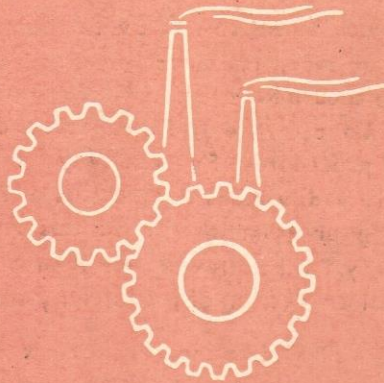


PRODUCTIVITY

JOURNAL OF NPC



NATIONAL PRODUCTIVITY COUNCIL, INDIA

VOL. 2 NO. 4

APRIL—MAY 1961

NATIONAL PRODUCTIVITY COUNCIL

The National Productivity Council is an autonomous organisation registered as a Society. Representatives of Government, employers, workers and various other interests participate in its working. Established in 1958, the Council conducts its activities in collaboration with institutions and organisations interested in the Productivity drive. Local Productivity Councils have been and are being established in industrial centres.

The purpose of NPC is to stimulate productivity consciousness in the country and to provide services with a view to maximising the utilisation of available resources of men, machines, materials and power; to wage war against waste; to help secure for the people of the country a better and higher standard of living. To this end, NPC collects and disseminates information about techniques and procedures of productivity. In collaboration with Local Productivity Councils and various institutions and organisations it organises and conducts training programmes for various levels of management in the subjects of productivity. It has also organised an Advisory Service for industries to facilitate the introduction of productivity techniques.

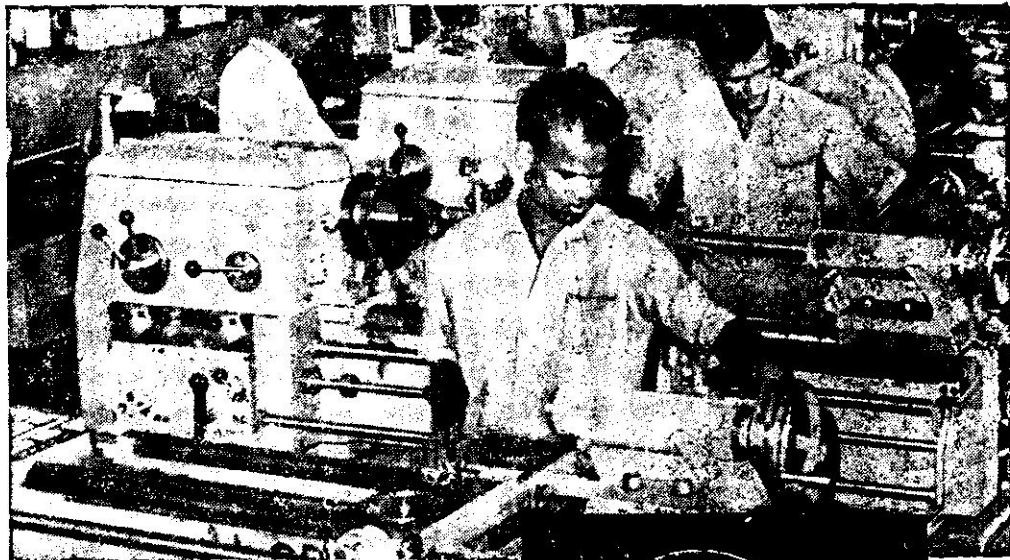
NPC publications include pamphlets, leaflets and Reports of Productivity Teams. NPC utilises audio-visual media of films, radio and exhibitions for propagating the concept and techniques of productivity. Through these media NPC seeks to carry the message of productivity and to create the appropriate climate for increasing national productivity. This Journal is an effort in the same direction.

The Journal bears a nominal price of Rs 1.50 per issue and is available at all NPC offices. Annual subscription (Rs 9.00 to be sent by cheque in favour of National Productivity Council, New Delhi) is inclusive of postage !

Opinions expressed in signed articles are those of the authors and do not necessarily reflect the views of NPC.

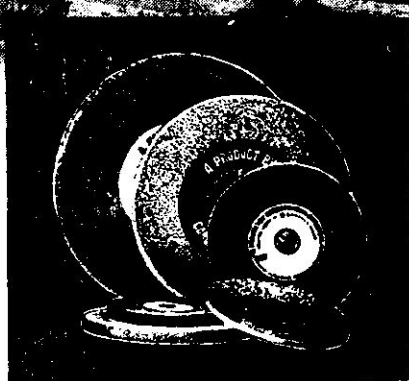
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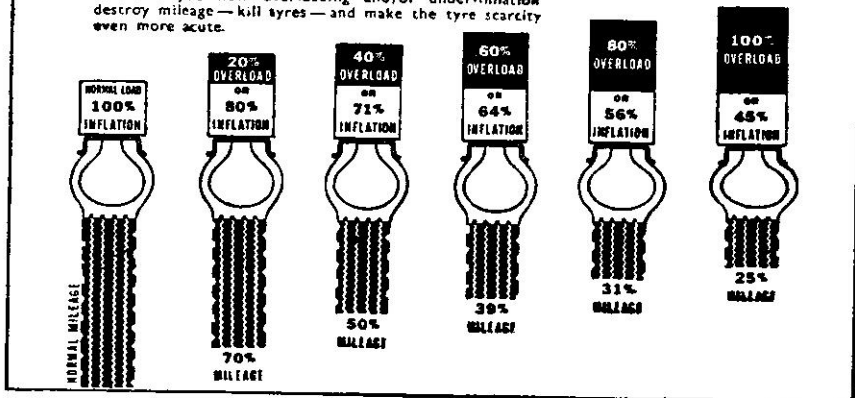
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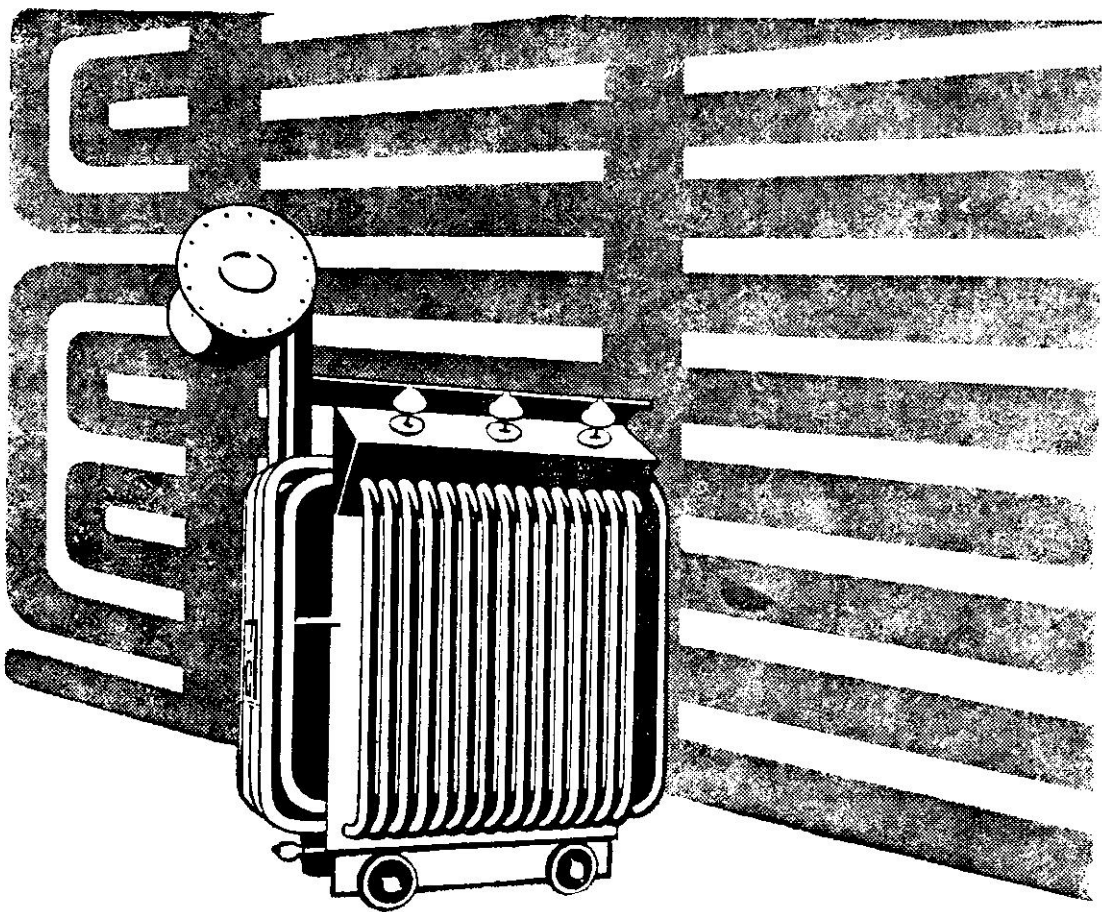
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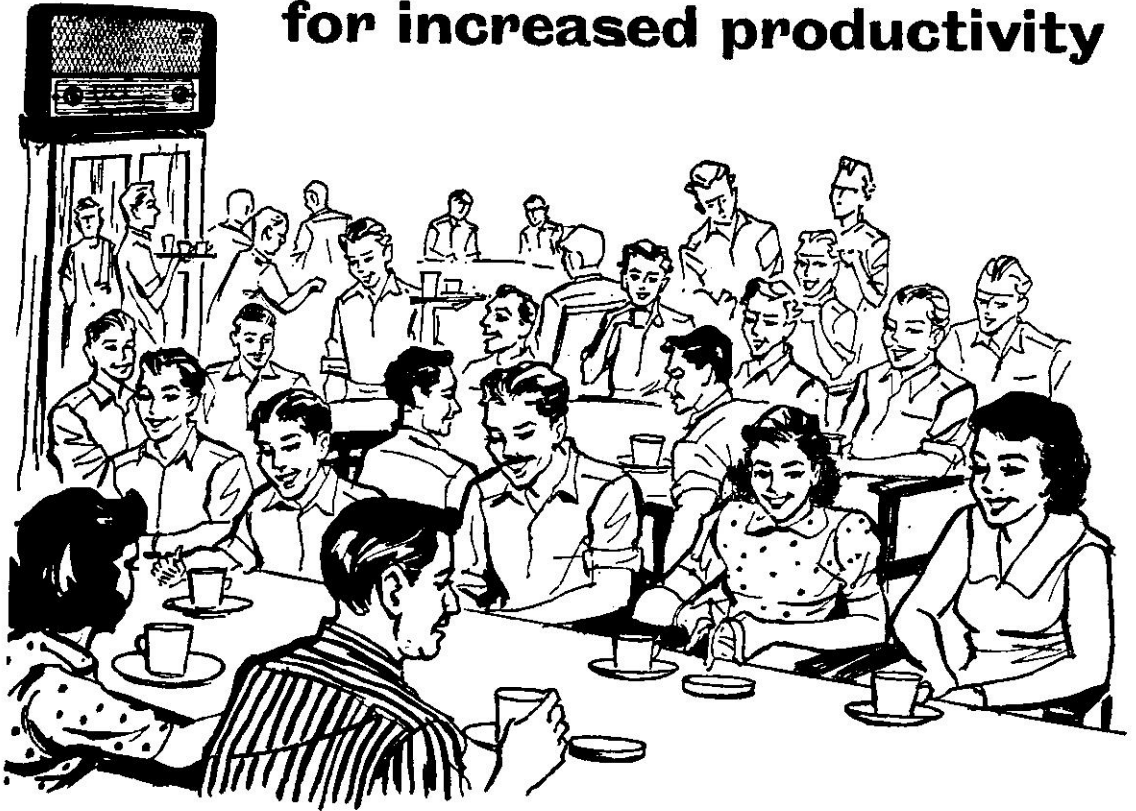
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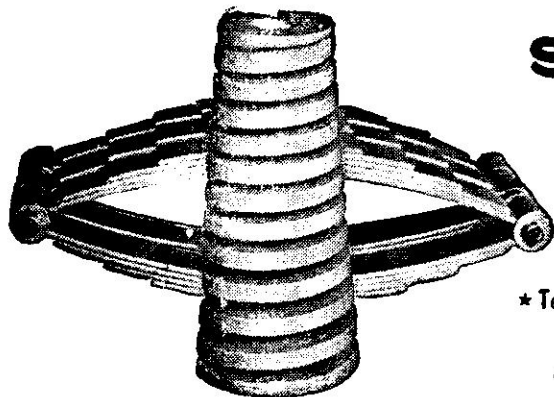


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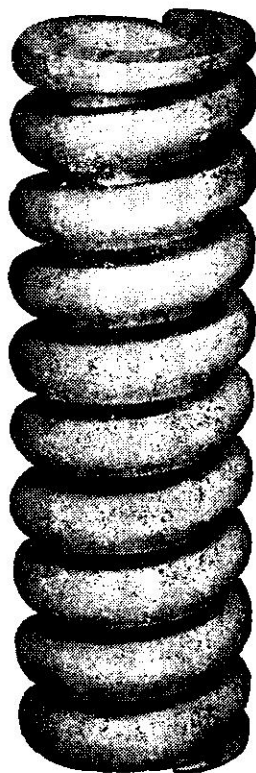
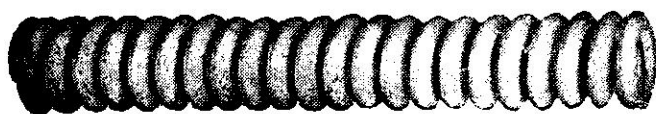
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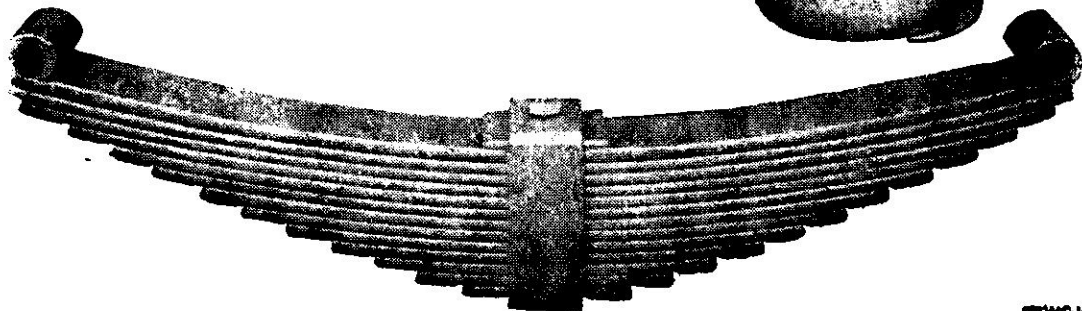
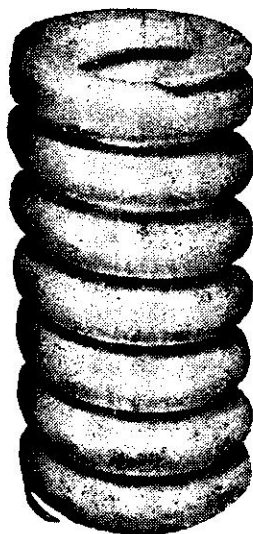
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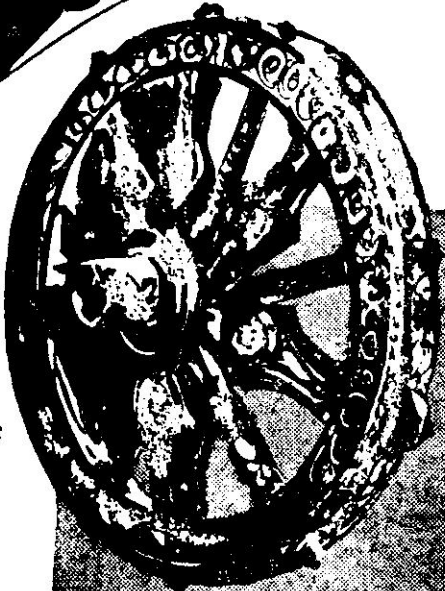
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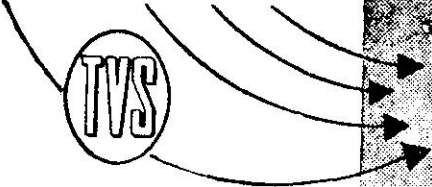




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PRODUCTIVITY

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THE WORLD OWES ME...

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One executive, as an experiment, listened to his meeting of departmental heads. The result convinced him. "It takes more of a man to listen," he said. "But it pays to make the effort."...In a poll by the Bureau of National Affairs a few years ago, the overwhelming majority of top executives agreed that "the art of listening remains one of the most overlooked tools of management."

What Then Must We Do ?¹

AT the last session of the National Productivity Council held in early February 1961, the secretariat of the NPC reported to the Council on the tangible and the intangible results of NPC work in the field of industrial productivity during the three years since its establishment in February 1958. The credit side of the achievements has been summarised in an article on the NPC, printed in this issue of the Journal.

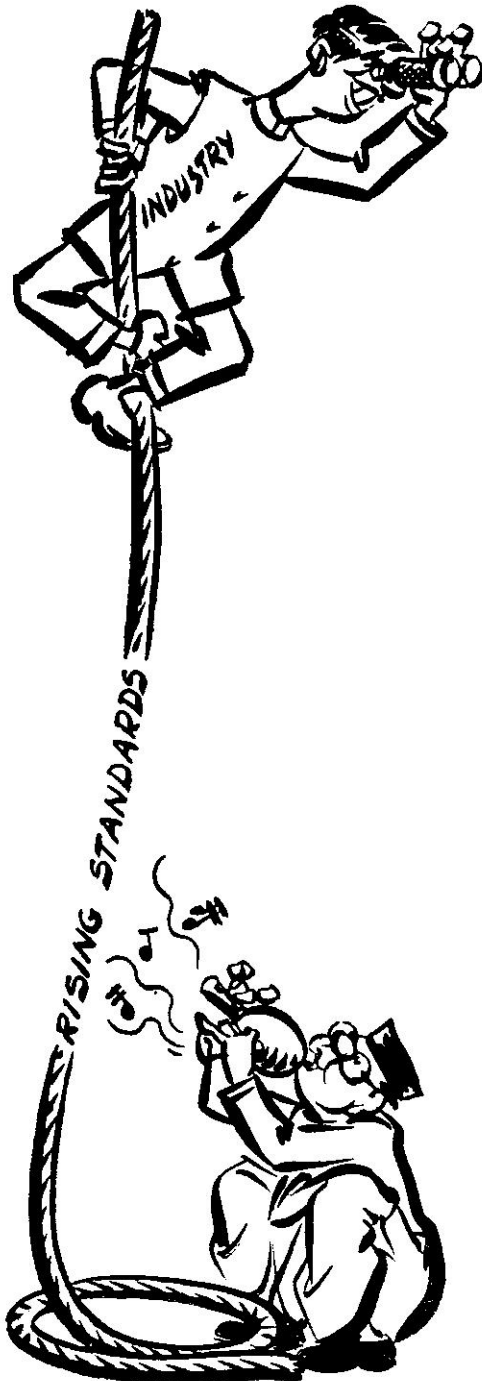
As regards the debit side, or what might more appropriately be called the development possibilities of the NPC, the secretariat reported *inter alia*: "... There is yet an enormous untouched field of work ... The work so far initiated is only the beginning, and a whole lot more has yet to be done. The drive has yet to fully reach the plants, where alone the effectiveness of the work of NPC will be actually judged. Employers, managements and technicians have started evincing keenness to know about productivity techniques; but the workers have not yet been touched in the programmes of NPC. In the trade unions nothing positive has yet been done by NPC. Whereas the bigger and medium-sized industries have started participating in the work relating to productivity drive, in the vast sphere of small industries no palpable impact has yet been made ...". This constitutes a complete, probably a

little too self-critical answer to the famous Tolstoyan question: "What Then Must We Do?"

The President of the NPC himself pointed out that it would be wrong to say that nothing had been done by the NPC in these directions. Trade union representatives have fully participated in the conferences and seminars of the NPC. In the South, attempts have been made to organize productivity programmes for workers in the local languages. At the plant level, the impact of the productivity movement on top as also on middle management has been obviously very considerable, as was much in evidence at the recent top management seminar, to which a reference has been made in the article on the NPC. The thousands of persons, who have benefited from the various training courses organized on subjects of industrial productivity belong very largely to the middle management group. As regards small scale industries, NPC sponsored a special productivity team for study of their problems. Under an arrangement with Small Industries Service Institutes, NPC will reorient over 400 of their experts in the concept of productivity.

At the policy level, there have been very considerable gains. The President of NPC stated in this Journal "... On one thing I should be unequivocally clear, both as Minister of Industry of the Central Government and the President of the National Productivity Council, that the first and prior claim of increased productivity must be higher

¹This title has been borrowed from Tolstoy who wrote a polemic on political economy with the title "What Then Must We Do?" In this book, he expounded his own economic and social philosophy.



remuneration for labour. We must write this in our industrial code and make it clear both by words and deeds that the gains of higher productivity must be primarily devoted to raising the remuneration of labour to a fair wage level..." In his article on the Fundamentals of Productivity, Dr P S Lokanathan had stated *inter alia*: "...a more productive orientation of the economy requires a positive and of course an egalitarian philosophy..."

The result of these policies has been that India is the only country where organized labour of all shades of political opinion has expressed its full preparedness to participate in the productivity movement. At the Seminar on Sharing the Gains of Productivity, all labour representatives expressed their readiness to cooperate in projects for measuring and increasing productivity.

NPC however does not propose to rest on its oars, but to move forward towards an actual accomplishment of a massive increase in industrial productivity during the Third Five Year Plan. The *modus operandi* of the NPC however is to let the LPCs act as the spearhead of the productivity movement. Action has already been taken by the secretariat of the NPC by way of preparation of an outline in considerable detail of the programmes of the LPCs. The situation is favourable, for the aggregate demand for NPC services continues to outstrip the aggregate supply. Under the pressure of the investment programmes of the Five Year Plan, Indian industry has begun to look ahead. In its own small way, NPC has played a part in the formation of forward-looking attitudes in Indian industry; but more, and more important work lies ahead.

² NPC Productivity Journal. Vol 1 No. 4, April-May 1960, p. 193

³ NPC Productivity Journal. Vol 1 No. 3, Feb-March 1960, p. 7

Line of Balance Technology

The Planning Commission's Committee on Plan Projects has recently published a small pamphlet on the Line of Balance Technology, which the NPC would commend to all productivity experts, particularly those who are concerned with the Planning and Programming of Works. Sri Indarjit Singh's foreword to this document speaks for itself: "A first reaction to the term 'Line of Balance' might be one of scepticism. It might seem rather a complicated and esoteric concept from its nomenclature... We have taken the courage to introduce it all the same. Though the nomenclature is unfamiliar, the concept is significant. In effect the technique is utilised to interlink time, tasks, control elements and utilisation of capital resources by means of work study and graphic presentation. All these are balanced simultaneously, hence the name 'Line of Balance'". . . The substance of this pamphlet has been reproduced below *in extenso* with minor changes, the only major drawback being that it has not been practicable to reproduce the well worked out and significant charts, appended to the original publication.

THE element of construction in the Second Plan is of the order of Rs 2,000 crores. In the Third Plan, it is expected to be much bigger. While embarking on a construction activity so big in magnitude and so diversified in character, one has naturally to think about the ways and means of controlling expenditure on various items so that the money spent at any time is commensurate with the benefits received. Planning and programming projects therefore have an added significance in the context of the Five Year Plan.

The importance of planning and programming has been recognised in production processes. The emphasis now is on "*more units of production of the highest quality at the lowest possible cost at the time consumers demand.*" It is only through sound and effective production planning and control that this objective can be realised. Modern production has become rather complex re-

quiring scientific methods analysis and control of manufacturing processes.

Top management must therefore have an effective means of coordinating the various phases of operation. Similarly, the various executive levels must know whether or not materials will be delivered in time or if not, how late. They should be able to foresee the shortcomings and predict future inadequacies, so that necessary steps could be taken in time to "short circuit them or minimise their effects". Decisions on such vital issues requires knowledge, whether or not current progress of individual constituents is "in phase" with the schedule of completion.

Several methods have been proposed for efficient programming and control of production processes. One recent tool in the hands of the planning engineer is the Line of Balance Technology which essentially is a technique of "*assembling, selecting, interpreting and presenting in*

graphic form, the essential factors involved in a production process from raw materials to the completion of end product against a background of time." The technique is highly effective in determining areas of weakness and focusing the attention of the executive on items requiring immediate attention. So far this technique has been used with telling results in industries and it has got immense potentialities for application in other fields as well.

The construction programmes envisaged in the Plan are not much different from any production process. The end products as well as the time and rate of delivery are fixed. A successful working out of such a plan requires all the skill and ingenuity necessary for production processes. The principles of planning and programming are also quite similar. But so far little or no attention has been paid to this, either for want of time or non-availability of proper technique. As a result, the time element for the completion of a project is not fixed in any scientific or rational way. Projects get delayed due to action not being taken on some constituent elements at proper time. Such delay in turn leads to idle investment on certain constituents ahead of utility. Further, in the absence of scientific programming, it becomes difficult to have a correct quantitative and qualitative appraisal of the situation in regard to several elements constituting a project or projects. Consequently, it is not possible to re-appropriate available finances at the proper time for other items where it can be efficiently utilised within the specified time.

The draft outline of the Third Plan correctly lays emphasis on the phasing of projects and outlays as without this "it will not be possible to implement the Plan efficiently, to keep investments in harmony with the internal and external resources available from year to year

and to ensure that there will be continuity both in planning and in the flow of benefits." This objective can be achieved only if systematic planning and programming are undertaken for works individually and collectively and for the Plan as a whole. The Line of Balance Technology will stand in good stead in achieving this objective. On the basis of the detailed study of a number of projects taken up in the Second Plan, the Committee on Plan Projects has attempted to apply this technique for a few representative projects.

The projects taken up for study are: (a) construction of 50 pre-fabricated school buildings (b) construction of grain storage structures (c) construction of a bridge (d) sewerage and sewage disposal scheme for a town. The charts with regard to these are given in plates 2 to 5 appended to the original publication.

The Line of Balance (LOB) study comprises the following 4 steps listed in the sequence in which each is developed: (1) The objective. (2) The programme-production or construction plan. (3) Programme progress which indicates the status of performance at a particular point of time. (4) The line of balance which gives a visual comparison of the progress with the objective in view.

The Objective: the first step is to determine and set down the objective which may be the delivery schedule of the end item or items in view. Where the end product is a number of identical items the objective chart is set out by plotting the number of end items to be delivered at different intervals of time. For example, 15 pre-fabricated schools are to be delivered at the end of 6 months, 15 more at the end of 9 months and so on.

In the case of single end products such as the construction of a bridge or com-

pletion of a sewage disposal scheme, the objective chart has to be set out either in terms of the extent of physical completion or expenditure incurred with reference to time. The chart naturally may or may not be a straight line. This may not be of much significance as the line of balance depends to a great extent on the objective graphs of individual components of the end item. The compilation of these graphs is based on the lead-time for the various components which is described in the succeeding paragraphs.

Programme: the second step is the determination and setting down of the programme. The programme is the planned process of production or construction. The construction of the programme chart in terms of key operations and their lead-time relationship to final completion is the most vital stage in the line of balance study. The plan should cover all the operations from initiation of work through the assembly portion or construction processes to the point of delivery or completion. In a production process, an observation tour has to be made to observe the physical layout of the plant processes involved and the sequence of operations. The trip should be made *in-reverse*, beginning at the delivery end and ending at the point of raw material intake. For a construction programme, a similar *in-reverse* study has to be made by experienced construction engineers tabulating all the contributing steps and the time at which action on each has got to be taken prior to the fixed date of completion.

The criterion of selecting "control points" is not so much their financial implication but their limiting or halting influence on the programme as a whole. After selecting the points, the 'lead-time' has to be calculated in a realistic way. Determination of the points to be monitored and the establishment of the

proper lead-time for each, require comprehensive understanding of the construction process. With more number of control points, the *sensitivity* of the programme is enhanced.

Allied to the lead-time is the extent of time coverage for each constituent item; as for example, the *time coverage* for cement is more than that for high tensile steel even though the lead-time for both is the same. This is because of the fact that the production process dictates that the supply of high tensile steel has to be covered within a shorter range of time while that of cement can be over a longer range. This incidentally helps in budgeting for materials and ordering out their supplies according to a phased programme.

The construction of the objective curve for individual items of single-end-item projects follows from the programme chart and the extent of time coverage for each item. "Manufacture and supply of steel bearing," for example, has a lead-time of 24 months and a time coverage of 16 months. The objective graph for this therefore should start from the origin and cut the completion level line at the end of 16 months. "Collection of material for approaches" has a lead-time of 9 months and a time coverage of 6 months. This means that this item of work should be taken up in hand 15 months after the start of work and completed within another six months. The objective graph therefore will start from the abscissa at the 15th month and merge with the completion level line at the end of 21 months from the start of work. Strictly speaking the objective curve of individual items should be parallel to the objective curve of the item as a whole if the required rate of availability for an element of the end item is the same as that of the completed item itself but generally this is not found to be so. The objective

curve of each item may lead or lag the curve for the item as a whole at varying degrees of divergency.

The reckoning of time along the abscissa may be in terms of months, fortnights, weeks or even days according to the time of completion of projects and the accuracy with which the graphs are to be drawn. For easy interpretation, the programme chart can be coded by symbol, colour and number to indicate the type of operations performed at each control point. The numbering should be serially done starting from the top left hand corner. This will result in a number of "sequential phases" such as the final assembly phase, major sub-assembly work, other contributory works etc.

Programme progress: in the two steps explained above, we have developed (i) a graphic presentation of the objective; and (ii) a pictorial presentation of the planned manufacture or construction process with a view to achieving the objective as contemplated. The next step in this study is the development of the progress chart which aims at giving at a glance the actual performance on various constituent items at a given time. The construction or production progress is usually depicted in terms of units of end items. In single end item projects, the progress is depicted as a percentage of each constituent element. The information for compiling this is obtained principally from a physical inventory for each control point, which can be obtained through progress reports and/or through physical verification.

In big construction programmes it will not be unusual to find control points which represent a group of operations or supply of different categories of the same material. A case in point is the supply of steel bars which comprise of different diameters according to require-

ments. The progress chart should show the status of the least available material of the group but the bar for this control point can be extended upward to indicate the status of the group as a whole but left uncoloured. Such bars are normally called "ghost bars". The position with regard to steel of small diameter is coloured while the remaining is left uncoloured which indicates that though the status of the control point will appear to be satisfactory, it is not really so as without the accumulation of necessary amount of steel bars of small diameter the work cannot proceed harmoniously. In drawing these bars it may be advantageous to use different colours for various control points and stick to the same colour for the same control point, both in the programme and progress chart. This will facilitate easy identification.

Now we come to the striking of the Line of Balance which is the pivotal centre of the study. With the setting up of the objective graph, the programme and progress charts, the accumulation and display of physical information is complete. The next task is the proper correlation of the intelligence so collected and displayed. This is accomplished by striking a line of balance which is the basis for comparing the progress with the objective. The line of balance has to be struck for a particular point of time. The balance line quantity for each control point depicts what should be available at that point in terms of the end products on the date of study, *to be in phase with the delivery schedule.*

The steps in striking of the line of balance are indicated below: (a) plotting the balance amount for each control point. This is done by starting with the study date on the horizontal axis of the cumulative delivery (objective) graph, mark off to the right the number of days, weeks or months of the lead time for that control point, draw a verti-

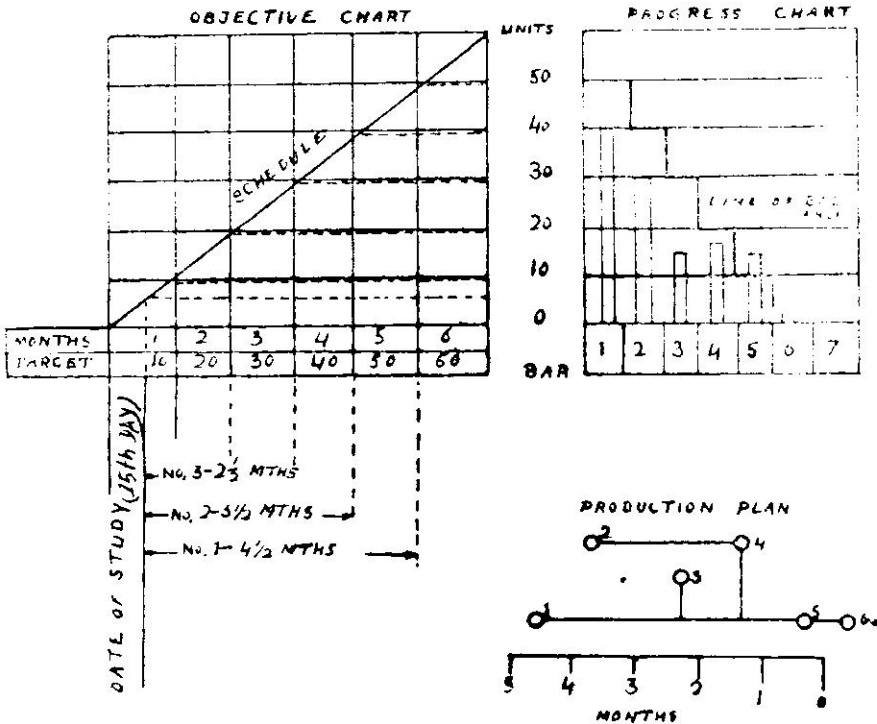
cal line from that point on horizontal axis to the cumulative delivery schedule. From that point, a horizontal line is drawn to the corresponding bar on the progress chart which will represent the balance quantity for that bar. (b) The horizontal balance line of all bars are connected to form a staircase pattern across the progress chart. A general sketch to illustrate the procedure is given below.

For single end item projects, the line of balance can be struck not from the objective curve of the item as a whole but from the objective curves of the individual elements constituting the end item. The balance quantity of an

individual item in that case will be the intercept of its objective curve with a vertical line drawn at the point of study. This in turn is projected on to the corresponding bar of the progress chart and the individual balance line so drawn joined to form the line of balance. In such a case the balance line will not necessarily be of a continually descending type, from left to right as in the case of repetitive end item projects.

The next step is the interpretation of the chart and the critical evaluation of the production or construction situation as depicted by the various elements of the chart. Some of the observations from such a study may be plain and

STRIKING THE LINE OF BALANCE



obvious while others though necessarily not so obvious may be of fundamental value. The primary purpose of the chart is to find out whether the progress is in phase with the objective or not. The bars which are below the balance line are the elements which require immediate attention. The shortfall in each case can be qualitatively and quantitatively assessed so that the management can take adequate steps to remedy the situation or adjust the work on other elements, in such a way as to avoid idle investment. On the other hand, the bars which reach much above the balance level indicate the pattern of investment which warrants a judicial check. In certain cases extra investment may be necessary either due to uncertainty of availability of some items or the pattern of development which may have to be of a continuing type. In either case, the management can take a conscious view of the situation. In certain other cases additional investment may be of no value. The investment in such a case has to lie idle which in the context of an overall programme and control of expenditure is not desirable. The management in such cases can either stop further accumulation at that control point or divert stocks to more profitable use elsewhere.

The balance chart on the whole gives the pattern of imbalance of the various constituent elements in a pictorial way capable of qualitative and quantitative assessment at all control points which cannot be obtained by any other means. Such a pictorial view will enable the management to take corrective steps in time to restore the balance or readjust the objective itself. A reorientation of the objective may be necessary, in case the original objective line is incapable of achievement because of inherent difficulty in the procurement of certain constituent elements. A redrawing of the objective line, therefore, becomes imperative and this can be done logically

and in a more realistic way from a line of balance study.

There are certain other valuable items of information that can be derived from the actual delivery curve and the planned delivery curve. The comparison of the slopes of the two curves will indicate whether the current lead or lag at various control points may be expected to continue or not. Horizontal differences at any control point between the curves indicate the lag or lead in terms of time while the vertical difference indicates lead or lag in terms of completed units.

The line of balance so far we have discussed has been drawn for a particular point of time. We can extend the principle and draw the line of balance even before the starting of work for different points of time. The line of balance for different points of time will be of a staircase pattern with the right hand end sharply rising until the line of balance becomes a straight line parallel to the abscissa at the stipulated period of completion. A study of this chart will indicate the rate of performance which should be achieved at any control point. For example, the different lines of balance applied to a given case may indicate the rate at which cement has to be procured. In the case of materials which are not scarce, a knowledge of the rate of supply will preclude idle investment and will enable the executive at site to plan the procurement in a logically phased manner.

In the absence of such technique and study, one is apt to overspend on items which are easily procurable. On a little reflection, it will be clear that there is no progress at all in the real sense of the term excepting accumulation of some material ahead of its use. Locking up of capital in such a way is injurious to the successful implementation of the programme especially when

the finances available do not match the demands of the situation. Such lopsided planning and execution bring out a bigger gap between the commitment of expenditure and the realisation of physical assets. The line of balance technique applied to the projects as a whole and the individual schemes comprising them will help in the avoidance of such wasteful situations. Another intrinsic value of the study is that it enables orderly thinking on the part of the project officials and the management of the various controlling steps and their logical sequence in time and causation. It is difficult in such an analysis to overlook any item of importance.

Yet another advantage of this technique is that it enables different levels of administration to view the project on a common basis. The line of balance chart as explained earlier can be constructed for the use of an administrator, the top executive or middle management. The basis of construction is the same but the points of consideration may be different to suit different responsibilities. It is needless to empha-

size the necessity for such coordinated view of the projects at different levels if the programmes, so vast in magnitude and varied in character as envisaged in the Five Year Plans, are to be successfully implemented.

The technique of line of balance study is apparently quite simple. Its effectiveness, however, in surveying a wide range of programmes is of great value in that a coordinated picture is obtained of all important factors needed for a critical evaluation of schemes and for a correct appreciation of the achievements and set-backs. The principle of the technique is a broadbased one and can bear effective application on any type of project whether it is the setting up of seed multiplication farms, construction of facilities, such as schools and hospitals, or the administration of a training programme. The utility of the study is further enhanced by the fact that it can be applied with equal advantage to projects with single-end item, multiple-end items and varied end-items. It is a technique of universal application.



We should beware of thinking that we have done something, when we have only said something. We must not use words as an excuse for inaction or a substitute for thought. Many phrases, for example, 'good human relations', 'work study', 'incentives' and 'automation', have, in turn, tended to dominate our thinking. There is a temptation to believe that here at last each time there is a magic key which will unlock the future. But progress is not like this. True progress is much more likely to come from an endless series of small advances rather than from isolated dramatic battles.

Management Responsibility for Industrial Harmony

JEHANGIR GHANDY*

Two questions immediately arise: First, what is meant by this pious-sounding word, *harmony*? And, secondly, is it right or even possible to single out management responsibility for harmony in an industrial situation in which there are at least two other active parties: the employees and the State?

HARMONY should not, I feel, be interpreted to mean the absence of conflict, since the industrial situation is, *per se*, one of conflict. As Stuart Chase says in his thought-provoking book, *The Proper Study of Mankind*: "the sharp division of the factory hand's day between work and leisure is itself something very new in human history, unknown to the agriculturist or the craftsman. For eight hours, the industrial worker must submit himself to rules made largely without his participation, which prescribe his duties, govern his pace and his movements into and out of work." A group of labour economists have reiterated the same truth: "He resents the imposed disciplines, which circumscribe his freedom; he toils at a task that he often finds distasteful; and he can be seldom certain that his compensation is adequate to his needs and commensurate with his contribution". These experts conclude, therefore, that the workers' natural state is one of discontent in some degree. And, for once, I think, we can all heartily agree with the experts.

While the discontent that gives rise to protest is something inevitable, there is no reason at all why this protest cannot be directed and managed to prevent damage to the productive relationship between men and management. Harmony means to me, therefore, a climate of mutual understanding and esteem which helps to engender and strengthen a sense of common purpose.

This, in the Indian context, must imply a willingness to temper group interests to the over-riding need for rapid economic growth. In practical terms, this means raising the efficiency of each enterprise to generate larger surpluses, to provide funds for expansion and growth, and also to provide the wherewithal for improving the workers' standard of life through direct monetary benefits, improved social security provisions and better welfare amenities. We should frankly recognise that the requirements of growth and the claims of labour are competitive. Not only in India, but in all rapidly developing countries, many hard decisions will have to be made between the alternatives of capital formation and higher wages.

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Management has the *primary opportunity and responsibility* for utilising the factors of production, including human resources, in the best possible way. As Charles Myers puts it: "To the extent that recruitment and direction of the labour force are the essence of the managerial responsibility, private or public, the initiative rests with management". Besides, the managerial class, enjoying the advantages of comparative affluence, education and culture, forms an *elite* group, and has, therefore, a moral obligation to supply the initiative.

The task is undoubtedly difficult, and I have no illusions that there are any short-cuts to harmony. A whole complex of factors enters into it: from adequate monetary rewards to the intangible psychological satisfaction that a worker derives from doing a relatively complete rather than a fragmented task. Old style managers were all too prone to dismiss psychology in the work-place as a lot of *mumbo-jumbo*. But the empirical studies done by Elton Mayo and others who followed him, have amply demonstrated the importance of human relations and group dynamics in the work-place. I agree with Sri Ramanujam's thesis that the relationship between manager and the managed must be humanised. If I may quote him, he has urged "employers to stop thinking of workers in terms of mere tokens and tickets numbers", and reminded managers that "a worker must be dealt with as a human being and the relationship should be one of partnership between management and workers rather than that of master and servant".

Managements have a strong belief that it is their inherent right to manage the enterprise, and this gives them certain prerogatives. Throughout the world, unions are, however, trying to widen the area of collective bargaining, claiming the right to participate in management and calling into question such manage-

ment rights as its decision on profits, depreciation reserves, production schedules, replacement of machinery and so on. This erosion of management authority has gone farthest, not in socialistically inclined Scandinavian countries or Britain, but in the citadel of private enterprise, the United States of America. Voices have been raised in alarm on this penetration of management by unions but the process goes on even in such famous and well-run enterprises as General Motors and Ford.

The arguments behind the union challenge to management prerogatives are three-fold: First, workers as citizens have an interest in the conduct of business, and their interest in this capacity extends to all aspects of the management function. Secondly, unions hold that the enterprise is an agency through which the worker sells his services to the consuming public, and he has a direct interest in knowing whether the enterprise serves as an efficient middleman. Lastly, challenge is offered when managements are asked to justify the rejection of a wage claim by placing all the facts about the economic health of the enterprise including its financial and pricing policies on the bargaining table. In India, it is fair to say that challenges on this sophisticated plane have not yet been offered, but given the prevailing climate of thinking, there is no doubt in my mind that these questions will arise and will have to be dealt with. As I see it, there is no finality about management or union prerogatives. A great deal depends on what is considered right in a given social and economic context. But the technological requirements of modern enterprise are such that there is growing specialisation of managerial responsibilities, and responsibility can never be satisfactorily divorced from authority, which management has to reserve to itself. It would help us to overcome the ideological and

ethical challenge involved, if we were to regard management as a trustee, holding the balance among the shareholders, the employees, the consuming public and society in general. Given this approach to professional management, it should be possible to resist on a moral plane encroachments on management authority.

Harmony requires an integrated approach which will take into account all the tangible and intangible factors that contribute towards a healthy state of mutual understanding. A good example of this approach is the code of discipline ratified at the Nainital session of the Indian Labour Conference in 1958. Its provisions range from prohibition of unfair labour practices like go-slow, or strike without notice, to a general plea for recognition of rights and responsibilities of either party. That the code has had some success may be inferred from the reduction in the man-days lost through stoppage since 1958. I am personally inclined to agree with Sri Nanda that it will take time to cast off old prejudices and habits of the previous ten years when both labour and management were relying to an excessive degree on State intervention. I therefore endorse the plea made for wider acceptance of the code and more rigid enforcement of sanctions implicit in it during the next plan period. I also agree that employers should take the initiative in honouring the code and thus set the pace for labour.

While I have no doubt that the code of discipline, if faithfully observed by all parties, will help to strengthen industrial peace, I am not so sure that the general improvement in industrial relations can be maintained in the coming years if inflationary pressures keep on mounting. In fact, inflation as a cause of industrial conflict is a problem all developing economies are faced with in India, as much as in Latin America, Middle East or South-East Asia. It has

been stated that the value of the rupee has fallen by some 20 per cent since the beginning of the Second Plan, with a resultant erosion in the real earnings of workers. If we take 1939 as 100, real earnings did not get back to the pre-war level, until 1952. In the next three years, there was a significant rise in wages in real terms because of the fall in foodgrain prices and the general price level, with the result that, in 1955, the index of real earnings stood at 114. It fell sharply in the next year to 105, and was down at 104 in 1957, the latest year for which I have statistics. It is reasonable to infer that the fall has continued because of the sharp inflationary increase in prices from halfway through the Second Plan. The INTUC memorandum on the Third Plan, to which I have already referred, makes a strong plea for insulating the pay packets of workers from the ravages of runaway prices. It is, however, clear that industry cannot by itself undertake to neutralise fully the rise in the cost of living. Employers' organisations have declared that full neutralisation is not possible, although they have affirmed their readiness to *revise wages where increases in productivity justify doing so. Quite clearly, this is the only long-term solution possible*, but in the short-term—and we are now thinking of the next five years of the Third Plan—each enterprise will have to reckon with the problem as best as it can in the light of its own economic situation.

These negotiations for wage rises need not, however, necessarily disrupt industrial peace, not at least to the extent that happened in the early 1950s, provided managements make a real effort to build up workers' confidence by following sound industrial relations policies. It is possible to imagine that where healthy relations exist, employees will be willing to temper their demands, keeping the larger interests of the enterprise and the need to safeguard its eco-

economic viability in mind. When managements plead inability to meet a demand on the plea of financial inability, I rather expect that they will have to agree to place on the bargaining table full information about their economic situation to enable workers' representatives to judge the validity of the management's arguments. During these discussions, I anticipate questions of overheads and other expenditures may well arise, the union representatives trying to show that increases in avoidable overhead costs have been permitted at a time of financial stringency. These discussions will inevitably raise the question of where management's inherent rights end and the union's rights begin. I can attempt no ready-made solutions except to suggest that a great deal will depend on the degree of mutual confidence subsisting between management and its employees. It would be prudent, I think, to prepare for the eventuality in advance by taking steps now to improve and strengthen the relationship.

Union rivalries pose a grave threat to industrial stability, and it is a hard fact of life which we must face up to. The effect of these rivalries has been deplored often enough. I recognise the real helplessness of managements in the face of this problem. I can only reiterate the plea made by my distinguished colleague, Mr Naval Tata, that strong trade unions are the pre-requisites to industrial peace. It might seem a contradiction in terms to suggest that managements should take a hand in building up sound trade unionism. If managements adopt the policy of recognising the most representative union, provided it operates within the democratic framework and accepts the obligations imposed on it by the code of discipline, and deal exclusively with it in all matters pertaining to collective bargaining, they will have done their bit towards promoting healthy trade unionism.

Another problem, that is bound to come up frequently in the next five years, is rationalisation. The Second Plan recognised that *it was not in the larger interests of a developing economy to freeze the existing techniques of production*. The planners themselves favoured, therefore, attempts at rationalisation provided these did not lead to unemployment. Secondly, they laid down that prior consultation with workers was necessary and that changes should be effected after improving working conditions and *guaranteeing a substantial share in the gains from higher productivity to the workers*. While the general principles have been accepted on all sides, difficulties arise over details at the unit level regarding the apportionment of the workload, redeployment of surplus workers and finding alternative jobs for them, and finally in the share-out of the gains. The planners had hoped that these problems of detail could be settled after technical examination by independent experts. The INTUC feels that rationalisation, directed principally towards workers during the first two Plans, should now be focussed on management! INTUC wants rationalisation of managements to be effected equally in both the public and the private sectors.

Experience at Jamshedpur

Here again, we have a very vexing problem, and I have personal sympathy with the union approach seeking to safeguard the jobs of its members in a situation of chronic unemployment. At the same time, going back to the first principles that labour policies should be geared to the requirements of economic growth, we need some workable basis for effecting rationalisation and *increasing per capita productivity*. It will be pertinent to cite our own example at Jamshedpur, where a doubling of the plant capacity has been achieved without any significant addition to the labour force. This has very nearly solved the

intractable problem of labour surplus which had plagued us for many years—a surplus recognised by even an impartial body like the Planning Commission. We never contemplated retrenchment to get rid of the surplus, because that would have cut right across our traditional policy. We sought and found a solution in expansion. At the beginning of the expansion programme, we entered into a detailed agreement with the Tata Workers' Union, the preamble to which stated that good and cooperative management-labour relations were important for the timely implementation of the schemes of modernisation and expansion. In a section entitled "Productivity", the first clause expressly stated that "*the union, its officers and its representatives agree to give their full support and cooperation to the company in the matter of securing improvement in labour productivity*". The Company, likewise, assured that there would be no retrenchment, present earnings would be protected and that employees transferred from one job to another—the reference here was to jobs in the new plant—would be trained at company expense for their new responsibilities. The union conceded to management the right to fix the number of men required for the normal operation of existing sections or departments, but provided for an appeal to arbitration by independent experts, mutually agreed upon or nominated by government, in case of any disagreement on the issue. Full discretion was, however, given to management with regard to the staffing of new departments. *The management, on its part, expressly undertook to offer an appreciable upward revision in wages and emoluments in recognition of the increased labour productivity.* An agreed basis was thus laid for bringing about the absorption of surplus labour in the new plants. This is how we set about "rationalisation without tears".

We had, of course, the advantage of *synchronising rationalisation with a massive expansion*, and also the further advantage of a strong and responsible union leadership, conditions which might not obtain in all cases. The facts enumerated might, however, provide a pointer to the direction which management efforts might take, as is borne out also by the experience of other enterprises. To sum up, managements must attempt to *understand and meet the legitimate fears of workers affected by technological change*. The steps taken to prepare the workers for rationalisation provide managements with an opportunity to demonstrate their good faith, particularly in the efforts they make to reduce costs other than labour costs.

Mutual understanding and goodwill are essential if any progress is to be made towards solving the admittedly difficult problems of management-worker relationship. I propose to discuss here a method of improving understanding, which has shown promising results at Jamshedpur. I refer to employee association with management: an idea which we accepted in the 1956 agreement with the Tata Workers' Union. Since we embarked on this experiment, joint councils have come up in another two dozen units. As we understand it, the purpose of these councils is really to heighten the sense of belonging by giving workers an opportunity of participating in the operation of the enterprise. I should perhaps qualify that the constitutional provision gives the joint councils only an advisory character. In practice, however, the recommendations of the councils have, by and large, been implemented; where for some reasons this is not possible, an attempt is made to explain, as fully and adequately as possible, the reasons for non-compliance. The work of the joint councils, we like to think, satisfies the worker's urge for self-

expression and gives him a greater interest in the efficient running of the enterprise, because he is now in a position to make his views heard on what should be done and obtain answers to his questions at three levels: the departmental level, the works level and also right at the top level where we have a joint consultative council of management, of which I am the Chairman. This apex council has the important right of discussing general, economic and financial matters concerning the Company, except: the reserved subjects of its relationship with shareholders, managerial staff, taxes or other confidential matters.

These joint councils are composed of equal representatives of management and workers, except the top council, where the management appoints an additional member to act as the Chairman. The bringing together of men from the shop-floor representing the workers with the top people of the department in the department council has a salutary educational impact and leads to great improvement in the understanding of each other's viewpoint. In order to stimulate ideas from the constituency that the worker delegates represent, agenda committees have been set up, whose work is to collect suggestions and ideas from all sections of workers for discussion in these councils. As part of the reporting back procedure, minutes of the council, drafted in simple English and Hindi, are put up on notice boards in that department. A new feature, introduced as a result of initiative from below, is an annual meeting of the department, where general issues are discussed in the presence of the entire work force and at which senior management representatives are on hand to give first-hand answers to questions of policy on which their comments are invited. Attendance at the annual meetings and the enthusiasm noticed convinces me that this innovation is wholly desirable. This apart, we held two meetings at

which our Chairman, Mr JRD Tata, invited the entire membership of the joint councils running into a couple of hundreds to have tea with him and raise with him any matter on which a member wanted his views. We hope to repeat these very successful meetings during future visits of the Chairman to Jamshedpur.

We have taken care, however, not to allow any matter pertaining to collective bargaining or the union sphere to be discussed in these councils. Failure to do so would have meant by-passing the union and undermining its position which industry in its own interest, must guard against. Secondly, management has in this initial period taken the responsibility not only for providing the secretarial service these councils need, but also for communication and dissemination of information. Thirdly, it is fair to add that the success of the councils at Jamshedpur derives from the fact that we have a strong and well-organised union, already dealing with the vexatious problems of grievance, wage rates etc., separately, leaving this new machinery to concentrate on production and welfare.

I just dealt with joint councils and the advantage of widening joint consultation to give employees a sense of participation and belonging. It is, however, clear to me that joint councils cannot be a substitute for good *man-management* and sound management practices. The first essential is leadership of the right quality at the front line, supervisors on the shop-floor. In a plant like our steel works at Jamshedpur, a good many of the supervisors have come up from the ranks and are neither highly educated nor sophisticated. Getting them to feel that they are members of the management team is a difficult and time-taking job, made worse by their comparatively advanced years. We have a staff training department through which we have been giving TWI course to equip these

men for their supervisory role. We have also started a course in foremanship in which we are putting two batches of 40 men through a 9-month course with the object of developing the qualities and skills required in man-management. Five years ago, we put all 1200 supervisors through a week-long full-time company information course with the object of giving them a background of the Company history, Company's policies and practices. At the end of the week, there was a question and answer session between the batch of supervisors taking the course, and a senior management representative, where ideas and views were frankly and fully exchanged. The course proved quite popular, particularly because of its last feature which gave men an opportunity to get things off their chests, and also provided management with a rare insight into supervisors' thinking and morale. We have now plans to repeat the course not only for the benefit of the new entrants into supervisory ranks, but also for those already covered, because a second exposure will be of benefit both to them and to the management.

I should like to emphasise that harmony is often jeopardised by many small and relatively unimportant matters like shortcomings in re-

cruitment and selection, inadequate attention to induction and placement of personnel, unsatisfactory promotion policies etc. All these may be classed under the general heading of good management practices, about which the personnel specialists have written volumes. Each enterprise should take a periodical look at its practices either by itself or in consultation with outside experts to discover and rectify the lacunae that may exist. The total impact of all these sub-divisions of good management is very considerable, particularly on morale. The call made by Sri Ramanujam for rationalisation of management is not an empty counter-charge.

Management as Laurence Appleby says is essentially getting things done through the efforts of other people. But this requires a deep and real understanding of why men work, and how they can be motivated to work better. That is the crux of all management, yet how little time and effort is spared to build up the essential skills of man-management compared to the enormous outlays on technical education and training to gain an understanding of and control over the machinery we work with. Yet all the machines in the world will be of no avail without the people that stand behind them.



"So Mr Gossett finally began to give some to the union and that was the time I had been waiting for. I knew things couldn't go on like this for ever. If we kept on fighting, we just would kill each other off. I was hoping to see the day when we would live like people, so when Mr Gossett began to give a little, I gave some too. That was easy to do then because *half of the grievances we had in there didn't mean a thing and were just put in to make things hard for management...*"

Theory and Philosophy of Management

WILLIAM E. ROBERTS*

The areas here covered are: the role of management and the jobs of management. The author also touches on the theory of management by objectives or pre-planning and discusses techniques for the evaluation of performance. Following this discussion on theory the author tries to get us back down out of the clouds and talk specifics. Throughout the background is the author's own experience how his own company utilizes this philosophy in actual practice in planning and developing operational plans and objectives.

WHAT is management? Management is the dynamic life-giving element of any business enterprise. Resources of production remain resources until management acts. Such resources never become production until they are made to do so, by act of management. The quality of management determines the success and actually the survival of the enterprise. *Management in the net and in the broadest concept is the only advantage that one enterprise has over any other enterprise.* Management itself is a very distinct group in today's industrial society. We used to refer to "capital and labor" the trend throughout the world today is to make this reference "management and labor." Very specific education is required to train for managerial responsibility. Extensive training and background and education in management and in management techniques and skills is mandatory in order to be a good manager, and

to be competitive with your counterpart managers of your competition.

This, however, is a recent trend. A managerial society, as an important factor, has developed only since the turn of the century. Management as a group has actually evolved in the past 50 years. In the opinion of competent observers, it will remain as an important factor in society of the future. It is not a fad by any means. Management believes that it is able, and this is one of the most important elements in the total theory of management. management believes it is able to control its livelihood; that it can control its environment through systematic organization of the economic resources entrusted to it. It believes that *economic change is a very powerful factor that can be used properly for human betterment and for social justice.* It believes too that *management per se can be used for further development of the human spirit, not just materialism.* This management concept is new; it's modern. Some societies existing today, many of them, still believe that they must limit themselves to available resources. They believe that there is a

* Leader of the Top Management Team, which recently went round the principal industrial areas, conducting seminars. See article on NPC.

restriction on their control over their environment. They believe that economic change should be viewed as a very definite danger to society and to the individual. They feel that government's first and prime responsibility is to prevent economic change. They believe that this is security. *Management is a very specific organ of today's society. It must make the resources that have been entrusted to it productive. It must create organized economic advance;* this is one of its prime responsibilities. It is in fact indispensable in our particular economy. Management has grown extremely fast as a group and it has grown with extremely little opposition.

Considering for a moment the question of the importance of management, it is obvious that the competence, the integrity and the performance of management will be decisive to the democratic world in the decades ahead. As we shift to a peacetime environment, we must be able to shift our plans and objectives quickly for proper use of the resources entrusted to us as management. When you shift from a complete wartime economy to a peacetime effort as we have in the United States, you can lose total control if you do not have adequate and intelligent pre-planning by good management. It is the management decision-making that enables you to make these sudden shifts and meet changes as they arise. We see no end to such economic shifts generated by political pressures; they are in existence and they have to be taken into account. *Good aggressive management can make society climb and improve. It must avoid the—"defend what we have" attitude, and push and promote the—"let's advance further" theory and theme.* The democratic world has an immense stake in the development of the competence and the skill and the responsibility of management regardless of which kind or type of enterprise such management is employed to handle.

Despite the rapid rise of management in our particular society, people in business themselves just don't know what it does; they don't know what it's supposed to do; they don't know how it acts; and they don't know why it acts. They don't know either whether it is doing a good or a bad job.

Management is the specific organ of any business enterprise. The enterprise in itself cannot act. Management does. By itself, an enterprise has no effective existence; to be alive and to function the enterprise must have management. This is true regardless of whether the enterprise is private industry or whether it's one of the trusts in Russia or whether it's one of the socialized industrial activities of Great Britain. Management of business differs widely in different areas. Management differs between government, church, army and business, and it differs in a very specific sense. Illustration of the military can be cited as a specific; but it should not therefore be assumed that management differs on all premises. Actually business administration, business management, or management of an enterprise is applicable almost across the board whether a service organization, military, church, or the individual business enterprise. But the basic fundamental difference lies in the fact that in the business enterprise, industrial enterprise, the purpose is to supply either goods or services. Also it has a secondary objective of strengthening society within the political and the ethical beliefs of that particular society.

The vital principle which determines the nature of a business enterprise is its economic performance. The existence of the business itself is justified only by the economic results achieved by it. There are secondary factors that certainly are important. Some of the non-economic results of the business enterprise are the happiness of its members,

the welfare of the community in which it operates, the system of development of the culture of the community in which it operates and so on. *Management and the enterprise, however, both fail if they fail to provide an adequate economic result.* The enterprise must supply both goods and services that are wanted by the consumer at prices which the consumer is willing to pay. It must improve or maintain the wealth-producing capacity of the resources that have been entrusted to it. On the other hand, the economic results from a military activity are very, very secondary, the purpose of the military as a specific is not to provide goods and services *per se*; they do that in some ways, but their principal responsibility and objective is security; security of the area or land that is entrusted to it. Economic factors, economic returns are not their principal objective. This is true also in other ways of the church and different service functions.

Management's job can be reduced to three specifics. The first of these is purely and simply that of managing the business. This implies a very severe limitation of the responsibility of the manager. The successful business manager is not necessarily transferable to church, army or politics. Management is the prime function in business. It's only one of several factors in other fields. Management can never be an exact science. Management is not a hunch or native ability; all of the elements of management can be analyzed; they can be organized and they can be learnt. The days of the intuitive manager are past or at least they are very very limited. The manager can definitely improve his performance. He can do this through the study of principles, the acquisition of organized knowledge and the analysis of his own performance. The impact of the manager on society demands great self-discipline and a very high standard of public ser-

vice. The test of management still remains, however, business performance. *Achievement, not knowledge, is both the proof and the aim.* Management is a practice rather than a profession or a science.

The scope and authority of management are severely limited. It must exercise social and governing authority certainly within the enterprise itself. The importance of enterprise and the growth of this segment in our society, however, has made it become one of the leading elements in industrial society. It has no authority, however, beyond the discharge of its economic responsibility. It is usurpation of authority if management goes beyond this responsibility for business performance. Management is only one of several leading elements in any given society. If it ever becomes all powerful, just as if any other group may become all powerful, it will be rebuffed; it may lead to anarchy, or it may lead to dictatorship with a total loss to all.

Management is not passive, it is creative. It acts to make the desired results come to pass. It can also choose rationally between different courses in effecting its decisions. The passive reactor approach of management is quite outmoded. Management is responsible to help shape the economic environment in which it operates. It must plan, carry through and initiate change. It must *challenge itself to push back continually any limitations* that it may face. It must *make what is desirable possible and then bring it through to actuality.* Management is the mastering of its economic circumstances, altering these circumstances by very conscious effort and action. This is in essence, managing by objectives and managing through pre-planning.

The second phase of managerial responsibility is that of managing manag-

ers. A productive enterprise is created out of both human and material resources. *The enterprise must be capable of producing more than the total resources entrusted to it.* The resources capable of enlargement are only the human resources; all others are under the laws of mechanics. Managers in this array of resources are the costly factor in the entire enterprise. Investment in managers are not shown on your books. They are not tabbed up as values of X amount. However, if you were to do so you would find in American enterprise that they are valued at more than the total remaining resources involved in a business enterprise. We must use this investment as fully as possible. Managing managers is to make the resources productive by making an enterprise out of them. This is a very vital and it's a complex job.

The final function of management is that of managing both the worker and the work. The resources to perform the work is certainly the workers. This ranges across the board from the very unskilled effort all the way up to the topmost skills available. It is the responsibility of management in this area to organize its work suitably for human endeavour. The organization of people for the greatest productivity and effectiveness is one of the prime responsibilities of management. It must consider the abilities, the limitations, the values of human beings in all its planning and all of its decision-making. It has control over whether and how much, and how well these workers work. It must develop adequate motivation, participation, incentives, rewards, provide leadership, status, to all of the working functions and to the workers. Management alone can satisfy these requirements.

There is another factor of time: the dimension of time that must be considered in equating management. Manage-

ment must plan: it must consider both the present and the long term future desires and planned objectives of the enterprise. The time span for "prove out" for any decision-making in an industrial activity at this time has lengthened very substantially. Since the war, in America and this is true of many other nations, the innovation in product and the turnover of product items has greatly accelerated in this post war period and the span from the conception of an idea to the availability of that product for market has lengthened very appreciably. This implies that the element of time when decisions are being effected must be considered in intelligent decision-making. Management decisions again must assure both present and long term profitability for the success of the enterprise.

In summary, there are these three jobs of management: managing the business, managing the managers and managing the worker and the work. All of these can be analyzed, all of them can be studied and appraised separately. There is a present and a future in every one of these factors, a different dimension that must be considered. And management cannot separate these factors in effecting its daily decisions. Further, management cannot separate decisions involving future and present. Each management decision affects all three of these areas, and no one predominates or should be permitted to be considered more important than the other.

Let us now consider: "what is a business." Two of the most common answers that would be given would be first, that an organization is one that has been conceived for the purpose of making a profit, or that it might be an instrument for maximization of profits. I don't believe this. Peter Drucker again in his works which many of you will have read, does not believe it; most American business does not believe it

either. We believe that profits are good: profits are mandatory in order to provide a means of existence of any given enterprise; profits must be made in order to generate a business economy, in order to provide for good community of business activity. However, profit is a means to an end, not the end in itself. Profits are mandatory and *I am very proud of the profitability of my own enterprise* and I shout it from the rooftops and every one else involved in any kind of business enterprise should do the same. *Profits are good; they are not bad. Profits again should be, must be made, in order to keep any given business enterprise alive.* Profits must be made in order to provide an adequate return to the investor in that enterprise. And one other dimension, enough profits must be made by those individual enterprises that are profitable to override and provide for those enterprises that lose money in any given economy, because in the net, in the total community there must be more profits than losses in order for the community to survive.

The purpose of a business, carrying through with this, and realizing that profits again are not the end but the means, the purpose of the business in my opinion is to create a customer, and customers in turn can only be created through two major areas, those of marketing and innovation. In the end it is the customer that determines what the business is. The business having just these two functions of marketing and innovation, its purpose is to market a product or a service. Modern marketing has caused a change from "sell what can be produced," to the philosophy of "produce what can be sold." This in turn is a very, very important factor that has changed the total face of business enterprise in America as we know it today. Again this is pushing back barriers, it is not accepting limitations. The enterprise is not just a manufactur-

ing shop where you determine the total capacity of that enterprise and produce what it can turn out. By changing the philosophy entirely we go to the market place and determine what is wanted by the consumer, and produce what that consumer wants, *basing your total philosophy on the marketing concept.* Marketing is *the* specific function and it is much broader than just selling. The whole business must be seen from the point of final result. You must see it from the customer's point of view. This thinking and theory must permeate every single segment of the business enterprise.

Marketing alone, however, cannot make the business enterprise. No enterprise can exist in a static economy. The enterprise can only exist in an expanding economy: one that considers change both natural and normal. By this I do not mean that the business must grow larger, that it must grow bigger. What I mean in specific terms is that each business enterprise must grow "better" within that total concept. Innovation, the second of these factors, provides better and more economic goods and services and this may take many different forms. It could be the matter of lower price; it could be a new and better product; or it could be a new convenience. It could be the creation of a new want by the consumer; it could even be new uses of old products. And innovation is not limited to just the product theory alone. This is effective and mandatory for the business enterprise in design, in the product as well, in marketing techniques, in service to the customer and in management organization, methods or procedures, innovation is present in all forms of the business activity, and again, not limited just to the manufacturing area of the business.

Productive utilization of resources has to be clearly understood in the context of this philosophy of business.

Greater productivity is certainly the key to higher living standards. I believe this is true here in India as well as in Russia or anywhere else in the world. This involves a greater *balancing out of all factors for the greatest output at the smallest possible effort*. This is not just productivity per man hour that I refer to. Increased productivity is not achieved through muscle effort. On the contrary, it is always the result of doing away with muscle effort: substituting something else for labour, such as capital equipment. *Unskilled labour must be replaced gradually and ultimately with analytical, theoretical personnel*. This is a matter of substitution, *substituting planning for working*. We must plan and design capital equipment capable of replacing the unskilled labourer. This calls for a change in the nature of work: the replacement again of skilled and unskilled with both theoretical analysis and conceptual planning.

Productivity gains, however, are not just a matter of capital investment. One specific example was a Stanford research study that involved the identical usage of capital and capital equipment for a given process under controlled conditions in the USA and UK and in this particular case with identical facilities provided, with identical investment: the British installation was only one third as effective as the counterpart operation in the United States. Tracing this back to reasons behind the effort and the results, it was purely and simply a matter of managerial skills and basic planning for utilization of these resources.

Productivity is vitally affected by the organization structure. Unclear organization is merely a waste of managerial time and effort. If top management is unbalanced, has an unbalanced interest in either engineering or manufacturing or marketing or whatever it may be, the organization itself is going to be

swayed in that particular direction, or that particular segment of the enterprise and this is not healthy for the enterprise as a whole. Management must establish yardsticks for itself to measure its impact on productivity.

I'd like to give you eight areas for which, in my opinion, objectives of performance must be established and results must be measured in any successful business entity. These eight are market standing, innovation, productivity, its physical and financial resources, profitability, manager performance and development, worker performance and attitude and public responsibility. Management must determine what to measure and it must establish yardsticks for each of these areas being measured. This concludes my presentation of thoughts and ideas dealing with Management Philosophy.

I'd like to be more specific than this and give you an actual case study on Bell and Howell, illustrating how we have used this philosophy of managing by objectives, managing by pre-planning. We have what we call our 60 months forward planning program. We believe everything that I have stated here as a philosophical and theoretical base for the planning of our enterprise. We do plan by objectives, we plan by establishing plans *trying to determine where we want to be some five years out in the future*; in some areas we plan far beyond five years. We have set this as our principal ground rule, that plans must be made available, these plans must be flexible, they must be fluid, they must be continually subject to change. We forecast in detail every one of our products at given retail and net prices, we extend it by month, by product, for a period of eighteen months ahead, and by quarters beyond that for a 60 month period. We carry this thinking from our product forecasting, all the way through to faci-

lities planning, to capital equipment planning, to our financial need, profit and loss statement, personnel needs, *every single factor that comprises a business enterprise is planned in this degree of detail.* This becomes our master plan, and this master plan is put together and frozen once every six months. If sufficient changes come about during the six months period it would again be modified but *the thinking process on this plan is going on continually* during the year and once in a while, at six months intervals, we put it together, take a photograph of it and in this process circulate this back to our top management people. This becomes the working instrument for all of our key management people. It is our guide, it is our agreed objective for the management team itself. We have veered from that pre-plan over a nine-year period by only about one per cent in both turnover or sales volume and in profitability. This is what I call optimization of profits, consistent with both the short term and the long term objectives.

Let me relate one of these experiences of planning. We had concluded one of these plan sessions which involved in this case approximately three weeks of our top management time. We had finished the work and put this plan to bed, so to speak, but it bothered us. It was a good plan but it blended with our forecasts of the economic conditions and these portended a downtrend for us and the economy as a whole. We were bothered by it and the reasons for the unrest in our minds were these: the economic climate in the United States about June 1957 seemed to be soaring and in retrospect this marked the beginning of a downturn in our economy. The economy as a whole had been booming, and then all of a sudden a shift occurred, it plateaued off and started down. No one realized this until maybe September, October of that year. But more and more people were

talking about it and more and more firms were beginning to be hurt by this particular trend.

At that particular time Bell and Howell happened to have introduced a new camera product. It was quite a revolutionary item and we were enjoying in the third quarter of 1957 one of the finest periods we've ever had in our history, *the finest as a matter of fact.* We were selling more goods, we were earning more profits, we were employing more people than at any time in our history. We, however, knew that we were not living in a vacuum. The plan that we had just wrapped up and put together said that we would continue to enjoy a good fourth quarter of that year and for most of 1958 as well, but at the end of 1958 we would begin to trend with the economic cycle and we would begin to move down because our new product which had been carrying us at that point would have spent its course and we would then have to follow the normal economic curve lines. We didn't like this, and discussed possible alternatives. *We asked ourselves whether we really did control the economic climate or must we bend and roll with these factors* and just say that because they are present we must accept them and plan accordingly. If we had accepted them we would have done these things. We'd have trimmed back our capital equipment investment from a sum of 2½ million dollars to probably a million dollars and we would have planned for less people. Those who left us for any reason we probably would not have replaced, planning for a lesser total working force. We probably would have cut back on our advertising and all our marketing costs. We would have cut back perhaps even part of our research in development plan, we would have trimmed all along the line, pulled in the storm doors, battened down the hatches, and said *let's wait until the storm blows over.* This in essence was

what the plan said after we'd finished. This was what most American industry was doing at this particular time. Very thorough consideration was given to the barriers that seemed in our way. We asked ourselves again if we could push these barriers back; if we could help either as an individual company or cumulatively with other firms in the United States; *could we do something about the economy in which we operate. Our management agreed individually and as a group that a more daring plan could stimulate others and that the obstacles in our path could be removed.* A new plan was evolved and in this instance it was based on product. We reached way out into October 1958 (it was then late August or early September 1957) and we accelerated some of our product development planning. There were certain items, four specifically, that we found we could pull forward, we took these four new items that had already been pre-planned but hadn't been planned to be introduced for a year later, and we said every one of these we're going to put in a crash basis. We talked with the engineering and research development people and asked if they could give us these items: "Is there any way that you can accelerate your effort on these? Is there any way in which we can shorten our total product development cycle?" Two of them were obvious "yes," they could do these, a third one was "probably can be done," the fourth one looked almost impossible, but they said we will give this one every possible effort. "Plan on the three and the fourth we'll try to give you" and we then developed new plans around the availability of these items. This meant increasing our expenditures in the Research and Development area to accelerate these items. In support of this what did we do? We went back and reaffirmed our capital equipment program which was then as I indicated about 2½ million dollars. Almost in-

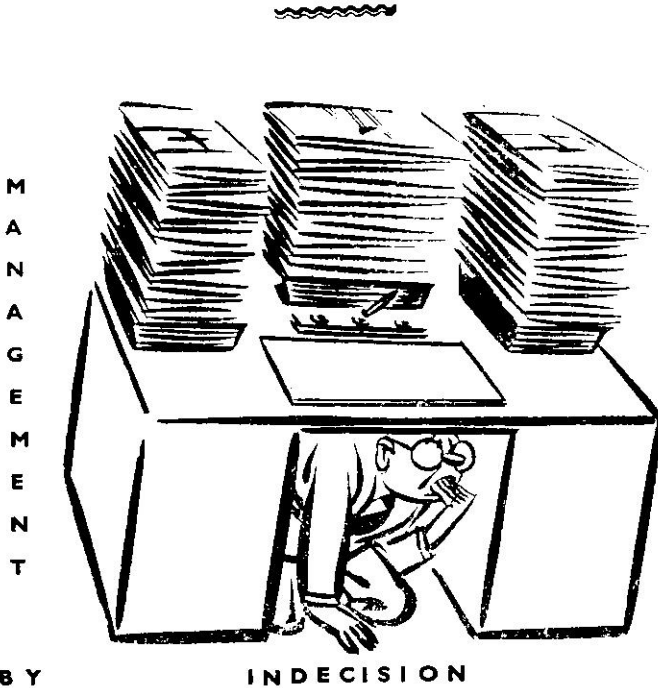
variably companies across the board in the United States were either cutting out or cutting down substantially their capital equipment purchase program. We reconfirmed ours. This meant to us when we did this that we got a 100% effort and immediate attention from every capital equipment supplier; they had people available and they had products available because no one was buying at that moment. We received the finest services, immediate delivery and special top talent helps from their companies because they were then available to us.

Moving off into the area of inventory, we agreed first on pricing; as part of this program we agreed that we would take certain of our products that were then in existence and drop those prices to what we considered to be an optimum level, in order to assure the maximum volume of sales. In support of this we had to produce very sizable additional amounts of products so it meant that we had to go out and hire more people. We added some several hundred people to our working staff within a period of a few months. We put several million additional dollars into inventory for build-up in order to have this product available when we announced the price drop which would occur two or three months later. In marketing we put an additional million dollars into our selling effort, not advertising, just the marketing activity in itself, including sales promotion and direct selling effort, warehouse activity etc. In addition to that we took another million dollars and went into the market for advertising. We found that wherever we went in the advertising market place, other manufacturers wanted to sell television programs and radio programs. We bought some of this time for 50 to 75 cents on the dollar and for a million dollars we got ourselves almost a million and a half dollars worth of market impact. The

net effect, jumping quickly to the conclusion, was simply this: where most companies in America experienced a dip in profitability and a dip in sales for the period of 1957 and for 1958, the record of our company was a continuing increase to new highs, both in sales volume and in profitability for both of these two years.

The investment banking public, the bankers themselves and many industrialists could not understand what we had done. In addition to this within Bell and Howell, our Company President was instrumental in getting a group just exactly as we would like you to do in India and talked about *the philosophy of barrier elimination*. Again, do we control our economy, or does the econo-

my control us? We found a few other companies, General Electric among them, that did strongly believe this philosophy and who were acting on their own to break their barriers. There were other companies that were doing so too and by pooling these companies' efforts and bringing many, many other industrialists into the effort, we are certain at this time that this cumulative effort was, at least in part, the cause for the correction in our economy in that period. We cannot take credit and I don't mean to take credit; ours was but one factor that helped to generate a different mental approach, mental attitude on the part of industrialists, and government leaders, that helped to shift the thinking of these managers during a fairly critical time.



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INDECISION

Management Techniques

Statement in general terms of the Effects Produced by Attributes of Plant, Product and Process, and the Management Techniques Required to Counteract them.

The text is intended to be read as in the following example: "As Size of Manufacturing Unit (ATTRIBUTE) TENDS to increase, EFFECTS are:—Top Management can no longer supervise details, etc. COUNTERACTING TECHNIQUES Delegation, etc."

As Attribute	Tends to	Effects are	Counteracting Techniques
1.0 Manufacturing Unit			
.1 <i>Size</i>	increase	.1.1 Top management can no longer supervise details .1.2 Subordinates must take decisions .1.3 Clear demarcation of responsibility required .1.4 Coordination becomes increasingly difficult .1.5 In smallest units management must be technically capable: as size increases, specialist guidance tends to be required	<i>Delegation</i> <i>Decentralisation</i> <i>Formal organisation</i> — <i>Specialisation</i>
.2 <i>Dispersal</i>	increase	.2.1 Above effects accentuated. Manager must rely more on the written word. It becomes less easy to see for himself. .2.2 Coordination of production practices becomes necessary to achieve standardised operation .2.3 "Caches" of materials and other stores tend to build up at units .2.4 Transport between units must be organised	<i>Communication and as above</i> <i>Production engineering production control</i> <i>Material control</i>
.3 <i>Location—</i>			
Distance from Materials) Markets) Labour)	increase	.3.1 Transport costs increase. Special studies must be made to find optimum practice .3.2 Rapid wagon and road transport turn round becomes increasingly important .3.3 Transport facilities required for labour	) <i>Transport management</i>)))) <i>Materials handling</i>)))

As Attribute	Tends to	Effects are	Counteracting Techniques
		.3.4 Canteen and other facilities required. Housing projects may have to be considered	(Welfare)
2.0 Product			
.1 <i>Design, Formula or Specification</i>			
.1.1 Technical increase complexity		.1.1.1 Constant study required to improve performance and acquire basic data .1.1.2 Constant survey of other developments in the field necessitated .1.1.3 Well qualified design and drawing office staff needed .1.1.4 Ease of production must be ensured as well as performance .1.1.5 Control of component and product quality becomes important	Research Technical information service Design Development design Inspection
.1.2 Consumer appeal	increase	.1.2.1 Consumer reaction to design intangibles tends to be unstable. Contact must be maintained with consumer opinion .1.2.2 Care must be taken with the appearance of the product	(Marketing techniques) Styling
.2 <i>Weight</i>	increase	.2.1 Product and/or components become difficult to move during manufacture .2.2 Larger quantities of raw materials are embodied. Material investment becomes substantial and cost increases .2.3 Special attention needs to be paid to form in which raw materials delivered so that minimum is removed to form finished parts .2.4 Material and product transport costs increase .2.5 Special care in working heavy components is required	Shop layout Materials handling Design Purchasing Scrap and waste recovery Process planning Purchasing Transport management Operator training
.3 <i>Size</i>	increase	.3.1 Product and/or components become awkward to move .3.2 Transport costs increase. Consideration may have to be given to assembly at consumer end .3.3 Inspection tends to become more difficult	Shop layout Materials handling Transport management Process planning Inspection

MANAGEMENT TECHNIQUES

As Attribute	Tends to	Effects are	Counteracting Techniques
.4 <i>Complexity</i> (No. of components)	increase	.4.1 Risk of unnecessary duplication of components fulfilling similar functions)	<i>Design simplification</i> <i>Standardisation</i> <i>Interchangeability</i> <i>Spares policy</i> <i>Factor layout</i>
		.4.2 Spares demands tend to increase)	
		.4.3 Flow of production through the works tends to be complicated)	
		.4.4 Bottlenecks due to shortages of given components tend to increase. Ensuring the carrying out of the production programme becomes more difficult	<i>Production control</i>
		.4.5 Control of stocks becomes more difficult. Storage and location of stocks becomes more difficult.	<i>Stock control</i> <i>Stores organisation</i>
.5 <i>Varieties of product</i>	increase	.5.1 In industries where each product is the result of a different process, each department tends to take on the characteristics of a small firm	<i>Formal organisation</i> <i>Decentralisation</i>
		.5.2 Where product is designed, sectionalisation of Drawing Office tends to isolation among designers	<i>Simplification</i> <i>Standardisation</i> <i>Interchangeability</i>
		.5.3 In manufacturing industries, machines may have to be general purpose rather than specialised. Personnel may have to be more flexible and more skilled. Preplanning is less easy to do.	<i>Technical training (labour)</i>
		.5.4 Allocation of production capacity is more difficult. Correct ordering of common parts demands close attention	<i>Production control</i>
		.5.5 Stock control and storekeeping become more difficult	<i>Stock control</i>
.6 <i>Variety of material embodied</i>	increase	.6.1 Unit material cost tends to increase since quantities are relatively smaller	<i>Design simplification</i>
		.6.2 Wider knowledge of sources of supply necessary	<i>Purchasing</i>
		.6.3 Control of stocks and storage becomes more complex	<i>Stock control</i> <i>Stores organisation</i>
		.6.4 Inspection becomes more difficult	<i>Inspection</i>
.7 <i>Mobility</i>	decrease to static	.7.1 Product and/or components become difficult to move	<i>Shop layout</i> <i>Materials handling</i>
3.0 <i>Material</i>			
.1 <i>Unit cost</i>	increase	.1.1 Capital tied up in stocks is liable to increase	<i>Stock control</i> <i>Development</i>

As Attribute	Tends to	Effects are	Counteracting Techniques
		.1.2 Economy in the use of material becomes more important. Raw material should be procured in forms likely to reduce removal of surplus to a minimum, and waste, surplus or scrap must be recovered.	<i>Design Process planning Scrap and waste recovery</i>
		.1.3 As unit cost becomes very high, (e.g. precious metals), necessity for the avoidance of spoilage may outweigh all other cost considerations. Highly specialised skills may have to be employed at high rates. Training becomes very important.	<i>Technical training (labour)</i>
		.1.4 Every available part of the material must be used	<i>By-product utilisation</i>
		.1.5 High investment in research for substitutes may be justified	<i>Research development</i>
.2 Availability	decrease	.2.1 Substitutes must be found	<i>Research development</i>
		.2.2 All possible sources of supply must be tapped. Close attention must be paid to Government regulations in case of controlled materials and liaison with Government departments maintained	<i>Purchasing</i>
		.2.3 Design must be carefully watched to ensure that the minimum of material is embodied	<i>Design</i>
		.2.4 Raw material for working must be ordered in a form which will necessitate the minimum removal of stock	<i>Process planning Purchasing</i>
		.2.5 Waste, surplus and scrap material must be recovered	<i>Scrap and waste recovery</i>
		.2.6 Bottlenecks may develop due to material shortages	<i>Stock control Production control</i>
		.2.7 Insufficient supplies of raw material will involve under-utilisation of capital, plant and labour	<i>(Only remedy to use all possible efforts to obtain it)</i>
.3 Ease of handling (hot, cold, acid, etc)	decrease	.3.1 As the material becomes difficult and finally impossible to handle, normally, protective clothing and mechanical handling become essential. Safety precautions must be stressed.	<i>Materials handling Operator training Safety precautions Safety instruction</i>
.4 Ease of working	decrease:	.4.1 Plant, equipment and tool wear increases, with increasing depreciation and consumable tool costs	<i>Tool maintenance Plant control</i>
		.4.2 It becomes important to develop machines and processes capable of working the material more efficiently	<i>Process research Pilot plant</i>

MANAGEMENT TECHNIQUES

As Attribute	Tends to	Effects are	Counteracting Techniques
		.4.3 Research for the purpose of developing the material to make working easier while maintaining desirable properties may be justified	<i>Raw material Research Development</i>
		.4.4 It may become impossible to work the material manually	<i>Mechanisation Automatic control</i>
		.4.5 Raw material for working must be delivered in a form which will necessitate the minimum removal of stock	<i>Process planning Purchasing</i>
.5 <i>Fragility or Perishability</i>	increase	.5.1 Losses through bad handling tend to increase. Staff must be properly trained	<i>Materials handling TWI</i>
		.5.2 Risk of contamination by foreign substances	<i>Process control Storekeeping</i>
		.5.3 Deterioration in storage	<i>Stores organisation</i>
4.0 Type of Production			
.1 <i>Jobbing</i>	)	.1.1 Flexibility must be maintained through the works. Tools and equipment must be of a general nature	
)		
)		
)		
.2 <i>Small batch</i>	)	.1.2 Optimum plant layout is difficult to obtain without intensive study. Line layout may be justified if products tend to go through the same processes.	<i>Shop and factory layout Method study</i>
(effects apply)		
in both cases in)		
varying degrees)	)	.1.3 Jigs and fixtures must be designed as far as possible for wide use. Tool inventories may be high	<i>Jig and tool design Tool room Tool stores</i>
		.1.4 Raw material inventories may be high and various. Raw material unit cost may tend to be high owing to smaller quantities	<i>Stock control Stores organisation Purchasing</i>
		.1.5 Any work measurement is likely to have to be estimated and built up from synthetics	<i>Estimating Synthetics</i>
		.1.6 Skill of operatives and inspectors is likely to have to be high owing to variety of demands on them. More initiative required at all levels	<i>Technical training (staff) Technical training (labour)</i>
.3 <i>Medium</i>	)	.3.1 Works tends to greater inflexibility. Special purpose machines may be justified	<i>Process planning</i>
)		
)		
)		
.4 <i>Large batch</i>	)	.3.2 Lines of flow become more easily discernible. Layout increases in importance as operations are broken up and simplified	<i>Shop and factory layout</i>
(as the batch size)		
increases, the)		
effects noted tend)		
to become more)		
prominent))		

As Attribute

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Counteracting
Techniques

- 3.3 Design for ease of production becomes more important
 - 3.4 Special tooling, jigs and fixtures become justified. Process planning may become a separate function
 - 3.5 Method and Time Study become increasingly justified by longer term effects produced
 - 3.6 Production planning in detail becomes necessary to avoid hold-ups in longer runs
 - 3.7 As batches tend to become longer, material delivery programmes can be given to suppliers. Stocks tend to buffer stocks, but adequate control is necessary to ensure availability
 - 3.8 Operations can be broken up and pre-planned to a greater extent enabling less skilled labour to be used. Larger technical staffs become necessary. Less initiative is required of shop supervision and labour
- 5.1 Definite programmes must be laid down for at least a year ahead
- 5.2 Operation becomes almost completely inflexible
- 5.3 Parts must be readily interchangeable. Modifications must be avoided once production has started. Design for production paramount
- 5.4 Specialised and single purpose machinery becomes economic. Operations may be simplified and standardised, and must be balanced to achieve even flow.
- 5.5 A hold-up in any part of the process affects the whole process and becomes at once very costly. Flow of material and parts must be continuous.
- 5.6 Because all programmes must be laid down well in advance, suppliers can be programmed and deliveries made to key in with production, avoiding carrying heavy stocks.
- 5.7 Machine breakdowns have the same effect as other hold-ups
- 5.8 Skills tend to move from the shops to the offices and become mental rather than manual. Preplanning and simplification enable use of unskilled or semi-skilled labour.

*Design development
Jig and tool design
Process planning*

*Method study
Time study*

Production planning

Purchasing

Stock control

Specialisation

*Operator training
TWI*

*(Marketing techniques)
(Sales budget)*

*Design simplification
Standardisation
Interchangeability
Development*

*Process research
Process planning
Method Study
Motion Study
Time Study*

*Shop and factory layout
Production control*

*Production planning
Purchasing*

Plant control

Specialisation

Operator training

5. Flow

As Attribute	Tends to	Effects are	Counteracting Techniques
.6 <i>Process</i>	—	<p>.6.1 Technical considerations usually paramount. Management not so important as technical training of staff.</p> <p>.6.2 Main improvements in output and quality will be through improvements in the process itself</p> <p>.6.3 Plant utilisation becomes the key to reduced costs</p> <p>.6.4 Wherever possible, use of by-products must be developed. This contributes substantially to cost reduction of main product.</p> <p>.6.5 Control of the process requires study. Quality and output may be improved by instrumentation and automatic control</p>	<p><i>Executive training (technical)</i></p> <p><i>Process research</i> <i>Process study</i> <i>Pilot plant</i></p> <p><i>Plant utilisation</i> <i>Plant control</i> <i>Plant utilisation</i> <i>Plant control</i></p> <p><i>Process control</i> <i>Instrumentation</i> <i>Automatic control</i></p>
5.0 Process			
.1 <i>Technical complexity</i>	increase	<p>.1.1 Major improvements will come from improvements in the process and from the operation of the process</p> <p>.1.2 Technically qualified works staff become essential</p> <p>.1.3 Design staff have an understanding of the process in order to take fullest advantage</p>	<p><i>Process research</i> <i>Process development</i></p> <p><i>Instrumentation</i> <i>Mechanization</i> <i>Technical training (staff)</i> <i>Design development</i></p>
.2 <i>Manual skill content</i>	increase	<p>.2.1 Less can be done by pre-planning and division of labour</p> <p>.2.2 Supervision must be technically competent in the trade</p> <p>.2.3 Skilled labour must be relieved of all unskilled work</p>	<p><i>Technical training of labour</i></p> <p><i>Technical training (staff)</i> <i>Method study</i></p>
.3 <i>Number of operations</i>	increase	<p>.3.1 Preplanning of production flow becomes more complex</p> <p>.3.2 Balancing of operations becomes difficult</p> <p>.3.3 Loading of shops and maintaining supply of materials becomes more difficult</p> <p>.3.4 Movement from operation to operation increases and proportion of operation time to move time tends to decrease</p>	<p><i>Factory and shop layout</i> <i>Method study</i> <i>Time study</i> <i>Production control</i></p> <p><i>Method study</i> <i>Materials handling</i></p>
.4 <i>Capital value of plant per operator</i>	increase	<p>.4.1 Full utilisation of the plant becomes increasingly important as depreciation forms a larger part of cost</p>	<p><i>Plant utilisation</i> <i>Shop and machine loading</i> <i>Production control</i></p>

As Attribute	Tends to	Effects are	Counteracting Techniques
		4.2 More effective savings are likely to be made by improvements to process than by reduction in labour force for given output	<i>Stock control Process research Process development Process control Process planning</i>
		4.3 Care must be taken that plant and machine operators are fully trained to get the most out of the plant and avoid damage to it	<i>TWI Technical training</i>
.5 <i>Operating cost of equipment labour cost</i>	increase	5.1 Savings in cost will derive less from the efficient utilisation of labour and more from the effective operation of the process	<i>If low work study Incentives Labour training If high Process research Process study Process control Process planning</i>
		(operating cost includes consumable tools, power, heat etc, and direct overheads connected with the process)	
		5.2 Where operating costs are more or less fixed, cost reduction must be achieved by increasing productivity	<i>Machine or shop loading Plant utilisation</i>
		5.3 Staff capable of getting the optimum performance from equipment must be employed	<i>Technical training (staff)</i>
.6 <i>Capital value of plant per unit cost of material</i>	increase	As above. With reduction in the relative cost of material, some stock-piling may take place to ensure no hold-up.	<i>Stock control Stores organisation</i>
.7 <i>Process time Handwork time</i>	increase	7.1 Plant utilisation becomes more important, methods of handling less so	<i>Plant utilisation Shop and machine loading Production control Stock control</i>
		7.2 Greatest savings tend to be from most economic and efficient operation of the process	<i>Process research Process control Process development Process planning</i>
		7.3 Evenness in quality of raw material becomes important	<i>Purchasing Raw material inspection</i>
.8 <i>Process time Handling time</i>	decrease	8.1 Reduction of movement between operations assumes importance	<i>Shop and factory layout Method study</i>
		8.2 Acceleration of movement between operations becomes important	<i>Method study Materials handling</i>
.9 <i>Distance between operations</i>	increase	Reduction of transport and handling times assumes precedence over process improvement	<i>Shop and factory layout Method study Materials handling Internal transport</i>

MANAGEMENT TECHNIQUES

As Attribute	Tends to	Effects are	Counteracting Techniques
.10 <i>Duration of operations or movements</i>	increase	If the duration of any operation or movement, or set of either, becomes disproportionately long compared to other times. (days/hours/weeks/days) concentration on that factor to the virtual exclusion of the others becomes justified	
.11 <i>Working conditions</i>	dangerous	.11.1 Elimination of the danger should be aimed at .11.2 Safety and health of personnel become paramount .11.3 Personnel should, as far as possible, be removed from the danger area	<i>Process research</i> <i>Safety precaution</i> <i>Safety instruction</i> <i>Mechanisation</i> <i>Automatic control</i> <i>Mechanical handling</i>
6.0 Quality Required	higher	.1 Closer control of the process is demanded .2 Operators must be more carefully trained .3 Supervision must be technically trained and taught the need for quality .4 Machines and equipment must be properly maintained .5 Inspection control at all stages must be tightened	<i>Process research</i> <i>Process development</i> <i>Process control</i> <i>Instrumentation</i> <i>Automatic control</i> <i>Quality control</i> <i>Technical training</i> <i>TWI</i> <i>Technical training</i> <i>Planned maintenance</i> <i>Tool maintenance</i> <i>Inspection or laboratory control</i>
7.0 Labour			
.1 <i>Type required</i>	unskilled	1.1 The amount of pre-planning must increase 1.2 Supervision and inspection control must be tighter	<i>Process planning</i> <i>Method study</i> <i>Motion study</i> <i>Mechanisation</i> <i>Shop supervision</i> <i>Floor inspection</i>
.2 <i>Availability</i>	decrease	2.1 Labour available may not be able to undertake operations as they have hitherto existed 2.2 Efforts may have to be made to substitute for human labour 2.3 Labour may have to undergo prolonged training to achieve proficiency	<i>Process planning</i> <i>Method study</i> <i>Motion study</i> <i>Mechanisation</i> <i>Automatic control</i> <i>Technical training</i> <i>TWI</i>



An inventor is simply a fellow who doesn't take his education too seriously

German Productivity Centre

The German miracle has been much talked of in post-war economic literature. There has been persistent demand for a clue to the miracle by which a defeated and destroyed country has rebuilt its economy to a new record in productivity. The organisers of the German Productivity Centre (known popularly in Germany as RKW) has, at the special request of the editor of this journal, stated their philosophy, economics and organisation in the article printed below.

The RKW regards *raising productivity as a permanent job*. It can be so organised as to constitute a *driving force for the whole economy*. But we must first understand what productivity means and consider a broad plan of organisation over a period of time.

GENERALLY speaking to raise productivity means to save work, capital, and materials in order to be able to provide more goods and services. These efforts are therefore a driving force for the increase of our standard of living and constitute one of the most important tasks of all branches of the economy.

It would be entirely wrong to permit oneself to drift along and, succumbing to pressure, to make sporadic efforts to raise the standard of efficiency in the so-called lean years. Instead, the advantageous conditions of a boom period should be used to make every effort towards a systematic increase of productivity, thus rendering the enterprise safer in periods of crisis. Who in times of growth, when labour is scarce, is quick to render his operation more efficient, keeps his enterprise in a competitive position and reduces his risk when conditions become less favourable.

This attitude is now firmly implanted in the responsible quarters of the economy and the result has been a remarkable increase in our industrial produc-

tion and the gross national product. Percentagewise, the Federal Republic of Germany leads the western world in this respect. The heavy capital outlay made in this connection is now bearing fruit. Despite the growing scarcity of labour, our national product continued to grow rapidly in 1959 and productivity rose by another 4.1 per cent in the same year.

The main object of the efforts to raise productivity has been to save labour. This has been achieved by developing machines and materials-handling equipment that do the same job in less time with less human effort and, usually, more reliably and accurately, in any case cheaper than human labour can do it.

The consequence of this progressing mechanisation is an increasing proportion of the capital outlay required in industry. From 10 to 15 per cent of our net national product has during the past few years been spent on additions to fixed assets until the latter now represent a value of more than DM 100 billion in

the West German industry. This of course calls for the greatest possible efforts to increase the degree of utilisation of plant and machinery.

A number of problems arise from this shift in the relative importance attaching to machines and labour. The workers are constantly being faced with new and unknown tasks by technological progress; highly skilled labour is therefore more in demand than unskilled labour whose work is more and more done by machines. To avoid psychological strain, social tension and inefficient utilisation of labour, all these problems should be tackled systematically.

Essential tasks of the RKW

In view of these considerations the RKW places the emphasis on the following tasks:

(a) *Operational*: Efficient utilisation of the capital tied up in the plant. (b) *Business Management*: Promotion of systematic overall planning, especially for small business, to make cost accounting an efficient tool in the hands of management. (c) *Sociological*: Providing guiding principles for suitable layout of new work places created by productivity measures, and solving personnel problems arising from technological changes, especially those involving a rising proportion of office staff and office mechanisation. These being mainly development problems, the chief topic of consulting work of the RKW in the coming year will be variety reduction and weeding of production programmes.

1. RKW has a special section (Man and Work) whose functions are to work out personnel policies and procedures to take care of the technical progress and social changes taking place in the economy; 2. to promote research in the field of human sciences and to disseminate its findings in a form suitable for

application in industry so that technical and economic progress will result also in a lessening of the physical and mental effort required of the worker; 3. to find ways and means which promote co-operation between management and labour.

(1) Technical and social development confronts management with personnel and social problems which are novel to it and sometimes arise rather unexpectedly. To meet these difficulties management has to set up a far-sighted personnel policy. This is only possible if we know how technical progress will affect the labour force. Therefore we have been sponsoring investigations in enterprises of different sizes and branches in order to learn in what way and to what degree technical innovations are influencing class and variety of work and the personnel structure in individual plants and branches.

These investigations into the impact of today's rationalisation process are supplemented by research related to social science and industrial sociology. In our opinion systematic research in this field is important in order to understand the background of the attitude and feelings of the labour force; in addition, we intend to open the way towards a better rapport between researchers and those responsible for the solution of the human problems in industry.

Technical and social advance will be possible only if facilities are at hand which provide the knowledge and experience modern business life require of both management and labour. Our concern in this matter is twofold: to find out in which way training and job security are influenced by the changing job requirements; and to see that management

trainees are not only equipped with the knowledge and experience of their technical fields, but learn at an early stage of their training how important for their future executive position the application of principles and methods of personnel management will be. In several courses we have familiarised teachers at engineering schools with the problems of personnel management and with the findings of work physiology and industrial psychology; at the same time we have tried to find ways to incorporate such topics into the teaching programmes without expanding the school curriculum.

- (2) Technical innovations force a big part of industrial employees to cope with constantly changing working conditions and novel working processes. The attitude of the worker towards the technical change will largely depend on how new machines relieve him of physical and mental strain. Therefore, research in the technical fields must be accompanied by promotion of research into the human sciences and by application of the findings. Today, ergonomics can offer many solutions in order to fit the job to the worker; new machinery has also reduced a big part of the physical effort formerly required of the worker. At the same time, however, mental strain keeps increasing and, so far, eludes control. This mental strain accounts for a waste of working power which only becomes perceptible after the strain has reached a certain amount when it is too late for a remedy. We have, therefore, taken the initiative in launching a scientific investigation into the various forms and degrees of mental strain in industry. Similar investigations are concerned with the con-

sequences of the reduction of the weekly working time for productivity, with the specific problems of shift and night work, and the causes of early invalidity.

Our activities include providing comprehensive information on productivity problems for trade union officials and works councils so that a great number of employees is enabled to understand or—if necessary—to judge critically individual productivity measures launched in their firms. Similarly we have endeavoured to have **business executives**, in addition to being trained in their special fields, also familiarised with the problems of personnel management.

Business Management

The technological and economical changes we are facing in Europe have made it necessary to furnish management more than ever with practicable methods to analyse, and with suitable instruments to control operations. To this aim the division "Business Management" with its undernoted departments devoted its particular attention during 1960: Business Management; Federal Committee on Business Management (BBW); Variety Reduction; Working Group Efficiency in Industrial Selling and Buying; Promotion of Consulting Service; Committee on Economic Administration (AWV).

Aside from the programme established years ago to encourage thinking and acting in terms of business management the department concentrated on the following points: promotion of inter-plant comparisons; exchange of business management experience, especially on an international basis; and planning as an instrument of management. Overall planning of operations is frequently paid insufficient attention in small and

medium-size enterprises. One of the main tasks of the RKW is therefore to convince such companies of the possibilities and advantages of such planning. To this end examples from the practice of good planning in German industrial undertakings were collected and made available to these firms.

Variety Reduction

This work was carried on in two directions: (a) Enterprises and trade associations received on demand assistance in rendering their production programmes economical. (b) Methodological: Procedures were developed that can be applied throughout the whole economy.

(a) In various undertakings of different industries turnover and cost analyses were made which permitted management directly to take decisions on future production programming and marketing measures. (b) In order to improve methods to render production programmes more economical, a working group was organised including among its members very prominent business consultants, scientists and industrialists. By means of seminars, press conferences, radio broadcasts, and series of lantern slides, the significance and procedure of economical production programming was brought to the notice of a broader public.

Working Group: "Efficiency in Industrial Selling and Buying"

Market research has not yet found in Germany the attention it deserves, above all in small and medium-size enterprises. This is why a number of qualified market researchers were trained in the various market research institutes. In a practicum on market research, participants from small and medium-size businesses are informed in two-week courses of the most important practices in market research.

Promotion of Industrial Consulting

(a) *Plant Inspection Service*: Independent experts hired by the RKW visit primarily small and medium-size plants for short periods of 1 to 3 days. At present nine such experts are active in the Federal Republic, who in response to requests by the firms render advice with a view to raising the efficiency in the entire undertaking. This service has proved its mettle sufficiently for an intensification to have been envisaged.

(b) *Promotion of Institutions in the Field of Industrial Consulting*. The second task is to promote free-lance consulting. The plan is to list such consultants by industries and later to give them further training by means of seminars. Undertakings desirous of the services of consultants can obtain from the RKW information on suitable consulting experts. Good international cooperation was ensured by various conferences held on the subject "industrial consulting".

Committee on Economical Administration

As the administration expands, the activities of the Committee on Economical Administration assumes increasing importance. There are five main fields of its activities: Personnel Management; Organisational Problems; Budgeting and Accountancy; Office Techniques, Mechanisation, and Automation; Correspondence and Forms, Rules and Regulations.

In connection with personnel problems, there are two main objectives: to promote the training of clerical and administrative junior personnel by means of suitable instructional aids; and to make studies in the fields of job analysis, work load, and job evaluation.

Industrial Engineering : Tapping Hidden Reserves for Productivity Measures

Seeing that the RKW is mainly meant to serve small and medium-size enterprises which, however, usually do not possess the necessary capital for new investments with a view to mechanising operations, the slogan for small business is *raise your productivity without capital outlay* or, put differently, *utilise your capital efficiently*.

Almost every item on the assets side of the balance sheet should be looked into to see where careful planning, standardisation, quicker turnover, quality control etc can increase the efficiency of operations. In this field the RKW is drawing on the latest findings at home and abroad to give advice in its lectures, courses, publications, and plant visits. Evaluation of studies on industrial engineering, economical utilisation of materials, equipment and energy, measures to cut costs in materials handling and storage, and the publication of information—all these activities come under this heading.

Plant Analysis

Publishing results of these analyses means that other interested parties can draw on them for their own benefit. Various stages of the industrial process like industrial planning, simplification, intra-plant materials handling, controls and simpler cost accounting are being looked into in various industries. All this material is brought into a form which will help others in their planning; to judge from the response they meet with, the publications appear to serve their purpose very well.

Productivity Measurement

A publication "Productivity Measurement (Definition—Method—Implementation)" to be issued will show a system

to provide indices for productivity measurement which will make it possible to approach the optimum of measuring the productivity in a plant.

Points of main emphasis

Efficient use of equipment. Inefficient utilisation of equipment, as it may occur even with full employment, can be due to insufficient production planning and control or unsuitable equipment causing excessive idle time. A study is being made to yield generally acceptable methods to ascertain the degree of utilisation of equipment. Good planning of production equipment, schedules, utilisation of labour, preventive maintenance, controls, and timing will help avoid any undue losses.

Efficient use of materials and energy. Careful husbanding of materials—include considerations whether non-cutting operations are preferable because they reduce waste—contributes to efficiency. The same holds good for the use of power and heat where economies may be achieved by accurate measuring of consumption and critical evaluation of existing results.

Implementation: A great number of lectures and seminars with lantern slides, attended by several thousand people throughout the Federal Republic, dealt with topics: cutting production costs by better utilisation of equipment; preventive maintenance as a means to reduce machine failures; lowering production costs by efficient use of materials; lowering production costs by efficient use of energy; recording and accounting for the costs of energy; what should the engineer do to influence production costs?

These led to requests for further, specialised seminars and discussions and showed that horizontal and plant analyses as well as case studies are a sure means of finding hidden efficiency

reserves that can be tapped. A number of studies were therefore launched dealing with various problems in this connection and aiming, among other things, at finding methods to help especially smaller enterprises improve their production planning and thus the utilisation of their working capital. While the main emphasis lay on these topics, other fields like technical statistics, operations research, product planning and the like were also receiving attention.

Improvements in materials handling

It becomes increasingly evident that also here, quite a few pockets of inefficiency can be found and removed. The use and exchange of pallets, for instance, can play an important part in rendering transportation more efficient not only within the plant but also on the way to the consumer. A German pool of pallets with standardised dimensions which was set up is to pave the way for a European pool. A brochure on this aspect of materials handling has already been sold.

On the international plane, the contacts with other Materials Handling Societies were intensified. The transport documentation centre now contains 15,000 punch cards for ready reference. Parties interested are informed of the various headings under which suitable reports and other literature may be found.

Efficiency in construction work

Here again numerous lectures were given throughout the Federal Republic, motion pictures were shown and meetings were held to disseminate information. A road exhibition dealing with sound and heat insulation and improved construction methods was shown in numerous cities and very well attended. A second road exhibition, combined with sound slides, on general

construction problems in winter and special problems in house construction was launched in October 1959, and has so far met with great success. The periodical "Der Querschnitt" was enlarged; it deals with the before-mentioned subjects. Several issues had to be reprinted. Various working parties were established to deal with such problems as pre-fabricated buildings, work simplification, and several working techniques such as earthworks, painting, masonry, plumbing and the like. Another working party prepared more than one thousand specimen forms.

Efficiency in packaging

The increasing importance attaching to packaging in Germany as a result of more self-service shops, rising exports, and higher emphasis on efficiency in materials handling (size of packages adapted to pallet dimensions) meant more extensive work for the working parties on packaging. All quarters concerned contributed towards finding common solutions. These efforts are coordinated by the Efficiency Group Packaging which has developed into a "German Packaging Centre." To promote activities in this field, an advisory council comprising representatives of manufacture, processing, trade, transportation and consumers was set up.

Various working parties are dealing with standardisation, training, damages in transportation, marking costs, terminology, and controls. Numerous enquiries were answered; brochures, reports and specifications were distributed; motion pictures were shown; and lectures and meetings were held. The figures show that there is very widespread response.

The Efficiency Group Packaging is a founding member of the European Packaging Federation promoting exchange of experience. The general

acceptance of the module system to adapt package dimensions to standardised pallets may be taken as an example of international success. The Group also organised the Fourth International Packaging Congress of the European Packaging Federation where papers submitted by twelve experts from European countries and the United States were read.

Seeking public confidence

If it may be said to be a fundamental principle of the modern economy that a maximum of output should be achieved with a minimum of input, then rationalisation efforts should be a generally accepted and essential element in all businesses and industries. Rationalisation will, of course, be concentrated on certain sectors of activities within the company, such as (1) human relations in the plant (2) simplification and improvement of administration (3) development of production techniques and methods towards higher productivity (4) improvements in marketing and buying methods.

One should think that such clearly stated aims would meet with ready acceptance everywhere. In actual practice, however, the first response is usually negative. This is due to wrong concepts of tradition and the lack of imagination and the inertia found everywhere. In addition, new findings scientifically gained frequently require operating skills not practised in the past. The inertia well known in physics is in the way of the reorganisation and stimulation in the field of working methods that are continuously necessary. This is why the Rationalisierungs-Kuratorium der Deutschen Wirtschaft (the German productivity centre) pursues various paths with a view to gaining the confidence of the public and keeping the necessity of continuous rationalisation efforts alive in the minds of everybody concerned.

Information service

The statutes provide for the RKW as a non-profit organisation to serve and promote rationalisation efforts to keep the German economy in a sound state. In this work the publication of the findings of the highly specialised RKW experts and the collection of experience gained at home and abroad play an important part.

Promotion of the exchange of experience both on a national and an international basis are the particular concern of the productivity centres. For a long time all firms believed they should keep their production practices a secret. The fact that we now have reached a stage where a distinction is being made between those individual procedures and results that must necessarily be treated confidentially and the experience that may be offered for the benefit of everybody concerned is an important achievement accomplished by the publicity work of the productivity centres.

Results

The efforts towards raising productivity and towards rationalisation, promoted by the RKW especially in small and medium-size enterprises, turn largely on the activity of the regional RKW offices which operate under their own managements in the various Lander of the Federal Republic such as Bavaria, Baden-Wurttemberg, Hesse, Berlin and so on. The yardstick for the effectiveness of the work of the RKW is on the one hand recognition by the economy and public authorities, assisting the work of the RKW by means of their growing contributions. On the other hand, it is above all the increasing response to the RKW publications that shows the extent to which these activities bear fruit.

Financing of the RKW by public authorities and contributions of member

firms rose noticeably during the past few years and is expected to amount to approximately DM 8 million for 1960 as against DM 5.5 million for 1958.

In connection with the general information service rendered by the RKW publicity, the increase in reprints by daily papers from the "RKW press service" is particularly striking. In 1959, altogether 1656 such reprints could be counted or 43.5 per cent more than in the preceding year, without the funds therefor having been materially increased. The evaluation of foreign publications has substantially contributed to this development. The readiness of radio stations to broadcast RKW information has likewise remarkably risen and, as far as programmes provided by the RKW Press Department are concerned, amounted in 1959 to two and a half times that of 1958. As a result of "RKW Information in Brief" and the information given to the press, 1762 questions were answered in 1959. Number of enquiries were still higher during 1960 because the information given out by the RKW is circulated even wider than before.

Occasionally, the opinion is voiced that the economic success of the Federal Republic of Germany is above all an achievement of big business. In actual fact, the increase in efficiency of big industrial undertakings lags, percentage-wise, behind that of the small and medium-size enterprises. These are genuine rationalisation successes, all the more so since the number of persons employed has not nearly risen in the same proportion. It should be noted, however, that in future the Federal Government, too, is expected to do more to assist small business. The experiences and recommendations of the RKW have already been taken into consideration in the preparatory work for the relative legislation.

Foreign Service of RKW

As the pattern of international productivity efforts becomes increasingly interwoven, the Foreign Relations Department of the RKW aims at evaluating for the German economy the technological, economical and sociological findings and experiences in other countries. As a result, the international exchange of experience has gained in importance. This interchange took place not only with highly industrialised countries but also with the developing countries. We have thus reached a stage where the RKW gives more than it takes in this exchange.

A great number of study trips abroad were made, primarily to the United States. Also numerous German experts attended international seminars, congresses, discussions and the like. 214 experts from abroad came to Germany.

Among the most important results of the activities of the Foreign Service is a greater productivity-mindedness and the recognition that neither automation nor progressive technological methods need to create economic or social tension. Productivity is being raised not only in big but also in medium-size and small enterprises. Not even in the United States have the latter been squeezed out of the market. On the contrary, cooperation and specialisation have enabled them to strengthen their position. Care must be taken, however, to retain a certain flexibility so as to avoid misdirection of capital.

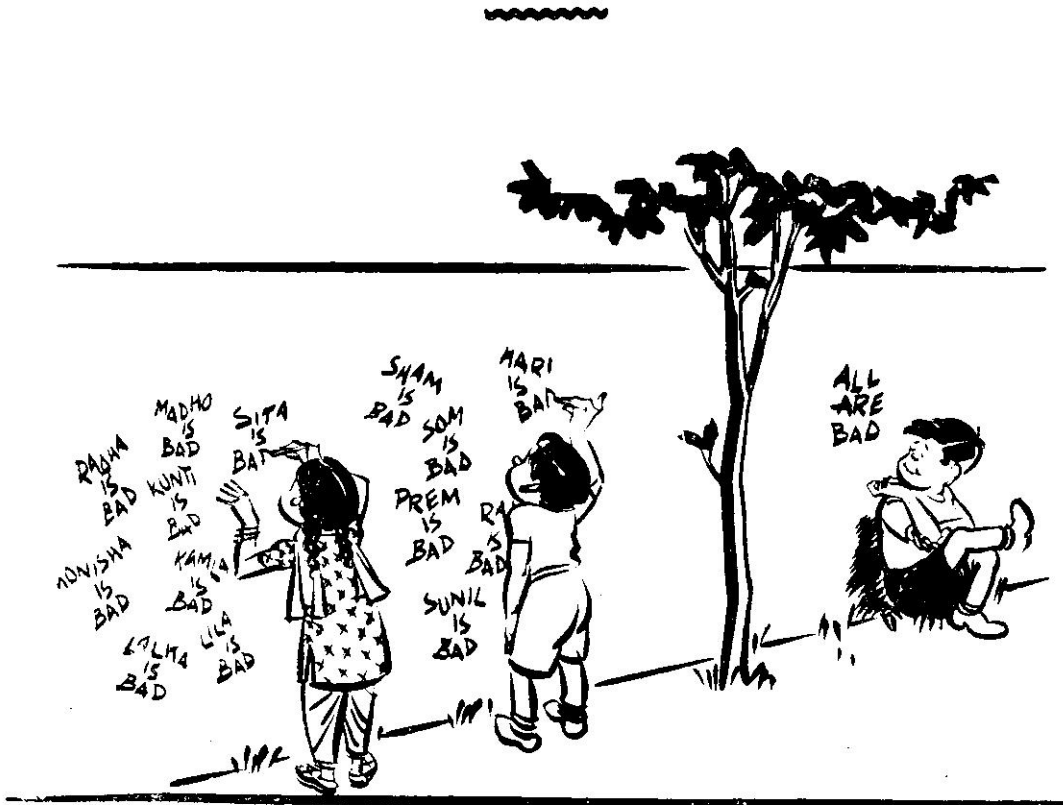
The rule of thumb has declined as technology and diversification have progressed. Modern methods of scientific management such as input/output analysis and linear programme analysis or operations research play an increasingly important part in planning, controlling and improving operations. To remain competitive, businesses must be able to

find answers to the questions how to design future products, what more efficient methods will emerge, what chances this or that merchandise will have on the market, what the personnel structure is going to be.

Among other things two particular productivity measures taken abroad have considerably influenced conditions in Germany: education for management and increased application of human

sciences. Specialisation is of course no good training ground for managers. The decisions to be taken at top level call for persons well-versed in all branches of the company's activities.

The emergence of new very large economic areas and the tasks facing management in connection with the developing countries will attach increasing importance to international cooperation by an exchange of opinions



Productivity I

What Work Study Means

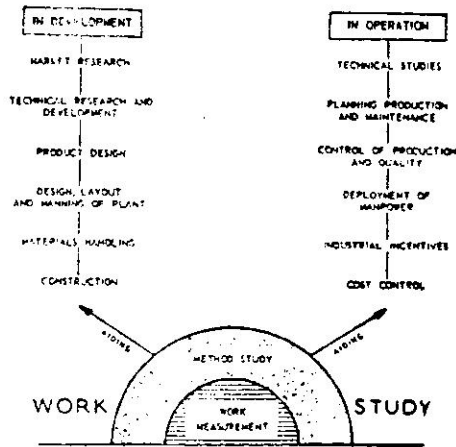


Fig. 1—Work Study as a service to management

There are two ways of bettering the performance of an undertaking. The first is to improve the processes of manufacture by the development of more suitable machines and equipment. This can only be the outcome of prolonged research and experiment, and may be called Process Study. It is generally a long-term matter, often requiring considerable capital expenditure, but there is practically no limit to the improvement in performance which may eventually be achieved.

The other way is to improve the method of operation of the plant and of the workers (not only those engaged in manufacturing processes). This is the outcome of Work Study, which is a relatively rapid means of achieving improvements: little or no capital expenditure is normally required.

IN practice, there is no clear line of demarcation between Process Study and Work Study. Furthermore, in the

smaller firm, Process Study, including the introduction of more suitable machines and equipment, may be a relatively short-term and inexpensive operation compared with Work Study on the scale employed by larger organisations.

* Reproduced with minor changes from British Productivity Council's publication: Better Ways (nineteen paths to higher productivity)

Work Study aims at: (i) the most effective use of existing (or proposed) plant (ii) the most effective use of human effort and (iii) a reasonable work load for those employed. It may be divided into two main techniques: Method Study and Work Measurement.

Method Study is the detailed analysis of existing or proposed methods as a basis for improvements. Its objectives are improved processes and procedures; improved layout and design; better working environment; more efficient use of material, machines and manpower; economy in human effort and reduction of fatigue.

Work Measurement is the determination of the proper time to be allowed and of the effort required for the effective performance of a specified task. Its objectives are more economic and effective manning; improved production planning and control; reliable performance indices; provision of a rational basis for incentive schemes leading to increased individual effectiveness, and provision of a reliable basis for labour cost control.

Method Study must be carried out bearing in mind the economic, technical and human considerations. The basic procedure of all method studies is as follows: 1. *Select* the work to be studied; 2. *Record* all the relevant facts of the present (or proposed) method; 3. *Examine* those facts critically and in ordered sequence; 4. *Develop* the most effective method; 5. *Instal* that method as standard practice; 6. *Maintain* that standard practice by regular routine checks. *These stages are essential.*

It will be noted that the second step in the basic procedure is *record*. There are a number of techniques for recording, which may be used either separately or in combination, according to the

Activity	Prominent result	Symbol
Operation	<i>Produces, accomplishes, furthers the process</i>	○
Inspection	<i>Verified—quantity and/or quality</i>	□
Transportation	<i>Moves</i>	➡
Delay	<i>Interferences or Delays</i>	D
Storage	<i>Holds, keeps or returns</i>	▽

Fig. 2.—Symbols used in process

particular problems involved. The most common are: 1. *Process charting*, in which a series of five symbols are used to signify the operations undergone by a product in the course of manufacture or handling. It should be noted, however, that these five symbols (shown in Figure 2) are not standard throughout industry and that practices vary.

2. *Flow diagrams*, which are scale drawings showing in detail the progress of the material or component in relation to its physical environment, that is, its path through departments, machines, benches and stores. With the aid of such diagrams the most efficient work flow can be determined, wasteful journeys eliminated and the sequence of operations carried out with the least possible delay.

There are two variants of flow diagrams. These are: *Models* and *String diagrams*. *Models* are, in effect, flow diagrams in three dimensions, enabling overhead obstructions and lifts to be

taken into account. *String diagrams* are scale models of the shop, with each work position marked by a pin. The distance travelled by an operative in a given period of time can be measured by running a continuous thread from pin to pin, corresponding to each journey made. The total length of the thread used will represent the distance travelled in the time given to the observation. This technique is useful in studying operatives who look after a number of machines or who fetch material components from stores.

3. *Multiple activity charts*, which record the activities of various subjects on a common time scale. They can also be used to record the relationship between an operative's body movements.

4. *Motion charts*, which are used for more detailed study of work at individual workplaces, in order to re-arrange the work place and simplify the movements of the worker. This not only reduces the time taken to do the job but, by cutting out unnecessary stretching and bending, helps the operative to work more steadily and to be less tired at the end of the day.

5. *Films*. It sometimes happens that the detailed movements of a worker are too quick to be followed by normal observation methods. When this is so, a film of the job may be taken and projected in slow motion, so that the movements of the worker can be analysed in close detail. This technique has limited usefulness on account of the cost involved and the artificial working conditions that often need to be created in order to produce a satisfactory film. There are various other types of equipment which may be used for special circumstances.

Work Measurement

After the best way of doing a job has been determined by Method Study, and

the new procedure installed, work measurement follows: usually by actual observation and timing of the job under operating conditions. Generally a stop-watch is used because this is an accurate measuring instrument, but it must be used tactfully, without giving the worker the impression that his ability and application are being checked. No standards should be arrived at except as a result of repeated studies, preferably on more than one operative. Each element is timed separately, the job having been broken down into a series of elemental movements.

When a reliable time for the performance of the operation has been determined, further time is allowed for recovery from fatigue and personal needs, the object being to achieve a work standard which can be maintained day in, day out, by a worker properly trained for and accustomed to the work. *The time allowed* may then be used as a basis for accurate costing, for planning the work, for manning the plant or for working out an incentive scheme.

For non-repetitive work and work where this method would be difficult or uneconomic, there are other techniques, such as analytical estimating, which, while lacking the accuracy of Time Study, still provide a satisfactory means of assessing standards of performance.

It must be emphasised that the essential pre-requisite to the introduction of a work study investigation is the readiness of all concerned to cooperate. This calls for consultation between management and workpeople at all stages and for an effective system of works information enabling the operatives who are part of the study to understand its nature and purpose.

It is above all important, where a Time Study with a stop-watch is being done, that the workman should be confident that the aim is not to *speed up*

the work or to cut down his wages, but to make an objective work analysis on which scientific costings can be used.

CASE STUDY

In a foundry dressing shop

A small group of workers in the foundry dressing shop of John Harper and Co Ltd, iron founders and engineers, of Willenhall, Staffordshire, asked to have their jobs time studied with a view to being put on an individual incentive payment basis. The men were being paid a collective bonus which, they considered, did not give sufficient personal incentive. The firm agreed. Time studies were made and the new system of payment was introduced. The system was applied gradually, eight men being involved as a first step. The immediate result was an increase in output from these eight men, and the system was extended to the other men in the shop.

Productivity was doubled within two years, and 30 men in the dressing shop were released for other work. The installation of two extra grinding booths and chipping benches brought a further substantial increase in output. To keep pace with the increased productivity of the dressing shop, other operations, chiefly shot-blasting and inspection, had to be speeded up. Time studies were made in these two sections and individual incentives introduced. The layout was modified to facilitate service to the operatives and two new wheelabrators were installed in the shot-blasting section. Output per man-hour rose substantially, and an additional two men were released for other work.

When the re-organisation of the dressing shop, the inspection and shot-blasting sections was complete, the existing method of trucking castings out of the foundry proved to be inadequate to cope with the higher output. Work pans were distributed at night, therefore, en-

abling the night *turn* to place the previous day's work in them. Trucks arriving in the morning were not kept waiting for complete loads as previously.

The time study engineers next went into the moulding sections. Moulders were performing jobs wasteful of their skill, such as knocking out moulds and rough chipping. This wasted skill would be entirely eliminated when a new layout with a rough dressing section was complete, but as a temporary solution better servicing by night-shift workers was introduced.

Nineteen men were employed in the grey iron foundry on the night turn getting up moulds and servicing 17 pneumatic machines' sides, 10 hydraulic machines' sides, and servicing the floor moulders. After time study, 21 men on the night turn got up the moulds and serviced the moulding sides of 17 pneumatic machines, 95 hydraulic machines, 12 bench moulders and part of the floor section. This extra service to moulders increased production by about 7 per cent.

The mechanite dressing shop has now ceased operating as a separate unit at the firm. Castings from both the grey iron and the mechanite foundries are processed in the grey iron dressing shop. This freed 1700 sq yards of floor space. All this was made possible because of the greater capacity resulting from the new methods and the individual incentive bonus scheme. Because of reduction in materials handling, there was a substantial saving in manpower. A fully-mechanised and centralised rubbish disposal section also saved labour employed on cleaning.

There was a saving in the shot-blasting and dressing sections of about 360 man-hours a week and in labourers' time of about 440 man-hours a week. Many workers displaced from the dressing shop were found alternative employment in other foundry sections.

METHOD STUDY

Method Study is the detailed analysis of existing or proposed methods as a basis for improvements. Its purpose is to improve existing methods of production and to ensure that in designing new products proper consideration is given to the importance of efficient methods of production. The main result that can be achieved by Method Study is the more effective use of materials, plant and equipment, and manpower.

Method Study may be widely applied since ways can usually be found of ensuring that work is carried out by new methods, more economical in time and effort. Some of the difficulties which cause jobs to take longer and require more energy than they should can be eliminated by improving: planning of the process; shop or factory layout; methods of handling materials; design of the workplace; design of jigs and tools; method of doing the actual job.

Before improvements can be made it is usually necessary to make a systematic study of the job, so that imperfections, however small, in the existing method of working may be brought to light. The causes of loss of output often appear only after such studies have been made. The basic procedure of Method Study has already been explained in detail on page 337. The six points in that basic procedure are the six essential stages in the application of Method Study; none can be excluded. Strict adherence to their sequence as well as to their content is considered essential to the success of an investigation. When this procedure is combined with a questioning attitude of mind developed by the method study approach, substantial savings usually result.

This questioning attitude is acquired as time goes on, so that in due course

the methods engineer, or whoever is carrying out the study, develops the habit of looking critically at every operation and movement in the factory, asking such questions as: *Is this operation necessary at all?* It may be that with changed circumstances the reason for the operation no longer exists. *Can the layout of the shop be improved to cut down the movement of work between processes?* This is important if handling time is large in proportion to processing time. *Can one operation be combined with another?* In short operations, this is often quite practicable. *Are the operations performed in the best order?* Handling and movement may be cut down by a simple rearrangement of the sequence. *Can a completely different process be used with better results?* Spot welding might supersede riveting, for example.

Factory & Workplace Layout

By the layout of a factory or shop is meant the arrangement of the different departments, machines, benches and stores. Bad layout leads to excessive handling and unnecessary movement by workers; it adds to the cost of the final product without adding anything to the value. A good layout will ensure that there is an even flow of work. For example, in the ideal factory, the raw material may come in at one end, pass through all the processes of manufacture and emerge as the finished product for despatch at the other end. Alternatively, the raw material may come in at one door, pass right round the factory, undergoing various operations, and go out of the same door.

These ideals may be difficult to achieve, but the more closely they are realised, the better the flow and the more economical the cost of processing. The principles of straight-line flow are

WORK STUDY

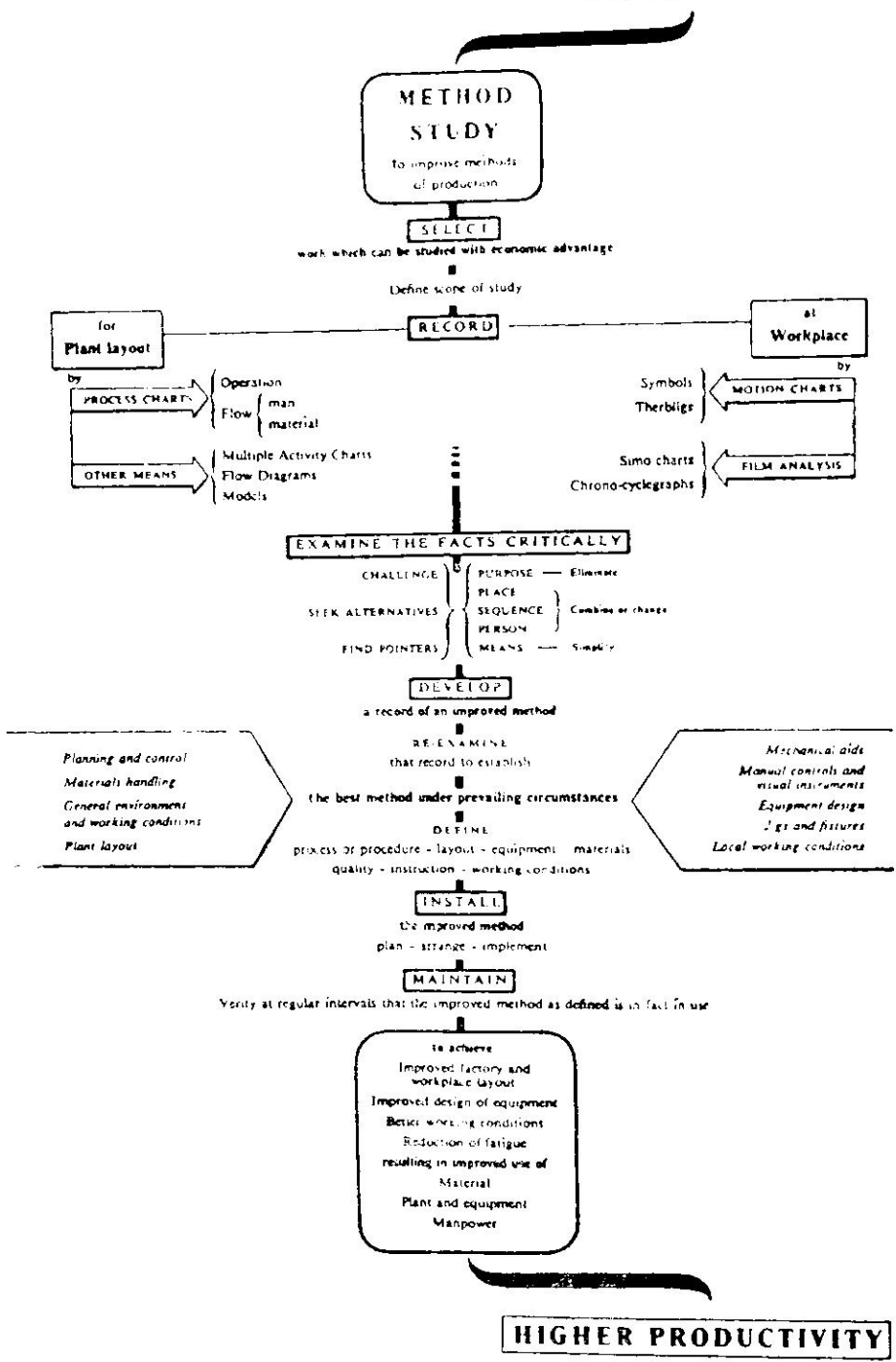


Fig. 3 — Method study procedure

still valid even where there are several parts going into the finished product, although it may then be necessary to introduce converging lines of flow with component or part stores at various points of the production line.

Once it is decided that a particular job is necessary and that it is correctly located in relation to preceding or subsequent operations the way in which the workplace is laid out and the positioning of tools or parts to be assembled can make a great difference in the time it takes to complete the operation.

Method Study is used to investigate the layout of the workplace and the movements made by the worker in doing the job. Having obtained all possible information on the methods used, the investigator analyses them and tries to eliminate unnecessary movements. This aspect of the job is called Motion Study and, as with factory layout, there are a number of basic principles which should be followed as far as possible if the most efficient method is to be adopted. Some of the principles laid down are: use the simplest and most natural movements possible; use smooth and even movements; use symmetrical movements; never use one hand for holding where a jig or fixture is practicable. Practical applications of these principles at the workplace are: In a bench assembly job for small components, containers holding parts should be tilted towards the operative and should be reached without stretching. The work area should, if possible, be within reach of the hands when the elbows are close to the sides (Figure 4).

Motion Study may mean anything from a study of the worker doing the job (using a motion chart) to a most elaborate investigation using micromotion films and other elaborate devices. The time spent and the equipment to be used depend entirely on the degree

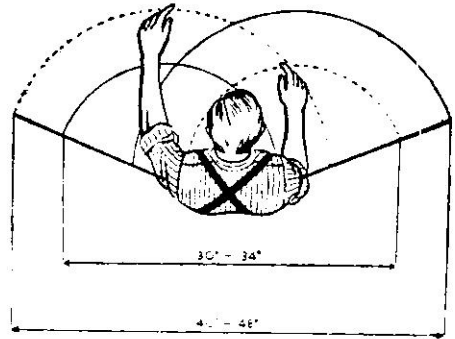


Fig. 4—Motion study, showing the limits of arm movement for efficient working

of savings to be expected. Clearly, it is not worth spending much time and energy investigating an operation which is seldom performed. On the other hand, in repetition work, where thousands or even hundreds of thousands of parts may be made in a year, a most careful and detailed study may be amply repaid, for a few seconds lopped off each cycle will add up to a consider-

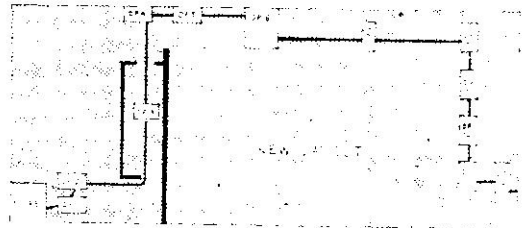
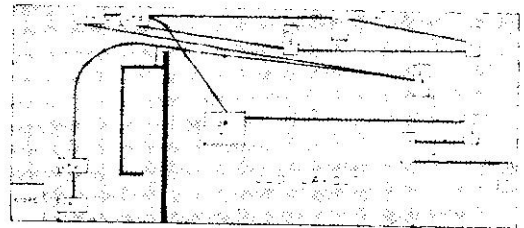


Fig. 5—Re-siting of certain operations, on applying method study—they resulted in smooth working and 20% increase in production. Note the convenient positioning, allowing good light, in new layout.

able saving of time and money. Once Method Study in all its forms has been completed, so that processes are performed as efficiently as possible, with the minimum of fatigue to the operative, the way is open for an accurate measurement to be made of the work.

CASE STUDY

In a carton works

Reorganisation by consultants and the firm's work study staff* resulted in a substantial increase in productivity over a period of five years at Field, Sons & Co Ltd, Bradford, Litho-colour printers and carton manufacturers. During this time workers' earnings rose by 33 per cent. Incentives, based on allowed minutes for the job, were set for many of the highly complex operations involved in the production of cartons of widely differ-

* The firm has established its own permanent work study department, manned by a staff of six trained employees.

ing shapes and sizes. But the works may be said to bristle with ideas, of which a few examples follow. On an operator-fed rotary slitter with a machine cycle of 2.4 seconds the feed gate was open for 0.4 seconds, giving only six feeds in every 10 cycles. Gearing was re-timed to allow the gate to remain open for 1.2 seconds. Now, a maximum 10 feeds is obtained without the need for altering the running speed of the machine. Box trolleys, which can be stacked on top of each other for space saving, act as storage bins for bulky cartons. A quick-action clip holds sheets of paper passing through the conditioning chambers; a spring ejector prevents sheets of card from sticking to the cutting and creasing formed in a platen machine. A holder for a spool of gummed paper is fitted with razor blades which cut the paper into strips as it passes over them and so avoids waste and helps machinists in making ready by saving cutting.

WORK MEASUREMENT

Work Measurement, as already explained, is the determination of the proper time to be allowed and of the effort required for the effective performance of a specified task. It has a dual function as a valuable tool for investigation and for setting standards of performance. Its main objects are more efficient manning of plant, improved planning and control, and the provision of a basis for incentive schemes. The introduction of incentive schemes, however, is only one of the purposes for which Work Measurement may be used.

The functions of Work Measurement as a tool for investigation and for the setting of time standards are complementary. In the day-to-day performance of work in factories, warehouses, or any place where operation is continu-

ous, there will always be a number of interruptions which are not revealed in their true significance until someone has studied the job and measured their incidence and relative importance, thus obtaining exact information about the actual time spent in each activity, productive and non-productive. There is no known substitute for this first-hand study of what is actually happening.

Work measurement techniques can be used not only to bring to light delays due to machine breakdowns, non-delivery of materials at the workplace, insufficient tools and the like, but also to ensure that successive operations are balanced one with another in terms of time, so that work flows smoothly and one section of the factory is not overloaded while another section is slack.

In plants with a high capital investment in machinery, full utilisation is vital to lowered costs; bottlenecks cannot be tolerated. Another important use of Work Measurement is in comparing the effectiveness of different methods, as, generally speaking, the method that takes the shortest time to perform is the best and cheapest.

The use of time, rather than money, as a standard measure is still new to some industries, particularly those where industry-wide piece-work agreements are in force. Yet time standards have many advantages over money standards. Time may be used to measure any activity in the works; it is unvarying; the work content in manhours or machine-hours (the number of hours taken to do a job multiplied by the number of men or machines employed) is very simply arrived at, and is independent of wage rates, fluctuations in price, or any other outside consideration.

Work Measurement Procedure

The most effective and most widely employed technique of Work Measurement involves the use of a stop-watch as an accurate recording instrument. The first task of the investigator after selecting the job to be studied is to break it down into elements or individual movements. This analytical approach is similar to that made in a method study investigation, but whereas Method Study is concerned with the way the job is done, the object now is to determine accurately how long the job takes. As a general rule these elements are of between eight and thirty seconds' duration, but as far as possible the breaks between the elements come at the end of definite movements. Each element is timed separately and the time noted on a sheet which records the name of the operative; the job being studied; whether any special jigs or

tools are in use; machine speeds and feeds (if a machine is used); set-up of tools; and type of material being used.

The job should be studied throughout its whole cycle at least 20 times, sometimes more, before the investigator arrives at the average time. The skill and effort of the operative is now taken into account. This *rating*, as it is called, is one of the most controversial aspects of Time Study because it is an estimated assessment. Doubts may be removed if it is made clear that the estimator is a specialist engineer, fair-minded, with carefully acquired skill and experience.

Rating is usually based on *work units* or *standard minutes*. These may be defined as the amount of effort expended in one minute by the average worker, suited and accustomed to his task, working at normal speed under normal conditions, with due allowance for fatigue resulting from the effort expended. This normal working is at the rate of one work unit per minute or sixty work units per hour, and corresponds to the productivity to be expected from an average worker for a guaranteed minimum wage without money incentives.

When sufficient readings of any particular job have been taken, the observed times are adjusted to those of a "normal" worker as a first step in obtaining the time allowed for the job. For example, if a worker averages 30 seconds in the performance of one element of a job, and he is rated as working at 80, then the normal time will be $30 \times 80/60 = 40$ seconds.

The sum of the normal times of all the elements will of course give the normal time for the whole operation. To this is added an allowance for recuperation from fatigue, personal requirements, varying from 7 per cent for light bench work upwards, according to the nature of the job, very heavy or tiring

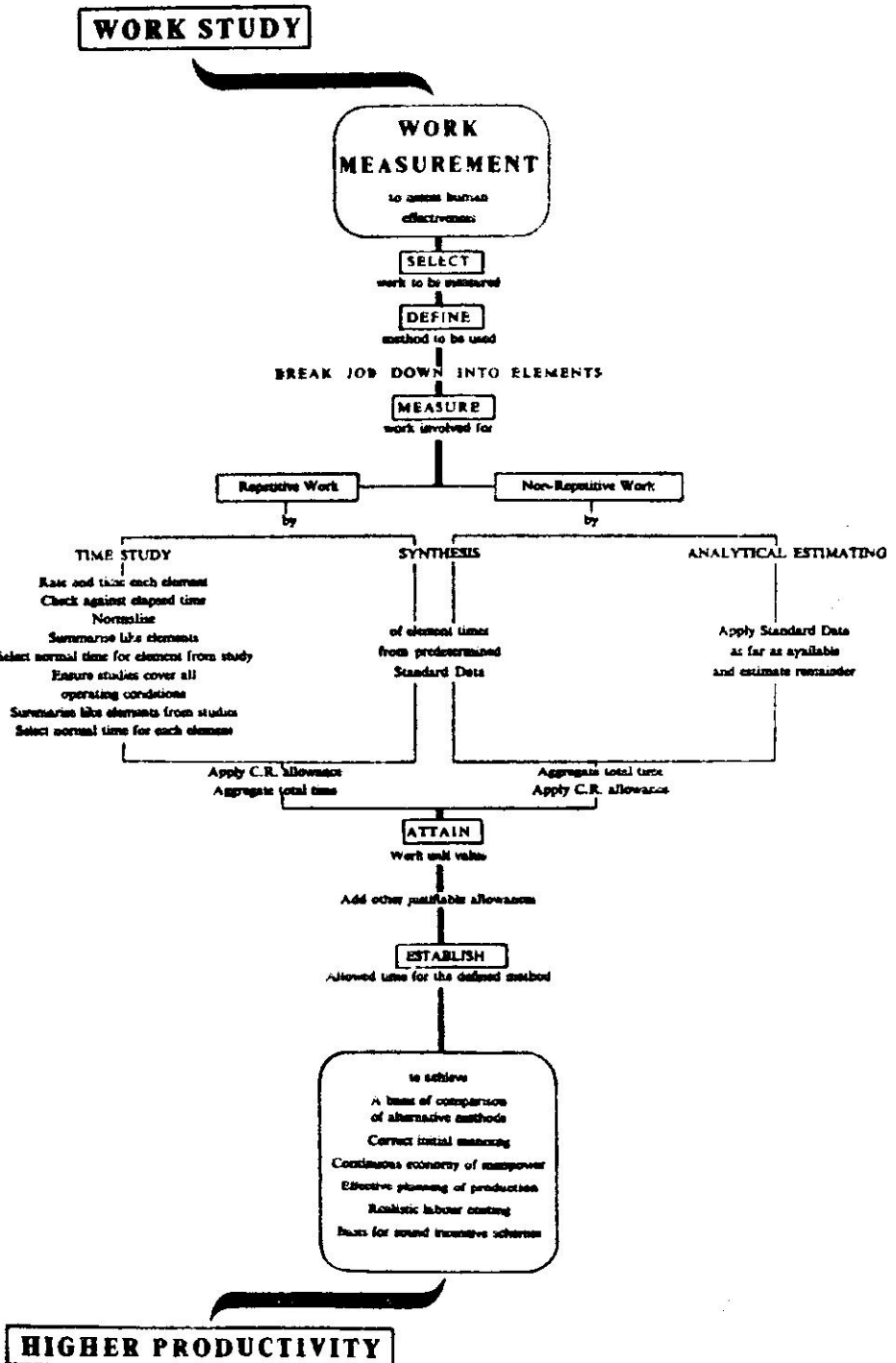


Fig. 6—Work Measurement Procedure

work often receiving a substantial allowance. The normal time for the operation plus the rest allowance gives the *time allowed*. This time allowed is a basis for costing, planning and calculation of bonus incentives.

If Time Study is to be successful there must be joint consultation at all stages. Fewer misunderstandings are likely if the studies are available for examination by the workers or their representatives and if once *times* are fixed they are not reduced unless there is a real change of method. Fair treatment will benefit management, who can expect full cooperation from the workers, leading to a sizeable increase in efficiency with a lowering of costs.

Assessing Non-Repetitive Work

Work Measurement is most effective and easily done where repetitive work is

being considered, but many workers are engaged on nonrepetitive jobs, such as maintenance, transportation, job production or heavy constructional work, which do not always lend themselves to straightforward timing.

Even so, a large proportion of non-repetitive work is, in effect, a new combination of previously known elements. Where this is so, the elements may be regarded as *repetitive* and are capable of assessment. A *synthetic* value for the whole job may be determined by summing the elements in the normal way.

But where the work content of a specified job is liable to wide variation—as for example, engineering maintenance and constructional work—a more difficult problem arises. Research is being carried out in this field both in the UK and the USA. One technique,

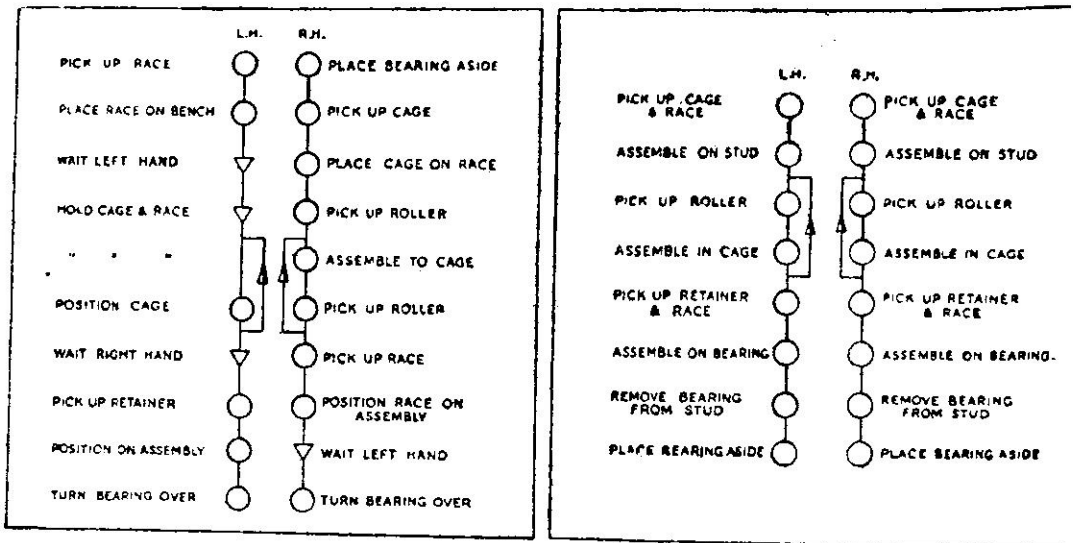


Fig. 7—Powers charts depicting the movements of the operative's left and right hands during the assembly of thrust races before and after Work Study. In the former sequence only hand was fully utilised; in the latter, provision of a holding device freed both the hands for essential operations

known as analytical estimating, consists of an assessment by a trained estimator of the work values of the particular job. The estimator breaks the job down into component elements. He then measures the work involved in as many elements as possible, as described above. The work content of any remaining element is calculated by direct estimation.

To sum up, the correct use of Work Measurement provides management with valuable information which can be applied; to disclose the reasons for hold-ups and lost time; to determine accurate manufacturing time which will serve as a basis for estimates or quotations, and for delivery dates; to help in finding the best layout; to plan the programme of work and the number of workers and machines required to carry it through; to balance the operation in line production and to find the true cost of work done; to obtain a firm and fair basis for bonus incentive schemes.

Work Measurement is not an exact science. There is bound to be an element of estimation, as, for example, in rating. It is, however, the most accurate system of investigation and setting standards yet devised and is achieving important results in modern factories, to the benefit of managements, work-people and consumers alike.

CASE STUDIES

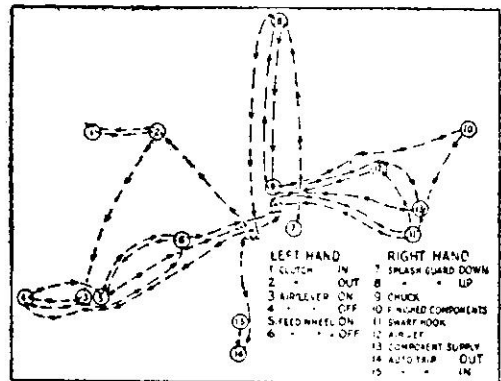
In a Roller Bearing Factory

Whether the task is raising the efficiency of a simple repetition assembly operation or improving the capacity of new capital equipment, the management of British Timken Ltd, Duston, Northants, believes in basing its plans on Work Study.

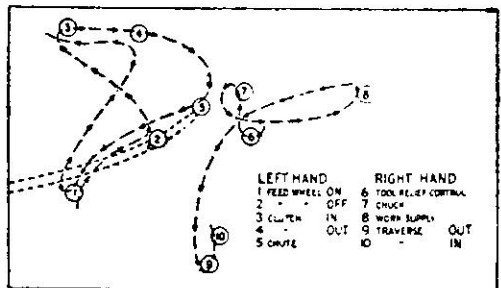
In the firms thrust race assembly section, for instance, a preliminary work

study investigation showed that an operative spent only half the working day actually assembling and measuring bearings. Collecting parts for assembly and despatching completed thrust races accounted in large measure for this low time ratio. An immediate productivity increase occurred when a servicing operative was employed to supply the assembly benches, remove finished work and sort reject components.

Each operative was given a separate bench. Previously, the girls had worked in pairs, one on each side of a table, with the parts heaped in the centre. A process chart revealed that only one hand was fully utilised; the other acted as a holding jig



(a)



(b)

Fig. 8—Left- and right-hand charts of lathe operation before and after Work Study.

for the large components into which tapered rollers were placed (Figure 7). A holding device was constructed, freeing both the operative's hands for assembly work. A gravity feed lip bin containing the roller components was also made, enabling the operative to pick up a roller with one fore-finger only—in a hook grasp—the whole assembly operation becoming two-handed (Figure 7). Other gravity feed hopper bins, containing all the necessary parts, were installed within easy reach on the bench, arranged in the sequence in which their contents would be required by the assembler.

As shown in the two-handed process chart for the new method, the first component to be grasped is the cage, and then the race. These are assembled (race first) on the studs, the operative holding two parts in each hand.

Assembled bearings are placed in work trays held in grooves under the benches. When the trays are full they are pushed along the grooves and on to a roller conveyor behind the benches. This conveyor transports the trays to their destination, cutting out lifting and carrying. The operative also has a chute under the bench for the disposal of rejected assemblies and wrong parts.

These new methods have reduced the time cycle for assembly operations by 25 per cent, and output has increased by 50 per cent. Earnings have risen by 20 per cent. The morale of the section has also greatly improved through better working conditions.

Work Study on new machines

A completely different application of Work Study occurred when 14 semi-automatic chucking lathes were installed and study was undertaken to facilitate maximum utilisation of the new plant.

The lathes are used for machining steel forgings for the outer races of tapered roller bearings. Several of the lathes are fitted with three-jaw chucks for turning the bore of the forgings; the remainder have a draw-bar and tapered plug for turning the outside diameter.

Work Study showed that the lathes could be modified so as to reduce and improve the operative's movements. Left and right-hand charts [Figure 8, (a) and (b)] representing movements, were drawn on tracing paper and placed over appropriately-sized photographs of the new machines. Positions of control and storage areas were marked and every line of movement was studied. Modifications followed.

The air control valve for operating the chuck, shown at position 3 and 4 on Figure 8 (a), was originally worked by the left hand, while the right hand held the component, placing the operator in an awkward position. To overcome this difficulty the valve was made to operate from a cam on the feed wheel periphery. As the feed wheel retracts the tools the cam engages the air control plunger and releases the component in the chuck. Conversely, when the tools are advanced by means of the feed wheel the chuck jaws grip the component.

Before modification, the feed wheel handle position varied with the tooling. This prevented the operator from forming a rapid habitual movement. Now, after re-setting the gears, the mechanism has been altered to operate in the same arc for all tooling variations. Figure 8 shows the economy in movement. The splash guard was redesigned to eliminate another handling movement. The new guard was made in two parts, one fixed and the other swinging. The swinging portion is operated by a dowel projecting from the cross slide. When the slide is removed

to the rear, the dowel engages the swinging portion of the guard, causing it to open. After loading the machine the slide is returned and the guard closes by means of a spring.

To operate the new splash guard, the worker has to know when the tools are fully advanced before engaging the automatic feed. An extension to the feed gear lever, which engaged in a step on a snail cam on the feed wheel spindle, was fitted. The tool slide could not be manually operated beyond this point, and, on engaging the automatic feed, the step on the cam was disengaged from the extension and the power feed was free to take place.

Economy of movement and planned layout enable each operative to run two machines. One machine is loaded while the other is working. Forgings are delivered to machines by conveyors and chutes.

Calculations showed that output from the 14 new machines is 20 per cent greater than it would have been without Work Study. Piece-work earnings are up by 12½ per cent.

In a Food Factory

Since the end of the war, the Cooperative Wholesale Society has engaged in a continuous and intensive campaign to raise the productive efficiency of its 200 factories in Great Britain. As nearly every factory makes a different product the measures taken to increase output vary considerably, but the principal methods employed have been: reequipment and renewals of plant wherever possible; Work Study and incentives.

In two of the Society's factories, the Preserve Works at Middleton and the Confectionery Works at Reddish, Lancs.

—where consultants introduced Work Study—productivity is up 50 per cent and operatives' earnings have risen by 25 to 30 per cent. The morale of workers in both factories has improved to a marked degree. Those displaced in reorganisation were absorbed into other departments. The aims and hoped-for results of the scheme were explained to managerial staff and operatives in the frankest and friendliest way before the investigations got under way. When the consultants commenced their studies in the Middleton factory they had to contend with a certain amount of opposition from workers who made no secret of their dislike of *stop-watch methods*. The manner in which the consultants set about their task, however, quickly allayed suspicions, and workers were soon cooperating whole-heartedly with the work study men. Some of the biggest gains were made in a department where Christmas puddings are mixed, cooked and packed. The puddings were formerly prepared and then cooked in individual earthenware basins. It was decided to scrap the individual basins and substitute cooking by multi-container trays, which could take 12 two-lb or 18 one-lb puddings. The pudding preparation is now a team job with a team bonus. The saving in basins in one season more than paid for the cost of the scheme.

Preparation and packing of mince-meat into pound jars was another operation to be completely reorganised. Here, a major change was the introduction of a gravity feed system between twin mincers and the filling stations, which cut trucking between floors. The jars are now filled, fitted with metal tops, washed and labelled in a continuous flow operation. Result: a lowering of production costs, a 50 per cent increase in productivity and an increase in earnings of 25 to 30 per cent.

PROCESS STUDY

Of the two ways of bettering the performance of an industrial undertaking, namely, Process Study and Work Study, Work Study has been taken first since it is a basic technique applicable to all industrial activities where the movement of men or materials or the operation of plant are involved.

Need for continuous application

Process Study is confined, generally speaking, to manufacturing industries. It may be described as study, research and development devoted to improvements by technical and scientific means in basic processes and in the performance of plant, machines and equipment. Associated with Process Study, and to a large extent inseparable from it, is improved design of the product, for easier and cheaper production.

It will be seen, therefore, that Process Study is, in fact, a new name for what technically-minded managements have been doing since industry began. If the term has any special significance it is that the search for improvement is *systematic and continuous* and that it takes into account all aspects likely to offer scope for more effective performance and more economic operation.

Process Study is likely to involve considerable capital expenditure, whereas *Work Study can often achieve substantial improvements at very little cost*. On the other hand, improvements brought about by Work Study are generally subject to limitation, while in many instances the *application of Process Study appears to have obvious limit and may result in revolutionary changes in process*.

Inter-relation with Work Study

Process Study and Work Study go hand-in-hand. It should be noted that

design in this context may be either plant or product design. The relative importance of each technique will depend very largely on the nature of the process and the proportion of time taken up in actual processing as opposed to handling and other ancillary operations.

Process Study tends to assume greater importance where the process is governed by scientific and technical considerations which require certain scientific qualifications in those responsible for seeing it through. It also applies where expensive material and plant are involved and where the plant, once installed, is required to operate over several years. In most branches of the chemical industry, research in processes and the development of improved plant are in the hands of scientists and qualified engineers. Most research, at least in the early stages, takes place in the laboratory, and there is generally little the operative or even the supervisor can do in the way of process improvement. Furthermore, in many chemical processes plant is operating continuously and materials and products are piped or carried automatically throughout most phases of manufacture.

Even in plants like this it has been proved that many decisions have to be made with regard to the placing of controls and instruments, the layout of the plant as a whole, manning and maintenance. This means that Process Study cannot be used in isolation but, to be fully effective, must combine with Work Study at the earliest possible stage, often even before the plant is built. Accordingly, plant designers must have some knowledge of the principles of Work Study.

At the other end of the scale is the factory where the process, while involving a high rate of manual labour, is yet,

technically speaking, comparatively simple. A good example is light assembly work. Here there is little scope for Process Study: the major improvements in output will be brought about by Work Study and may even come from the operative or methods engineer, who need not be highly trained technically.

Engineering falls between these two extremes. Improvements in performance of the works may be achieved by using machines of higher capacity, improved cutting tools or oils resulting from Process Study, as well as labour-saving jigs and fixtures, and by proper layout and flow of materials as the result of Work Study.

Research and development of new machines and basic research in improved cutting tools and methods is outside the scope of the average engineering firm and is performed either by the machine tool or cutting tool manufacturers or by a research association. It is, however, necessary, in order to obtain the best performance from machinery, that the conditions and manner of operation should be controlled by someone with specialised knowledge of the processes: the Process Planning Department, a common feature in many engineering companies, especially on large-scale production, is established for this purpose.

The responsibility for obtaining a complete specification of the finished product, together with the drawings, if any, rests with the sales office, in consultation with the design and drawing office. The process planning department receives the drawings and specifications from the design office, and from these the planners prepare operation layouts which set forth in detail how the operations are to be performed, on what machines, at what speeds and feeds, with what tools, special fixtures etc.

Process planners are often drawn from the ranks of skilled tool room operatives. To achieve maximum effect and secure the respect of people in the shops it is of the utmost importance that those promoted to the planning office should be of the highest quality available and be supplied with as many specialist data in relation to machines, tools, etc., and upto-date developments in these fields as possible. The process planning department is the logical link between the workshop and the drawing office, and should continually advise designers about their designs for production. This applies particularly where designs have been found unsuitable, or where alterations in design could reduce the cost of manufacture without detracting from the quality.

The process planner works hand-in-hand with the jig and tool designer, whose activities lie more in the field of Work Study. Indeed, it is essential that both process planners and jig and tool draughtsmen should have had adequate work study training. Failure to ensure this frequently means that layouts and fixtures produced to planning office specifications have to be altered by methods engineers in the shops.

Link with research

Any consideration of Process Study must also take into account research. Many large firms have their own research laboratories, in which possible solutions to specific problems may be tested on the spot. Other firms may make use of a research association linked to their own industry, though of necessity research associations will be primarily concerned with work likely to benefit the industry as a whole. In many cases it is on the basis of their work that firms and plant manufacturers staffed with suitably-qualified men can further develop and improve their own processes.

An intermediate stage between the research association and the firm with its own laboratories is the sponsored research institute, staffed by qualified scientists and engineers, which will undertake investigations into special problems of individual firms.

Complexity of Process Study

It will be seen that Process Study may be extremely complicated, involving the plant designer, the work study department, process specialists, a firm's own laboratories, the resources of external associations and in many industries the operatives themselves.

It should not be assumed, however, that the function of Process Study is exclusive to the large firm which can delegate responsibility to a special department. The importance of Process Study is in no way diminished in the smaller firm where, resources being limited, the need for such a department will not arise; instead of being a whole-time occupation it becomes one of the responsibilities of the works manager.

Where Process Study is carried out by a special department it is sound policy to work in close *liaison* with men in the manufacturing shops. This applies particularly to foremen and supervisory grades who may regard with suspicion, even hostility, the assumption of duties which they consider come within their own province. Good human relations will ensure greater cooperation and enhance the value of the production engineers' work.

CASE STUDIES

Staffing engineering shops with unskilled workers

Electro-Hydraulics Limited, aircraft component manufacturers, made use of Work Study and Process Study

methods to get increased production when faced with an acute shortage of skilled labour at their Warrington factory. To achieve a higher rate of production it was necessary to intensify production planning and design, simplify tools and methods, make maximum use of unskilled labour and cut down on materials handling.

A competent technical staff took care of the first two essentials, while the resources of an associate company, Conveyancer Fork Trucks Limited, were exploited to save time and money in handling. But the success of the new production methods as a whole hinged on making the best use of unskilled workers. The first step was to promote the majority of skilled men to section setters. Unskilled workers—many of them fresh from the Services were drafted into these sections. Training took 8 to 12 weeks.

Jobs were broken down into simple operations. Standardisation was introduced on a large scale in jigs, fixtures, tools and handling methods, covering several thousands of separate detailed parts. In addition, special-purpose machines were designed and built for intricate machining operations by semi-skilled labour. These machines (plus the standardising of jigs and fixtures) were the answer to a common cause of confusion in machining aircraft parts: the difference between right-hand and left-hand components which are otherwise identical. Most of the jigs and fixtures now in use are fool-proof, being designed to take both hands of a component but only in the correct sequence. Chucking automatic lathes have been installed to deal with quantity production, thus leaving skilled turners to concentrate on key operations and small batch work.

On the assembly side, expansion has meant a breakaway from traditional

bench methods. To save human labour, assemblies are built in convenient groups on specially-designed holding fixtures. Completed assemblies of aircraft hydraulic systems are simultaneously checked in multiple inspection fixtures for all important dimensions. This used to take several hours; it is now done in as many minutes. After inspection and test, each assembly is placed on an overhead rail conveyor and not handled again until delivery to the customer. Finishing operations, like cleaning, masking, spray painting and drying, are performed on the flow principle without intermediate handling. Risk of damage to the expensive aircraft units has been practically eliminated by the unit load by a fork-lift truck. This has meant a five-fold increase in storage capacity at work stations. Other features of the firm's re-organisation scheme include a production control system by means of which shops are work-loaded with accuracy on the basis of short-term and long-term efficiency requirements. Actual performances are compared each week against forecast requirements by the issue of efficiency statements. These are circulated to all executives, including departmental foremen.

In a textile mill

Process Study from fibre to fabric is an axiom of production efficiency at the century-old textile mills of Wood Brothers (Glossop) Ltd, Derbyshire. Processing cotton or man-made fibres from raw state to finished product gives the firm the initial advantage of being able to control processes at every stage

of production. Cotton fibre testing is an example of how the firm brings science to the shop floor. Hair weight of cotton fibres is checked regularly to gain advance information on the blending and dyeing qualities of the yarn to be produced. Accuracy of the forecasts is checked during final processes. The firm has systematised scheme of "know-how" exchange which keeps its scientific applications and Process Study constantly in line with the world's foremost textile mills.

Several years ago a working *liaison* was established with one of the best textile concerns in the United States. The two companies maintain a constant two-way flow of information on production problems and specific projects; key men on both sides interchange regular visits. The British firm has similar contacts in all countries with a progressive textile industry, and it is the ready acceptance of scientific aids and information on cotton crops throughout the world that enables many production problems to be solved before the raw material reaches the mills.

When the present company took over in 1946, weavers were working four to six looms on *plain Cheshires*, as their parents and grand-parents had done before them. Most of the 1,152 looms are now fully automatic, with one weaver in charge of 18 to 20 looms. The weaving rooms were redeployed as new machinery was put in, and once the cooperation of the operatives was secured progress was rapid. Production has increased five-fold since 1946. In the same period the labour force has almost doubled from 440 to over 850.



The man who can't make up his mind is hard to work for and hard to work with—especially if he is the boss.

NPC

THE most outstanding programme which created a sizeable impression in recent months was the top management seminar organized by the npc through the Local Productivity Councils and Management Associations. The photographs preceding and following this article are all about this Seminar except the last page which gives productivity snapshots of Indian industry, taken especially by an expert of the npc. An account of this Seminar is given elsewhere in this article.

In its own official history, the npc having completed 3 years of its life made some sort of an evaluation of its work in the report submitted to the last annual session of the National Productivity Council. The credit side was summed up as follows: "... the development of consciousness of productivity in the industries, the generation of an urge in the industries which is conducive to higher productivity, the realisation among managements and workers that there must be greater harmony and togetherness between them if they have to increase productivity, and the creation of an understanding and appreciation on the part of both managements and the workers about the viewpoints and problems of one another. In these areas the impact of productivity drive can only be felt and it cannot be measured. There is all-round recognition that in these areas there is a certain definite improvement which is palpable. There is in general the generation of appropriate climate. The government,

employers, managements, technicians and workers are increasingly becoming alive to the need of increasing productivity and are evincing desire to explore ways and means for achieving this objective. These intangibles are on the credit side of the balance sheet of the work of npc.

"Besides these intangibles there are a number of tangible results for which the npc can legitimately claim to have been responsible and which it has stimulated and brought about. These are, firstly the platforms of local productivity councils spread all over the country on which employers, workers and other various interests sit together for determining what programmes they should initiate for carrying the productivity drive to the plants. In these productivity councils the workers' representatives have found a forum where they can sit with the employers, on recognised basis of parity, for settling the problems and programmes relating to productivity. There are now 42 Local Productivity Councils in the country. Their aggregate membership is 2953 and the members pay subscriptions to them. Secondly, 3185 persons have so far received training in the various training courses on subjects of industrial productivity which have been organised by npc; and 11,016 persons have participated in the seminars, conferences, and symposia etc. which have been organised under the auspices of LPCs. Thirdly, 227 persons in 25 in-country productivity teams have conducted inter-plant visits and studies within the country.



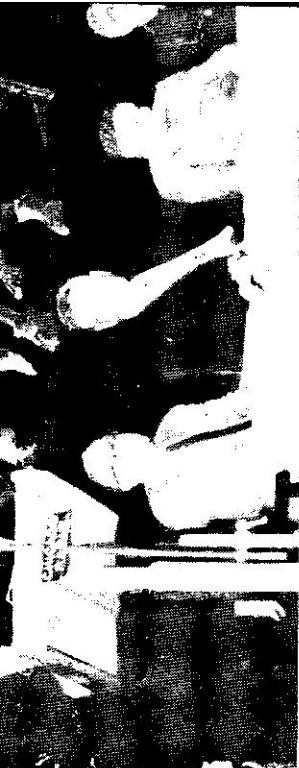
Part of the audience at the plenary session of the NPC Top Management Seminar, 14 February 1961 Grand Hotel, Calcutta.

Executive Director NPC speaking at the valedictory function, Madras



Albert Blake Dick speaking to the Personnel Group





Top Management Seminar, Delhi, 16-19 February 1961
Top left : Mr Harry M. Hopkins, discussing production problems
right : Sri Dalmia of Delhi Productivity Council, speaking at the plenary session

Below left : Close-up of the audience at the plenary session
right : Mr Arthur C. Neilson, Junior, discussing marketing problems



20 Productivity Teams have gone abroad and conducted studies there. 122 persons have gone abroad for training of six months to one year in subjects of industrial engineering, industrial management, industrial relations, and production management. Projects have been undertaken in the factories for demonstrating concrete results of the increases in productivity..."

In his opening remarks, the President of the *npc* said that it was time to consolidate the position of the productivity movement. The 43 Local Productivity Councils, with the addition of one or two could, if properly organized, accomplish a good deal in terms of increased productivity. The President felt happy that LPCs had been established covering practically every industrial area in the country. There was widespread support for the Seminars and Symposia and other Productivity Conferences organized by the *npc* and the LPCs. More emphasis was now to be given to technical training in the arts of productivity.

Much practical work yet remains to be done on the shop floor and it is only this type of work that would be of substantial benefit to the whole economy. The President appealed to every member of the *npc* to have five industrial units X-rayed from the point of view of productivity. The *npc* is in fact setting up five groups for the study of productivity of the following industries: (i) cement (ii) electric transformers and motors (iii) jute textiles (iv) rayon, and (v) bicycles. At the time of writing, work is being done on the organization of these productivity groups.

The President also stressed the management aspect of the productivity movement, particularly, the middle management. Inaugurating the top management seminar at New Delhi on 13 February 1961, the President expressed the same ideas regarding a

revolutionary change in the whole concept and practice of management: "Management by succession must go and management by competence must take its place... a financier is not necessarily a good manager. If we are to raise industrial productivity, we must make the choice... we must particularly train the middle management group, for it is this group that has played a revolutionary part in modern industry... No longer can management operate by rule of thumb or by hunch. It is a regular science to be acquired through education and training... There is no substitute for good human relations; and management must apply these new techniques into its practices and policies..." This top level management seminar which ended at Delhi on February 19 really created some sort of a history on a small scale and a good deal of sensation in industrial circles, for practically the first time, four top American executives went round to the principal industrial cities, sat down with groups of Indian industrial executives and discussed with them intimately, the ground level problems regarding organization and policy, production, personnel and marketing. These four executives were: Mr William E. Roberts, Executive Vice-President, Bell and Howell Co., Chicago, Mr Harry M. Hopkins, Vice-President-in-charge of Operations, Tool Steel Gear and Pinion Co. of Cincinnati, Mr Arther C. Nielsen, Junior, President of A C Nielsen Co., located in Chicago, Illinois and Mr Albert Blake Dick, President of A B Dick Co., manufacturers of office equipments.

These management experts held a series of six seminars at Kanpur, Bombay, Madras, Cochin, Calcutta and Delhi. Over 350 top management personnel participated in these seminars, but the more important facts were that crowds of people attended the plenary sessions, asked questions about all aspects of management practices and re-

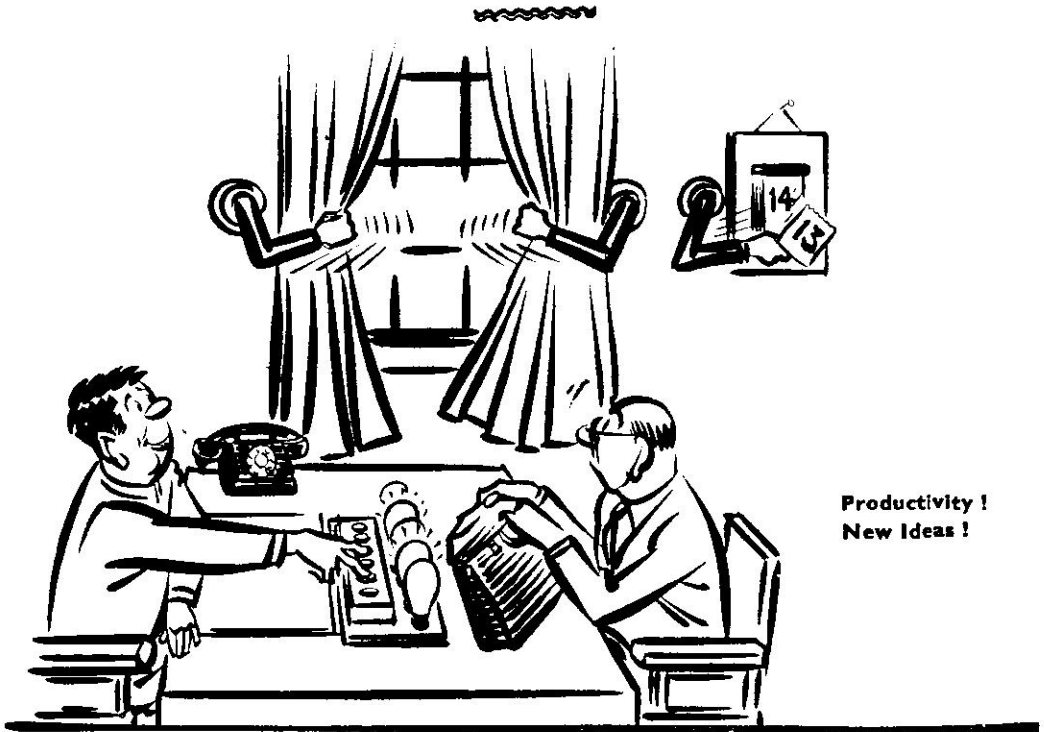
ceived answers which reflected a general state of mutual satisfaction. Among the participants themselves, there was noticeable enthusiasm and the American executives had been able to establish such *rapport* with their Indian counterparts that the mere psychological gains in terms of superior managerial attitudes should have been very considerable. In this Journal (page 309) a special article has been printed on Management Philosophy by the leader of this Team, Mr William E. Roberts.

The appetite grows by what it feeds on. Another such Team will visit this country in October-November 1961 and will deal with Effective Mobilisation of Human Resources in Industry. Preparations are being made by npc to make it as fruitful as possible.

By the time this Journal is printed, the second session of the Advanced

Management Programme will commence at Coonor on April 22, to be repeated after every three months: Nainital June 3, Darjeeling September 10 and Poona October 11. The first session was held at Bangalore towards the end of last year.

Through the LPCs, a considerable programme is being put through of which an account will be found in the npc Information Bulletin for April 1961. This Bulletin will also give the necessary details of training programmes for the second quarter of 1961. Suffice it to say here that a position has been attained by which *on any day, on the average, 8 to 10 training programmes of npc are being conducted in various parts of the country.* It is obvious that the Productivity movement is acquiring a considerable momentum at the ground level.



**Productivity !
New Ideas !**

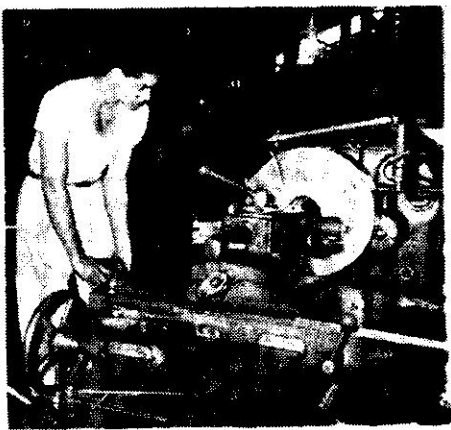
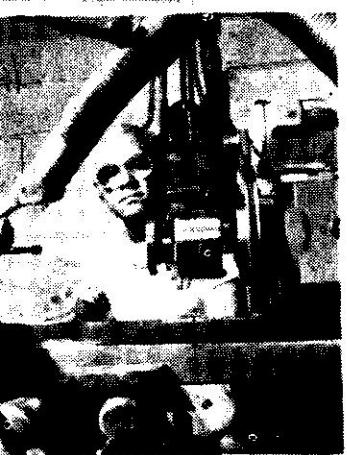
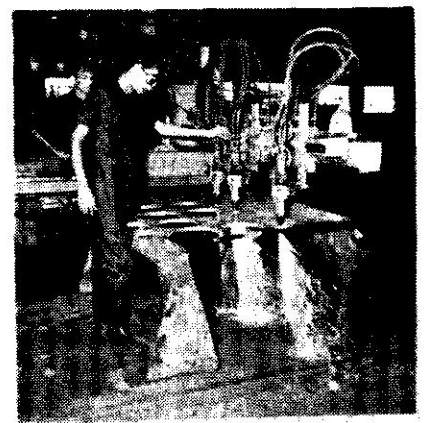
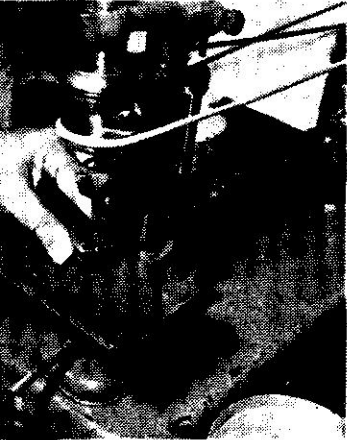
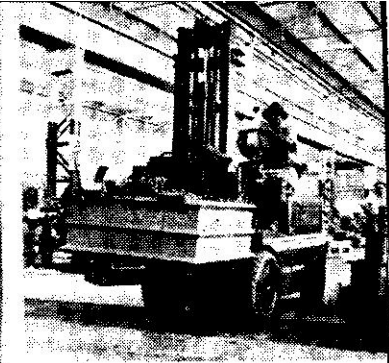
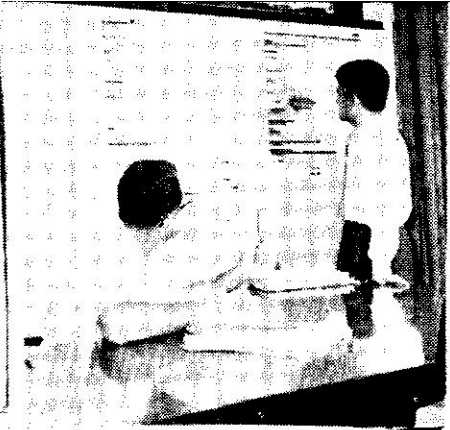
Mr. William E. Roberts, Leader of the Top Management Team, rounding up the proceedings on 14 Feb. 1961.



TOP MANAGEMENT SEMINAR, Calcutta



Mr. Arthur C. Neilson Jr., talking to the participants on 12 Feb. 1961.



Factors Increasing Productivity

ROBERT L. WALKINSHAW*

Increases in output per manhour of work are based on improved labour skills and the increased use of power driven machines and production systems. Rising productivity is the result of improved machinery and production processes, better raw materials and a more efficient flow of work from one operation to another. Continuing improvements in productive efficiency arise from the application of scientific knowledge, labour skills and management ability.

- Productivity increases can be summed up then as dependent on
- (1) more and better directed effort on the part of the employee;
 - (2) elimination of waste and better planning by the employer; and
 - (3) full mechanisation of productive operations.

IF words were the answer to productivity, all of us would be living in utopia. What most of us forget is that the real answers lie with people: people who manage and people who are managed. If the people who manage are selfishly inclined, the productivity system suffers, the economy suffers.

If those who are managed cooperate with those who manage to make a given industrial establishment more productive, the economy as a whole should benefit. The employer should get more production and more profits; the stockholder should get better dividends; the worker should get higher wages; the consumer should get lower prices, all of which benefits the economy. If, however, those who manage are not willing to share the gains resulting from in-

creased production with those who are managed, then, those who are managed will not extend their cooperation. In other words, *the way to get people to be responsive and to rise to the occasion is to treat them as people*. If people know that they are not being exploited, they will always be responsive and do what is right.

Let's look at people being asked to increase their productive efficiency by exerting more individual effort. Those who manage decide that this is possible because the industrial engineer they employ has proved it *scientifically* possible. The average worker does not get excited about scientific approaches to his workload; he gets excited about the workload being increased, especially when he is told by management that a stop watch was used as a determinant. I do know that this was true of the American worker, and I would guess, the Indian worker would react in the same way.

* Chief, Labour Division, United States Technical Cooperation Mission to India, New Delhi.

It was not too long ago that American workers looked upon a stop watch as a tool in the hands of some industrial engineer, as a method for increasing production and eliminating job opportunities. This feeling, even today, has not been completely eradicated. There are still American workers and labour leaders who reject the notion of time and motion study as a method for measuring production. This group prefers to negotiate with the employers on the basis of the job content of a specific classification rather than how much the worker produces.

They argue that time and motion study creates discontentment among the workers rather than harmony. They argue that workers will automatically produce if they know that a wage rate is established on the basis of equity and on the basis of justice. They cite production statistics to sustain their contentions. The potency of their argument, they contend, evolves from the fact that time and motion study pits worker against worker.

This point of view is not shared by all American workers; nor is it shared by all American labour leaders. There are, within the American labour movement, leaders who feel that the best way to handle this question is to be active within it. These leaders felt that since employers were proposing to introduce time and motion studies as methods for measuring production and wages, it was incumbent upon them to acquaint themselves with the techniques of industrial engineering, with the idea in mind that this might be a way to increase the earning power of the workers. Their main consideration was to employ collective bargaining as collective protection. They wanted to make sure that the employer did not utilize this method for the purpose of getting more production at the same earning level.

As I look back at the events which took place at the collective bargaining table, I am satisfied that most labour leaders, who elected to take this position, were justified in doing so. Proof of this is the production and wage statistics presently existing in the United States.

One should not get the idea that the participation factor alone is in itself a panacea; nor is it a cure—all for the ills which result from time and motion study. Participation, however, exposes the ills and affords workers an opportunity to propose, through their unions remedial measures. Here again, we must concern ourselves with people, it takes men of goodwill on both sides of the bargaining table to agree upon the kind of medicine which will best serve the patient's needs.

Union participation has, in my estimation, served two separate and distinct purposes: (1) it was responsible for the improvement of many types of time and motion study plans, which, at the outset, were complex by design and discriminatory by application; (2) also for awakening the union leaders from their indifference toward training in the techniques of industrial engineering.

Today, most, if not all, of America's labour unions are equipped with competent staff people who are either graduate industrial engineers, or whose competency results from attendance at union-sponsored training programmes. There is also great emphasis put on the training of rank-and-file leaders.

To substantiate this point I quote a well-known and competent person, who is president of one of America's largest trade unions: "You are undoubtedly aware of the increasing application of time and motion study schemes for a variety of purposes which directly affect us in collective bargaining. The resulting number of grievances and arbitra-

tion cases is staggering, and takes up a substantial proportion of the available time of union representatives at the local and international union level... Your international officers do not expect you to become management engineers in a week: this would be neither possible nor desirable. We do expect you to improve your abilities along lines of obtaining maximum contractual protection for our many local unions which are faced with problems in this field. And we expect you to be in a better position, through increased practical knowledge of technical language and practices, to penetrate the complexities of many of the problems which you will face."

What is significant about this statement? The significant point here is that a president of an international union is admonishing his constituents to face up to their responsibilities. Equally significant is the illumination of the American labour movement's policy, that problems, whether they be about productivity or other matters, be settled on a day-to-day basis at the plant level by rank-and-file leaders.

Was this training a contributing factor to productivity? My response to this is yes. Either knowingly or unknowingly the American labour movement made a great contribution to productivity by training their people to understand the techniques of industrial engineering. I say this because, as the union leadership began to understand the machinations and the techniques of time and motion study, collective bargaining replaced ignorant bargaining. Now both sides of the bargaining table were able to meet on an equal basis. Each side was well aware of each others' capabilities: capabilities which created the necessary atmosphere to assure the workers a just and fair share of the fruits resulting from increased production. It is fair to conclude then, as I previously stated

was their goal, that out of collective bargaining came collective protection.

Today the American worker is confronted with a new problem: automation; in India it is known as rationalization. The American labour movement is not so concerned about what automation is as it is about what automation means. The problems associated with automation are big. Let's look at one of the problems. The United Auto Workers Union is presently confronted with a serious unemployment problem, most of which arose from automation. Let me give you an example of automation in the automobile industry. In 1927, it took about 24 hours to take a rough engine block as it was cast in the foundry to machine that block, ready for assembly. And that was a simple Model T Ford engine. Progress, however, has been made over the years since. First it was ready in 18 hours, then 14 hours, then 12 hours, then 8 hours. Today, in the Ford engine plant in Cleveland, Ohio, which is fully automated, you can see a Ford V-8 engine—a very complicated piece of mechanism—in which the rough castings are automatically fed into an automated line, and in fourteen and six-tenths minutes later, it is fully machined, without a human hand touching it. You can see the machine bore the engine cylinder, and the boring bar go back in place with an electronic eye measuring the diameter of the bore. If it is not the right size, an electric impulse in the brain of the machine makes an adjustment on the tool which makes another cut. Not a single hand touches the operation.

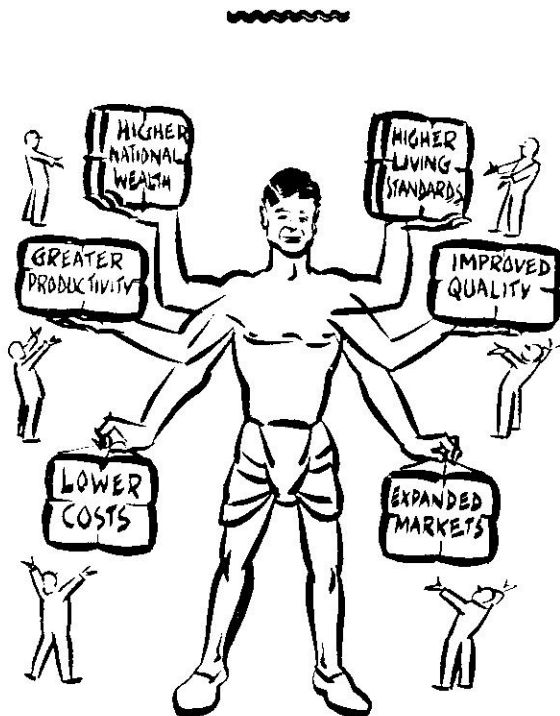
Is that good or is it bad? The people who invented the machine will not make that decision. That is not a mechanical problem. That is a human problem, and the answer will not be found in a laboratory dealing with the know-how in the field of physical sciences. The United Auto Workers Union contends, and

rightly so, that the answer must be found in the human and social sciences, and in the capacity, the ability, and the morality of a democratic society to gear the wonders of these great machines to the common good so that all may share in a better, richer, fuller life; so that having satisfied material needs, we can all have more time and more opportunity to grow intellectually, spiritually, and culturally into better human beings.

This is the great challenge for the American Labour Movement. American Labour is not against automation. They welcome it. They know that *technology, in the ultimate, will mean more jobs and a better way of life.* What they are against, and they demand safeguards against it, is what happens when automation is not properly handled.

Something must be worked out immediately to harness automation as a force for good. We must subscribe to the philosophy that *we will get what we work for and we will get what we plan for.* We will get what we have the vision to see.

There is no place for the advocates of go-slowism. There is no place for those who would put out the fire with tea cups of water. There are no simple answers and no magic formulac. There are no panaceas. But there are answers if labour and management have the good sense to look for them together. No one can find any answers in a little comfortable compartment unrelated to the welfare of his neighbour. There is only one compartment where the answers lie, and that is the compartment in which all of us live together.



Productivity & Small Scale Industry

India is on the threshold of planned progress towards industrial development. In the context of scarcity of capital resources and the need to canalise small savings to build up requisite development finance, small industries have a vital role to play. Further, manpower is the most important among resources of the nation; and the economic prosperity of the nation depends upon expanding employment potential to accomplish full utilisation of manpower resources. In fact, the productivity of our whole economy can be promoted by the growth and establishment of small industries that should develop a pattern consistent with our economic conditions.

Small scale manufacturing units occupy such a vantage position in the economy in respect of specialised skills in manufacture, quality and precision in products that even in progressive countries with their mass production factories, the small manufacturing units exist and thrive as ancillaries of larger units and in specialised production lines. There is emphatic recognition of the need for smaller industrial units as sub-contractees or feeder units of larger ones. The productivity of larger units to some extent depends upon the fulfilment of their specialised requirements by smaller units. The establishment of self-contained large units carries with it larger overheads and corresponding increase in cost of production. The need to eliminate diseconomies and to promote the productivity of larger units has led to the encouragement in many countries of credit, technical, research and organisational, facilities to small scale industries.

ENCOURAGEMENT of small scale industries has now a high priority in the economic policies of the State. Hence the National Productivity Council sponsored a productivity study team on Small Scale Industries. It visited Switzerland, West Germany, USA and Japan to study the structure of small industries in these countries, their problems and the solutions that have been developed there. The Report of the Team is of a pattern different from the Reports of other productivity teams, as the objectives were formulated in the wider context of the whole economy. In

presenting the experiences and observations of the team members through publication of their valuable report*, NPC believes that a well informed approach will develop as to the solution of the problems of small industries, which in turn will contribute to the productivity of larger units and the whole economy. A summary of the Team's principal recommendations is printed on the next page.

* Available from the Information Officer, National Productivity Council, 38 Golf Links, New Delhi: price Rs 2.00.

1. Legislation

"We recommend that the legislative measures in force in the USA and in Japan be considered by the Small Scale Industries Board to see to what extent they could be adapted to suit Indian conditions."

2. Sub-contracting & development of ancillary industries

- (i) Large industrial establishments should take greater interest in developing ancillaries and the system of sub-contracting. They should render active technical and other assistance to their sub-contractors. Such assistance should include supply of jigs, tools and fixtures free of cost as well as full working drawings and detailed specifications, besides suitable training, whenever required, to the technicians of the sub-contractors.
- (ii) The technical officers of the Small Industries Service Institutes in different States should be in constant touch with the large industries in their area with a view to finding out the possibilities of getting as many of the parts and components as possible manufactured by small units in their jurisdiction.

3. Financing of Small Industry

...It would be worthwhile to study the Small Business Investment Act 1958 in the United States with a view to exploring the possibilities of encouraging the establishment of small business investment companies in India. We recommend that the S.S.I. Board may examine this problem...we recommend the adaptation of the system of *participation* loans as practised by the Small Business Administration of America with reference to the loans given by the Directorates of Industries.

4. Common Service Facilities

There is considerable scope for expansion of these facilities, and we suggest that special incentives may be given to any entrepreneur, association or cooperative interested in setting up such Centres.

5. Research and Technical Assistance

- (i) To overcome the shortage of technical personnel, which stands in the way of expansion of training facilities, we recommend the system of employing on a part time basis experienced men drawn from industrial enterprises, Government organisations and other technical institutions.
- (ii) The Industrial Design Cell in the Office of the D C (SSI) should be raised to the status of an Industrial Arts Institute and should undertake research on problems of small industries in cooperation, when necessary, with other technical and research institutions in the country for utilisation of indigenous raw materials, and on evolution of new and attractive designs for products of small industries. The results of such research and experiments should be disseminated through the Institutes and Extension Centres all over the country.

- (iii) In addition to this, we feel that the scope for utilising our National Research Laboratories and Universities to do research on problems of special interest to small industries may be examined.

6. Industrial Cooperatives

Encouragement should be given to the formation of different types of industrial cooperatives by small entrepreneurs, particularly cooperatives for common facilities required by them.

Industrial Management Organisation and Training

EXPERT opinion is now veering round to the view that management plays a crucial role in productivity; and for that purpose, the whole of the industrial system has to be properly organized and men trained in the modern techniques of management. In order to make available to the country the knowledge and experience of developed countries in Industrial Management Organisation and Training, NPC sponsored a Team of Indian experts to visit West Germany, the UK and the USA to learn foreign techniques being used in this field and to utilize them in the development of Indian industry. The report of this Team has now been published by NPC*. Its recommendations regarding industrial management, personnel for management, education and training for management, research in industry and management consultants are reproduced below.

I Industrial Management: (1) the Top management of each organisation should clearly lay down the goal of the enterprise, taking into account the organisation's responsibility to its employees, shareholders, consumers, the State and the community; (2) senior management should formulate a philosophy of management, in the light of which junior managers will be able to take decisions; (3) an overall plan of action

should be drawn up for the organisation, in conformity with its philosophy; that such plans should cover the long-term prospects of the organisation, for a period of at least 5 to 10 years, and that such plans should admit of flexibility; (4) each management should be encouraged to develop a sound organisation structure of its own and that this should be made clear, logical, flexible, taking into account the specific requirements of the organisation; (5) Indian Industry should be encouraged to consider the feasibility of introducing a two-tier structure at the top level, one representing the trusteeship interest and the other responsible for administration or operation, on the analogy of the practice obtaining in West Germany; (6) scope should be afforded for suitable senior management personnel to be associated at Board level in order that their competence, experience and loyalty may be made available for making a valuable contribution to the Industry at top level; (7) ways and means should be devised to improve communication system within each organisation; (8) efforts should be made to secure the participation of all personnel for the promotion of efficient management, through the constitution of committees for joint consultation and coordination; (9) industries should be encouraged to make proper delegation of functions to lower levels and match authority with delegated responsibility; (10) wherever industries have not yet developed organisation charts and manuals, they should be encouraged to use extensively such control techniques as standard costing, budgetary control, inventory control, etc.

* Available from the Information Officer, National Productivity Council, 38 Golf Links, New Delhi-3. Price Rs 2.00

II Personnel for Management: (1) a well-defined and integrated personnel policy for obtaining and retaining key managerial personnel should be developed in each industry, and that a personnel budget be prepared periodically, suited to its present and prospective requirements; (2) each industry should be encouraged to adopt scientific selection procedures and to improve them continuously; (3) industries should be encouraged either to institute regular development programmes of their own or, where these are not possible, to avail themselves of facilities offered by such organisations as the National Productivity Council, Management Associations, Administrative Staff College etc; (4) all industries should be required to define their promotion policy, which should be on the basis of merit assessed through proper procedures of evaluation of executive performance; (5) the executive remuneration policy should ensure satisfactory status and salary for all executives through a judicious combination of direct and indirect incentives; and (6) where proprietary succession prevails, prospective top executives should be suitably trained to become professionally competent.

III Education and Training for Management: (1) Universities which do not at present offer courses in management, but are located in and near industrial areas, should be encouraged by the Government of India, through adequate aids, to consider the feasibility of instituting courses in management at the under-graduate, graduate and doctoral levels; (2) the National Productivity Council should explore ways and means for creating the right climate through conferences, seminars and the like, for acceptance, by industry, of the functional values of education for management offered by the universities; (3) the National Productivity Council should likewise create scope for universities to recognise the value of the body of knowledge and skills available within industries in India and elsewhere, for inclusion in their curricula; (4) a National Institute of Management should be establish-

ed with responsibility for offering advanced education in Management and also for conducting basic and applied research, and that this institution should be a joint undertaking of industry and the State; (5) full-time as well as part-time programmes of education for Management and sandwich courses should be sponsored by technological institutions, Chambers of Commerce and other allied Associations for the benefit of personnel in industry; (6) full-time residential executive development programmes, on the model of the summer schools of American universities, should be sponsored in India by the proposed Central Institute of Management; and (7) industries, either by themselves or jointly with universities, should be persuaded to institute Fellowships like the Sloan Fellowship Programme, designed to develop senior executives with high promise to become industrial statesmen of our country.

IV Research in industry: (1) Ministry of Scientific Research and Natural Resources should be requested to take such steps as are necessary to coordinate all fundamental and basic research and to disseminate the results; (2) basic research should be undertaken by research organisations sponsored by the Government, universities and also Research Institutions supported by Industrial Associations; and (3) applied research dealing mainly with process and product development, should be undertaken by individual industries and that, where the industries by themselves cannot independently establish and operate such research projects, an organisation of related industries should undertake this task with or without the assistance of the Government.

V Management consultants: (1) surveys and researches should be sponsored and undertaken by the National Productivity Council in selected segments of industry in the public and private sectors respectively, to demonstrate to industrialists the enhancement in production accruing from the services of professional management consultants; (2) the findings of these efforts should be

duly disseminated to the field; (3) the National Productivity Council should take the lead in stimulating interest among leaders of industry: (a) to recognise the value of associations like NUMAS in the UK, and NAM and BAHIL in America, through study circles organised for the purpose; (b) to encourage them to sponsor and build up similar organisations in our country; and (4) the National Productivity Council should undertake an evaluation of the existing resources available to the industry for professional consultancy.

VI *Associations*: (1) the All-India Management Association should, on the model of the British Institute of Management in the United Kingdom, undertake all activities that are of common interest to their constituents, such as research, collection and dissemination of statistical data, guidance in industrial relation matters, etc; (2) all-India organisations like the Federation of Indian Chambers of Commerce, Associated Chambers of Commerce, etc, should be requested to consider the desirability of organising service sections like the one organis-

ed by the National Union of Manufacturers of England (NUMAS) to undertake advisory service for small and medium industries and to make market surveys and studies; (3) all-India organisations should be requested to evolve a code of conduct on the analogy of the one prescribed by the National Association of Manufacturers of the United States to promote fair trade practices and also to enhance the prestige of Indian industry abroad; (4) all-India organisations should be persuaded to take a leading role, in collaboration with the National Productivity Council, in sponsoring various development programmes, seminars, conferences, symposia, group discussions, etc, thus not only providing a meeting ground for exchange of ideas, but also ensuring wider acceptance of modern methods of management; and (5) Directors of training in Indian industries should be encouraged to come together in conferences and seminars and be stimulated to organise themselves into a society like the ASTD in America which will help them refresh their skills and knowledge and keep them abreast of progress in these days of rapid technological advancement.



"There are all sorts of ways to skin a cat," said Starkey, "and Ray knew 'em all. He could start with the head or the tail or any one of four feet. Ray knew all the tricks! I used to have a laugh at the way he got up a sweat when they were timing him. He would jump around the machine like a monkey on a string, with the sweat just pouring off him! His shirt used to get soaking wet, and he would have to wring it out afterwards! And when they finished timing him, he would stagger away from the machine a little, like he'd given everything he had in him. But of course, it got to a point where he was not fooling anybody any'more, except may be some new time-study man that came along, and the time-study department would have him tipped off about Ray. I never did see Ray sweat a drop when he was actually running a job; he was always about 40 pounds overweight, the laziest guy I ever did see. He'd move a box up to the machine and putter around all day like he was making mud pies or something."

Factory Layout and Construction

WITH the Industrial Revolution in full swing and the very urgent necessity of making the most productive use of scarce resources, *factory layout and construction* have acquired a high priority in the industrial programme and more so in the productivity movement, for industrial productivity depends very largely on layout, in the first instance. The Planning Commission's Committee on Plan Projects in its excellent publication on the Line of Balance Technology (page 295 of this Journal) has estimated that "the element of construction in the Second Plan is of the order of Rs. 2,000 crores; in the Third Plan, it is expected to be much bigger". In view of the industrialization programme, it is only to be expected that a very large part of this construction expenditure will be on factory building. In this respect, it has to be acknowledged that foreign experience in the line has great value, for they have struggled and built up an efficient system out of more than 100 years' experience and an investment of almost historical magnitude. In the process, there has been obviously a very large wastage of resources, which we just cannot afford, for our resources are very scarce and our task of development very urgent. In order to gain the advantages of this experience, NPC sponsored a Team on Factory building, Layout and Construction, which reported only last month (March 1961)* on its

experiences in Japan, the USA and Italy. The following extract from the report gives a summary of the Team's important recommendations.

1 *Location and zoning of industries:* (i) Adequate attention is required to be paid to the question of exploring the possibility of locating industries in rural areas. (ii) In order to prevent deterioration of living environment caused by mixed existence of factories and residences and to prevent factory nuisance, it is necessary for the city planning and building administrations to have detailed zoning and measures for its strict enforcement.

2 *Layout of buildings:* (i) *General:* A grouping of separate buildings should have inherent flexibility for future expansion. If the layout demands more than one open gantry, the logical decision would be to use the same span or all the open gantries to facilitate interchange of gantry cranes. Single-storeyed construction is a logical solution for factories to facilitate modern material handling and for efficient arrangement of production lines. (ii) *Factory-buildings:* To effect cost reduction, the following salient features of industrial structures are highlighted: (a) the building should be as open as possible in the plan (b) in view of the economy offered, flat type roof may be adopted in arid regions (c) foremen's offices and other shop offices and employees' facilities such as locker space, etc. may be situated on a mezzanine floor so that the valuable shop floor below is not wasted (d) roof purlins and gantry girders should be designed as continuous. With the increase in steel production, it should be possible to set up fac-

* Report available from the Information Officer, National Productivity Council 38 Golf Links New Delhi 3. Price Rs 2.00

atories for fabricating open web girders for different spans and loading conditions together with deckings of different sizes and patterns. This will facilitate single storeyed shed construction for industrial undertakings. (iii) *Office buildings*: For office buildings, the best layout seems to be of the central corridor type with a corridor width of about 6 ft to 8 ft with rooms of 16 ft to 18 ft on one side and deeper halls on the other side. The usable space or carpet area should be of the order of 65 to 75% of the total build-up area.

3 *Landscaping*: Sufficient attention should be given to landscaping as an essential item in factory buildings layout.

4 *Working conditions in factory*: The following factors should be kept in view to ensure better working conditions in a factory: (a) ease of access to the various shops of the plant (b) adequate parking facilities for the employees' conveyances (c) short walking distance from parking space to the place of work or the time clock.

5 *Space planning*: In workshops provided with extensive craneage, the economical spacing of internal columns along working bays can be about 40 ft. The width of bays can also be 40 ft. For palletized storage, the distance between the column spacing across the building should be a multiple of 3 ft and along building a multiple of 7 ft.

6 *Lighting and ventilation*: Advantage should be taken of the abundant daylight available in the country to avoid recurring cost of artificial lighting. In view of the higher cost involved, northlight roofing should be restricted only to those particular buildings in the layout which need it. An effective glazing area of 20 to 30% of floor area gives a reasonable standard of lighting for our climate consistent with economy. In hot humid regions of India, windows and permanent openings should be placed sufficiently low to ensure thorough ventilation. In arid regions, louvres in the side sheeting and precast concrete louvres in the masonry walls below should be eliminated.

7 *Services*: (i) The use of compact floor trenches, covered with steel chequered plates for accommodating services is recommended; (ii) Overhead busbar distribution system should be considered only if otherwise unavoidable; (iii) Indian industries located along the sea coasts should investigate the economies of the ocean conduit system, wherever large quantities of cooling water are required; (iv) In large halls, provision should be made for wide fire aisles, well marked and always kept clear to sectionalise the plant and prevent the spreading of fire.

8 *Construction in seismic zones*: (i) The development of Steel Skeleton Reinforced Concrete Construction as in Japan, will be of advantage in the seismic zones in India. The ISI should look into the problem of preparing a Code for such construction. (ii) Further research on a seismic design and construction is essential. Necessary facilities for this should be provided.

9 *Composite construction*: The ISI should take up the preparation of a Code of Practice for composite construction urgently.

10 *Shell construction*: (i) The construction organisations should see that shell designs are promoted wherever they are economical in order to save structural steel, which, even if available in greater quantities now, should not be wasted on structures, for which other alternatives are possible. (ii) The extensive use of model analysis in structural design which has been adopted in Italy is worthy of emulation. It is desirable that suitable facilities for this are made available in this country.

11 *Concrete construction*: (i) Considering the economy in cost and better control over quality, central batching plants for concrete mixing may be set up, at least at places where there is concentration of building activity; (ii) Metallic forms may be standardised for increased use as it would lead to conservation of timber which at present is in short supply.

12 *Steel materials*: (i) Steps may be taken by Government to step up factories for pro-

duction of light gauge steel and other structural units. The plans for the factory proposed to be set up for manufacturing high tensile wire should be finalised quickly; (ii) The manufacture of deformed bars may be undertaken in the country so that they may be used in RCC work, thereby affecting economy in cost as well as in the consumption of steel reinforcement; (iii) The possibility of introducing high strength bolts in the country needs examination.

13 *Light weight aggregate*: The possibility of manufacturing light-weight aggregate in India requires investigation.

14 *Building materials centres and research*:

(i) Building materials centres may be set up in this country in the bigger cities like Calcutta, Bombay, Madras and Delhi where there is great concentration of building activities, (ii) One-fourth per cent of the expenditure on buildings should be set apart for financing research work on building materials and for putting up pilot plants where necessary.

15 *Manufacture of equipments*: Provision must be made in the plan itself for the manufacture of equipments like rotary kilns, block-making machines, extrusion plants, etc. and for the setting up of pre-cast

factories and factories for the production of light-weight aggregates.

16 *Standardisation*: Encouragement must be given to the adoption of new techniques of design and construction on the basis of performance standards.

17 *Mechanisation of construction*: A phased programme for mechanisation of the building industry is essential. Greater adoption of fork lift trucks, hoists and derricks in construction jobs should be encouraged. Steps should be taken to manufacture some of these construction equipments in the country.

18 *Planning for safety*: Planning for accident prevention in building industry is of great importance. Greater attention to this is called for.

19 *System of contract*: (i) The method of giving contracts for complete works to the general contractor who, in turn, should engage specialists as contractors for executing several items of specialised work should be tried; (ii) Bonding system, as is prevalent in the USA, should be introduced in India.

20 *Apprenticeship training*: It is advisable to draw up National Standards for apprenticeship training for various building trades.



TOO MUCH WORK, TOO LITTLE TIME

"Not enough hours in the day," "I have to do everything around here," "I had to take work home three nights last week, and I am still not caught up." If you ever find yourself in this position, it is time to sit down and figure out just what your job is. List the things you have to accomplish and how much time it takes to do them. You may find you are quite right, that you do have too much to do! If that is the case, it is time to organise and simplify—or delegate some of the jobs to a subordinate. Sometimes, just looking at the pile of work you have to do will depress you so much that you have a hard time getting started. Research found this was true in an experiment carried out in a marmalade factory. Every day, the whole day's supply of oranges was dumped in front of the girls who prepared the fruit. Looking at the mountain of oranges was depressing. When trays of fruit, each holding a small part of the day's total, were substituted, production went up. If the job you have to do seems so big you cannot catch hold, try cutting it up into smaller jobs and doing them one at a time. The main idea is to start organizing instead of worrying about having too much work to do.

Book Reviews

MANAGEMENT GAME

MURTY, VARANASI S. R., *MANAGEMENT GAME*, published by Vora and Company Pvt. Ltd Bombay 1960.

PERSONS in every culture throughout the ages have left behind records of games played by them in their youth and as adults. Now to be added to this extensive list is one of the most sophisticated games ever conceived — the Management game. Unlike most other types of games, the Management game is not undertaken solely for diversion or casual amusement, but is a simulation of the give and take, the ebb and flow, the challenge to intuition, intelligence and good sense which are typical of industrial management of the present day.

Business gaming was first introduced in the United States about four years ago when the American Management Association presented its "business war game". Since then at least several dozen varieties of training games have come into operation in the U.S. They are widely used there for executive training in larger industrial companies, and potential-executive training in some of the more progressive educational institutions. The latter institutions include: Harvard University Graduate School of Business Administration, Michigan State University, The University of California at Los Angeles, and other institutions.

It is most gratifying, therefore, to observe that approximately a year ago for the first time in India, the Business Management Section of the Department of Economics of Bombay University also undertook the successful presentation of an Indian version of the Management game. The game played here was

stated to be "...an educational device for giving practice in decision making at a top management level"—a purpose consistent with existing needs in Indian industry.

In this book Sri Murty gives us a description of the game played by the participating group, of which he was "Programme Officer". Certainly the impact the Management game had on the participants is unquestioned, as observed by comments of the participants:

"The Management game was indeed a new and very thrilling experience..."

"Of the various techniques of imparting management knowledge I feel the Management game takes the first place...."

"I am convinced that Management games of this kind can be taken without any reserve and are the strongest medium of instruction."

Generally business games are "total enterprise" endeavours which provide realistic practice in making high-level management decisions. They are designed to stimulate problems experienced in running a competitive business either in a specific industry or in the generalized business world. Some of the more complicated games deal with internal management problems, while others are designed to teach, or to convince participants of the value of, a specific technique. They may deal with specific techniques of business such as marketing, systems management, or production control.

The game played in the undertaking described by Sri Murty was of the "king-for-a-day" variety in which the participants undertake the handling of major business decisions for a fictitious company. In this game, these persons compete against each other in groups in operation of the "Janata Cycles Limited" and other fictitious but realistic cycle-manufacturing companies.

In playing the game, teams are given financial information about their companies and are asked to make decisions expressed in quantitative terms—usually in rupees. These decisions consider the price to be charged for the product, the amount of money to be spent on production, on research and development, and on plant expansion.

In scoring the results, a group of cause and effect formulas are employed, and data representing decisions made by the group are usually fed into an electronic computer. By using electronic computation, results of a large number of inter-related effects are secured quickly, thereby permitting the group to undertake succeeding "period" decisions with a minimum of delay. The games usually continue through "several years" of simulated operation.

In the game reported in this book no electronic computer was used, but instead an "information centre" was used to feed the required information to competing groups.

Sri Murty provides an interesting and detailed explanation of what is undoubtedly the first public adoption of the business game in India. It is particularly important that opportunities for simulating responsibilities associated with the making of business decisions on a high level be given wider scope in India. The awareness of inter-related effects of competition, price levels, changes in customer preferences and other unpredictable effects may be enhanced by further gaming applications.

Nor, it should be observed, is India necessarily lacking in the facilities by which full-fledged gaming operations may be undertaken. Computers already are in operation regularly at the Indian Standards Institution in Calcutta, and at the Indian Institute of Technology at Kharagpur. The latent interest in the presentation of such an advanced training procedure exists, merely needing further encouragement to bring about widespread participation. This book also makes it clear that the requisite knowledge for setting up such a program is available.

The efforts undertaken by the group reported in this book have established an initial undertaking which is certain to be repeated in India in the near future. Here is an opportunity for Local Productivity Councils, in association with other management groups, to embark on a venture of the greatest value to Indian industry. The successful initial undertaking reported by Sri Murty offers assurance not only of widespread interest, but of vast scope for the learning of executive skills, and the broadening of understanding of the operating executive.

One of the most important industrial uses of such business games which immediately comes to mind is the "testing" of potential executives to determine in advance their potential in the decision making process. In India, where the mushrooming of industry is certain to demand larger and larger numbers of young executives, the opportunities business gaming offers is indeed impressive. It is a considerable service Sri Murty has rendered in bringing to our attention the potentials which this newest of the new management devices offers to India. Those who recognize this opportunity will find this little book not only interesting, but a source of inspiration.

R F Bruckert

PERSONNEL MANAGEMENT

PERSONNEL MANAGEMENT IN INDIA edited by Mary Sur for the Institute of Personnel Management; printed at the Asia Publishing House, Bombay, February 1961, pages 316, price Rs. 10.00.

THIS book is a rare type: refreshing and comprehensive. In fact the title is a misnomer. The sub-title: "The Practical Approach to Human Relations in Industry" is probably more significant, but yet does not convey an adequate idea of what the book is about. There is practically no aspect of the industrial economy it does not cover. It is really a comprehensive thesis on the socio-economic life of India in the sphere of industry. There is nothing relevant (or irrelevant) that is missing in this publication, whether it is from the point of view of industrial economics, sociology or social psychology.

As such it is more than a manual on personnel management; it is a complete book of reference for the personnel manager, for it says *something about everything*, which the personnel manager might possibly need. The Institute of Personnel Management, which has been fighting the battle for the rehabilitation of the Personnel Manager as an integral part of industrial management (this book also contains evidence of that) deserves to be complimented on this very timely publication.

The book has a marked simplicity of style and the presentation has an analytical clarity which is rather rare in the socio-economic literature of this country. The editing has an under-current of human sympathy and fair-mindedness in its analysis of industrial relations. Not philosophical in an abstruse sense, the book has a social perspective. Though not explicitly stated, the sort of society that is assumed in the analysis is simultaneously productive and pro-

gressive, healthy in a broad way, but above all it has some resemblance to the realities of the Indian social and economic situation. The book in fact begins with a close look at the "worker from the country", the crowded cities, the new industrial townships, the old plantations, the resistance to change etc.

The book is well documented. At the end of each chapter is a reasonable list of additional literature that could be read, with advantage on all aspects of personnel management. Interspersed are references which show a very wide reading; the Hawthorne experiments (pages 22—23) the Ahmedabad experiment (pages 24—25) and so on. The book abounds in such references. Wherever necessary, relevant statistics have been quoted, but fortunately it is not cluttered up with statistical tables designed only to show off.

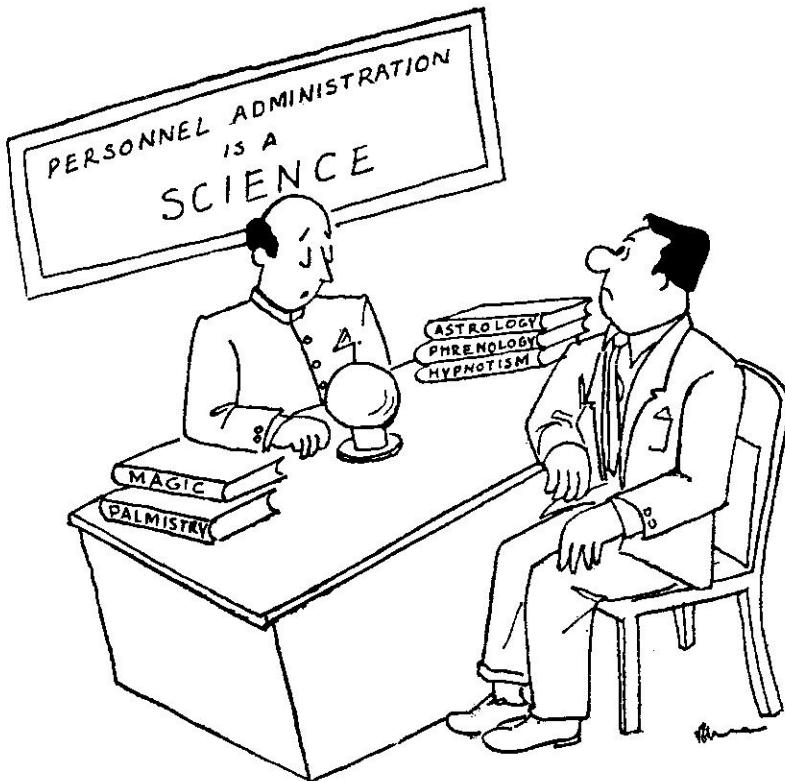
The book is very precise and clear in its approach, as for example, in its analysis of personnel management (pages 65—66). The approach throughout is constructive, as for example, in the treatment of the Works Committee Experiments (p. 162). The presentation of the argument with regard to worker participation in management has been pretty well done (p. 195). Few would question the editor's analysis of the weaknesses of the trade union movement in India (p. 158). Throughout the book, the editor has been at very considerable pains to avoid literary flourishes. Sometimes, an under-current of humour is apparent, but an effort seems to have been made to suppress it. The epilogue, however, rises to quite a

height of social analysis, intellectual honesty and literary excellence. It deserves being quoted at length: "In a single generation India has become industrialized on a large scale. A revolution is taking place before our eyes. ... While we are trying to complete modernisation and mechanisation of our factories, in the West further vast changes are being brought about by automation... Whatever the disadvantages of the large scale industrialised unit, it has come to stay and man must adapt himself to a society which now thinks in terms of large scale planning. The worker only recently come from the soil has not only to face the mechanical giant, the machine, but also the administrative giant, which dwarfs him to a particular job, as part of a section, which in turn is a part of a department, which again is part of a unit of something so large that he can have no real conception of it. Administration has become a depersonalised authority completely removed from the worker, whose life it ultimately controls. How to replace the personal relationship lost through the dehumanising effect of impersonal administration is one of our present problems and it will become even more pressing in the future... The major weakness of modern personnel management in the West is its lack of integration into the organization structure of the business. This is also true of India... It is the less tangible incentives that act on morale, such as belief in the purpose of the business, confidence in its leadership, the individual dignity found in job satisfaction and the social approval of the working group. It is in the achievement of these intangible, but all-important foundations of morale that personnel management will be judged... Ultimate ownership of the business itself makes little difference to the average worker. ... Scientific and technical advances have far outstripped the knowledge of

the right approach to human problems. Personnel management therefore offers a real challenge to those who take up the profession. They need a sense of vocation; they need to believe that proper human relations are right in themselves; otherwise they will never win the confidence of management and employees. They need personal qualities of a high order to *meet and listen to all*. They need a sense of perspective and a wide tolerance — "to find the greys between the blacks and whites of more orderly, dogmatic minds". They need to see the wider issues of man in society, not only man the machine-minder... the individual as part of the working group and the group as part of the larger industrial community... the worker against his social background, as a family man, a citizen and a spiritual being ... the need for genuine humility, *the willingness to admit a mistake and to try again*, to compromise where basic principles are not involved, *to give up theories if they do not fit the facts, and to be sensible rather than sentimental*... in the past we have failed. There has been too much withdrawing into our own problems, too much conformity in our thinking... If a man or a woman has the compact mind that likes to put everything into its proper pigeon hole, if he or she likes a regular, known job, without too much responsibility, then personnel management is not that job. It is infinitely variable, often tantalizing, and always a challenge; but to those interested in their fellow beings it can be infinitely rewarding... If industrialization is to proceed smoothly in India, if the inevitable changes are to be achieved without violent upheavals, then we need much more research into human problems in industry; "and a profession of personnel management, willing to make known and to apply in a practical manner the results of that research."

Obviously this is a book of the times. It does not need a recommendation, for it shows a productivity technique without which no other productivity technique would click. The printing and get up of the book are good; except a com-

ma here or there, it contains hardly a printer's devil. The book has a number of useful appendices. The selection of the documents quoted in these appendices is markedly intelligent.



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## FORM IV

Statement about ownership of Productivity Journal and other particulars required under  
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| 6. Names and addresses of chairman and<br>members of Trust/Executive etc. | See page opposite                                                       |

I, D H Butani, hereby declare that the particulars given above are true to the best of my knowledge and belief.

D H Butani  
signature of publisher

15 April 1961

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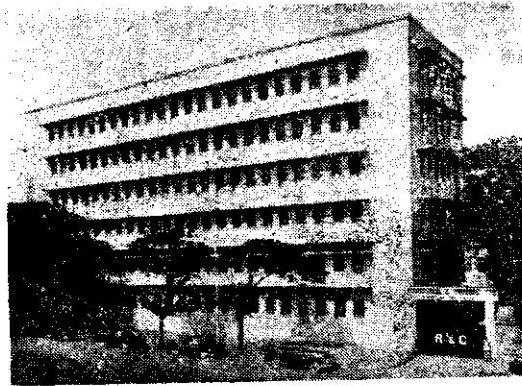
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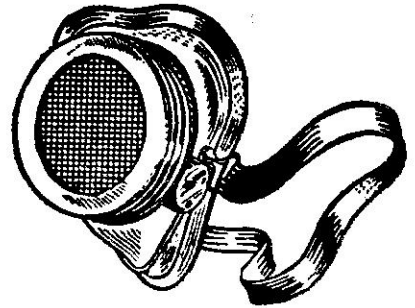
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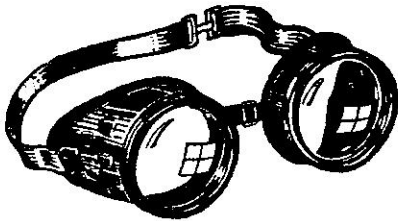
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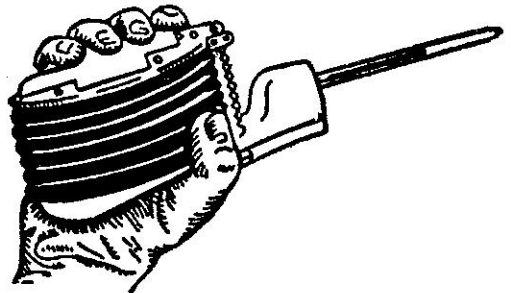
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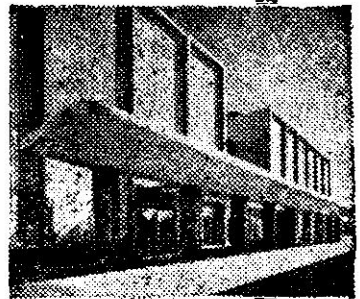
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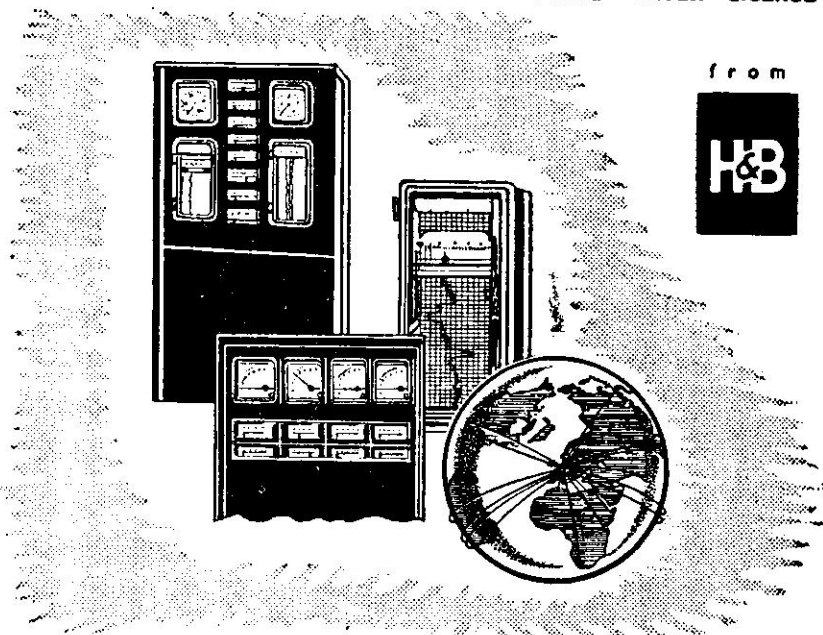
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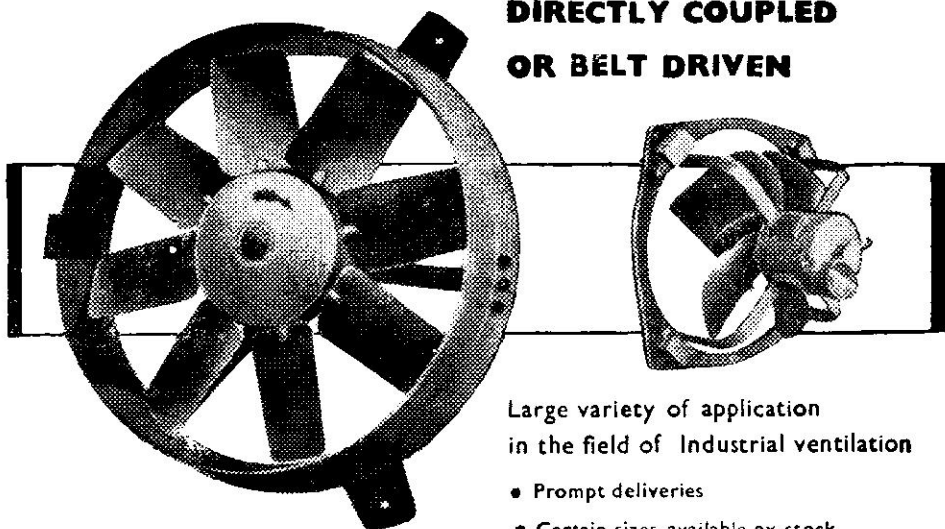
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