of mechanisation and automation in offices, it may be appropriate to summarise briefly the main problems which have emerged. The changes involved in the introduction of these new techniques affect almost every facet of the working life of the employees concerned. Many of the problems which arise are not essentially new ones. It has been brought

out, however, in the course of the present study, that certain aspects of the problems of a general nature, such as prevention of unemployment and protection of the health of workers, have acquired a new urgency as a result of recent developments. In addition new problems have appeared, particularly in connection with training and occupational status, which call for a new approach and new solutions. It is, moreover, impossible to discuss the consequences of automation without touching on such broad questions as an eventual reduction of working hours, and a shortening of the length of the working life through longer vacation periods and changes in social security provisions.

Mechanisation, and to a much greater extent automation, offer management the promise of greater speed and accuracy in routine office operations, more rapid, complete and accurate information concerning every phase of the undertaking, and, above all, a reduction in cl rical costs. In evaluating the results of such applications in specific cases there is often a tendency to shift emphasis from the latter benefit to the former ; management has frequently stated that personnel economies have not assumed as great importance as the savings accruing from higher productivity and efficiency, or the indirect benefits of better information. Analysis shows, however, that considerable reductions in staff have in fact been made in almost every case in the departments or services where automatic systems have been introduced. In some cases the clerical cost savings reported have been quite spectacular. In addition to immediate staff economies, many undertakings have experienced a levelling-off in their need for more workers as the undertaking expanded, and a reduced need for temporary staff in peak periods. Thus mechanisation and automation have undeniably affected the requirements for clerical workers, and it appears likely that they will continue to do so to an increasing extent as the movement spreads.

The continued increase in the size of the clerical work force during past decades has obscured the eff ct of these developments on clerical employment. Up to the present the absorption of displaced workers has not presented an acute problem, because of the continued high demand for office personnel. A general management policy of avoiding dismissals and, in a few cases, the negotiation of collective agreements on job security, have contributed to the protection of workers against unemployment due to redundancy, but these measures have also been facilitated by the expanding employment situation. The extent to which the effects of redundancy can continue to be mitigated as automation becomes a more general trend, will depend not only on the general economic background but also on the action taken at both the local and national levels to foresee the changing nature of the demand in clerical occupations and assist workers in adapting to the new trends.

A high degree of internal displacement—displacement and reclassification of personnel, and displacement of skills—has resulted in considerable changes in the occupational distribution of the clerical labour force and in its composition. The need for certain categories of semi-skilled and skilled workers tends to diminish sharply as mechanisation spreads, and even some classes of specialised machine operators (of book-keeping machines, calculators, etc.) are becoming obsolete through the progress of automation. These workers are being replaced to a large extent by an entirely new type of unskilled worker, many of whom are young girls just out of school, trained as machine operators. The shift in emphasis from the traditional clerical skills and training to machine operation has thus resulted in a growing proportion of young, comparatively

unskilled girls in the clerical work force. At the same time, at the other end of the scale, more technical knowledge is required for some of the new, specialised jobs created by automation, so that a portion of office manpower is becoming more highly skilled.

The problems stemming from this evolution are serious ones. The displacement of older, experienced employees by young, unskilled workers can only be carried out without hardship if special solutions are sought in individual cases. The selection and training of workers for promotion to the new jobs requiring high skills may involve criteria which conflict with established seniority rights. New training methods and facilities are required in order to supply the demand for qualified staff, and workers are faced with problems of access to training and adaptability to these methods. The organisational changes involved in a conversion to automation may make great demands on their flexibility and mobility. They are required to discard old techniques and learn new skills and methods; they are often asked to transfer to a new job, or even move to another location ; many of them are suddenly finding their entire experience and professional skill outmoded and are faced with the necessity of starting out again at the bottom in a new field, in order to keep their jobs. A great many may have suffered periods of unemployment, more or less prolonged ; and even where the introduction of new methods has not actually resulted in displacement, the reclassification of jobs may profoundly affect opportunities for promotion. While for certain workers new avenues of advancement to more rewarding jobs have opened up, others will have found their hopes of promotion more restricted than before. Age and lack of adaptability may prove major obstacles to learning the new techniques where the opportunity is available ; and the very nature of a mechanised or automated office tends to eliminate the intermediate steps between the subordinate jobs and the fewer high-level posts requiring very different qualifications. In addition, the new conditions of work, and the requirements of machine operation, often place considerable strain on the workers' physical and nervous strength, while the monotonous nature of routine mechanical jobs, and their lack of interest, added to the tension of a rapid working pace, may have serious effects in some cases on the employees' mental health.

The challenge of automation may therefore prove an uneasy burden to clerical workers, and it is clear, from the foregoing survey, that the joint efforts of employers, workers and public authorities are necessary in order to solve the problems which arise, both at the level of the undertaking and on a broader plane. Practical measures to meet situations characteristic of a transitional period have in fact been taken to a large extent by management, with or without joint consultation with the workers concerned or their representatives. Redundancy has, as shown above, been handled in many cases through the transfer of displaced workers to other jobs within the undertaking, and the spreading of the conversion over a long period of time, in order that staff cuts may be absorbed through normal attrition. The immediate demands for different kinds of skills have been largely met through improvised methods of rapid training on the job, with assistance from the equipment manufacturers. The adaptation of physical surroundings, and the changes necessitated in working conditions are problems which have had to be solved on a local level, as are also problems of job classification and remuneration, and the selection of personnel for promotion or transfer. Workers' organisations, where they exist, have in some instances played

a useful role in the search for satisfactory solutions which will ensure the protection of the workers' interests and guarantee their full co-operation in the new systems. A management policy of full information of its employees concerned has, in many cases, helped to serve the same ends during a difficult period of conversion.

It would appear, however, unwise to assume that individual or joint initiatives of this nature, on a local level, essential as they may be, are sufficient to ensure a smooth transition to automation in offices on a more generalised scale. Such measures have proved effective in a period of rapid economic expansion, and as long as automation has affected only a relatively limited number of workers. But the problems referred to are not likely to diminish in intensity as time goes on, nor will they solve themselves. On the contrary, they will in all probability assume greater urgency as the trend gathers momentum. There is therefore a growing realisation of the need for a broader view of the consequences of mechanisation and automation in offices, and for long-term planning by the responsible public authorities, in co-operation with employers' and workers' organisations concerned.

Government action can have a decisive influence, first of all, in the field of employment and the prevention of unemployment due to redundancy. Close supervision of the labour market, research on employment trends and the changing nature of job opportunities becoming available as a result of the mechanisation and automation of office work, and the establishment of forecasts of occupational demand, are fruitful fields of action for public authorities. Manpower surveys of this nature may, moreover, usefully be supplemented by an effective system of placement and advisory services, easily accessible to office workers and equipped to deal with their particular problems—such as assisting displaced workers to find alternative employment suitable to their experience and training, or directing them to sources of vocational training to fit them for new types of jobs. Vocational guidance, both for young people and for adult workers, is of paramount importance in view of the evolution of the occupational structure. While rapid changes in the nature of jobs make long-term planning difficult, it is essential that every effort should be made to encourage young people entering employment to take jobs which hold satisfactory prospects for the future, and to guide displaced adult workers into occupations where opportunities are likely to expand. This kind of service often falls within the compass of government bodies, which have the fullest information available concerning over-all trends, in co-operation with established educational and vocational training institutions. Similarly, the changing requirements of vocational training necessitate a co-operative endeavour on the part of educational and public authorities, attention being given to the expansion of existing facilities, the standards of training offered, and the adaptation of curricula to the new techniques, in order to ensure an adequate supply of qualified manpower.

The changes in working conditions entailed by the use of mechanised equipment may also involve action on a broad national scale—such as the reassessment of standards for comfort and hygiene in offices, or the modification of statutory provisions concerning working hours. It is, moreover, possible that the spread of automation in offices may eventually require adjustments in social security provisions, such as unemployment insurance, age of retirement, and pension rights.

Public authorities, educational and research institutions, as well as employers' and workers' organisations, are therefore directly concerned

in these developments, in every area where mechanisation and automation have already given rise to the problems outlined, or are likely to do so in the future. It is only if a close watch is kept on the movement from the very beginning that information can be gathered concerning its direction and strength, and measures designed and carried out in time to prevent possible harmful effects for the workers concerned.