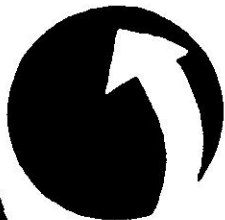


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- 2. To increase productivity consciousness; and**
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PRODUCTIVITY

Vol. X, No. 4

JANUARY-MARCH 1970

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We are grateful to the Editor of *HMT News Digest* for the two cartoons on Supervisors, by Soman, appearing in this issue on pages 632 and 757.—*Editor*

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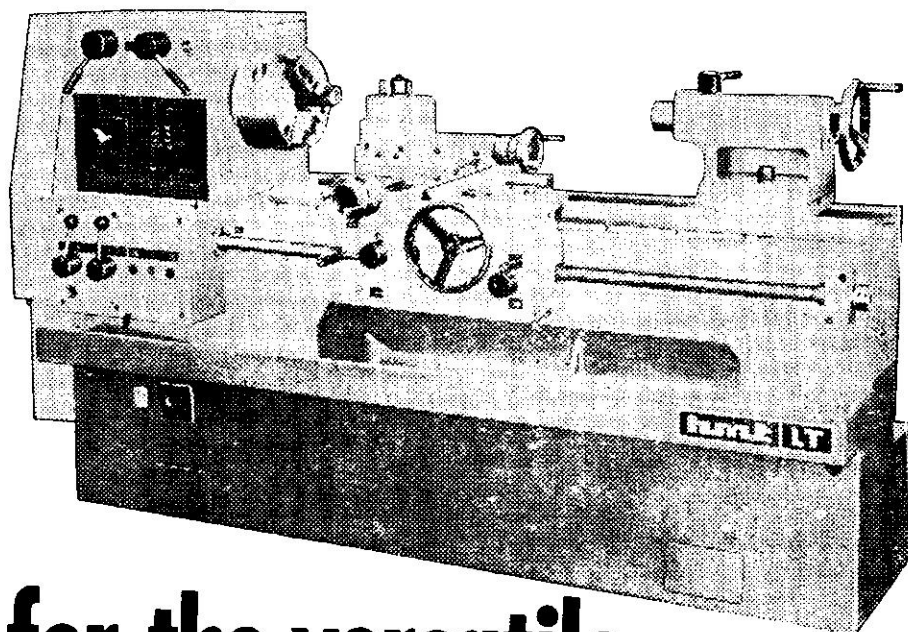
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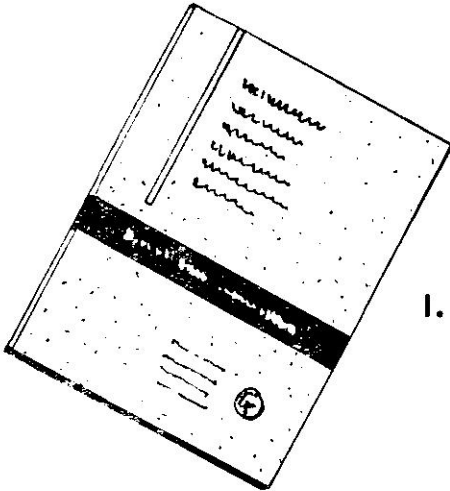
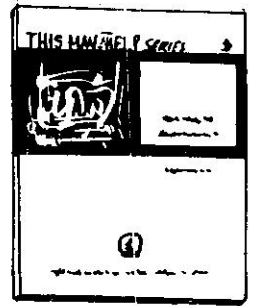
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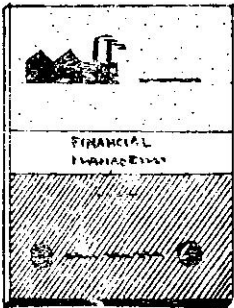


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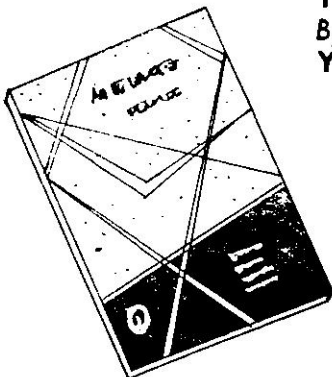
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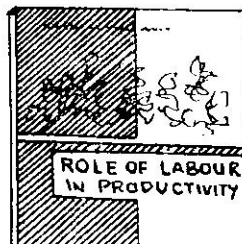
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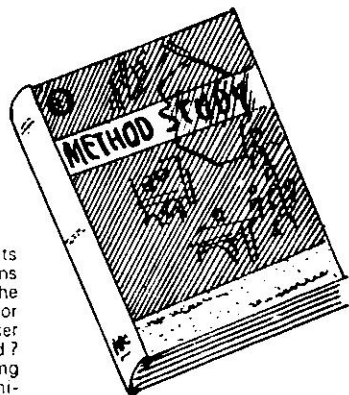
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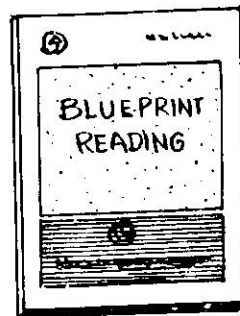


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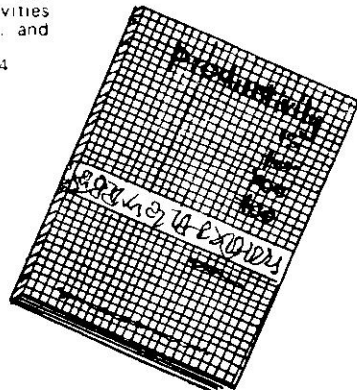


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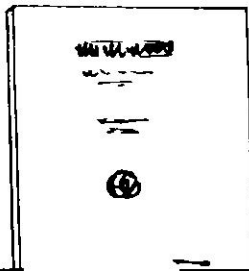
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(See Page 646 for Details)

Asian Productivity Year—1970

ESSAY CONTEST ON

QUALITY RELIABILITY IN TEXTILES

Under the sponsorship of National Productivity Council, the South India Textile Research Association invites from persons working in the textile industry and allied organisations essays in English on "Quality Reliability with particular reference to the Indian Textile Industry."

The subject can broadly cover quality reliability, quality control, quality audit and inspection procedures, process control, corrective measures, and other related aspects.

The following prizes are offered :

FIRST PRIZE	(one)	Rs. 500
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The contribution must be an original unpublished paper in English, not exceeding 5000 words. Five copies of the essay, typed on only one side, double spaced, with all illustrations, diagrams, tables, etc., neatly written, should be sent to Director, SITRA, Coimbatore Aerodrome P.O., Coimbatore-14, *before 31st August 1970.*

A panel of five experts from Textile and Quality Control areas will be constituted to scrutinise and decide the prize-winning essays.

The results of the contest will be announced early in December 1970. The decision of the panel on all matters pertaining to the contest shall be final.

SITRA shall be arranging a seminar some time in December 1970 for the presentation of the prize-winning articles.

The NPC has the rights for publishing the prize-winning articles in their journal.

PRODUCTIVITY

NATIONAL PRODUCTIVITY COUNCIL JOURNAL

Quality Reliability

THE Asian Productivity Organisation has, quite appropriately, chosen 'Quality Reliability' as the main theme of the Asian Productivity Year-1970. To several countries in the region, it is of special relevance because they are industrially developing themselves, and striving hard to raise the living standards of their people. Productivity is the primary requirement of rapid industrial expansion, and to raise the level of productivity still higher we need to promote and sustain Quality Control. In fact, Quality Control—or SQC as it is now called—is a powerful technique for raising productivity, but despite the vigorous drive launched by APO and the various National Productivity Organisations in the 'sixties, its application in industries has been still on a limited scale. Which means that the drive to focus the importance of Quality Control in the minds of industrialists must go on for a long time to come.

Let us look at the problem a little more closely. Quality Control consciousness began growing rapidly after 1950. In the early stages, inspection was considered as an important factor, but when it was realised that quality cannot be imparted to a product through this method, efforts were made to have it built into the product by taking the SQC system into the production stages. With this came the concept of Total Quality Control under which it had to be organised by the combined efforts of all the departments of an enterprise. This concept has since been popularised widely through seminars, training programmes, publications, etc.

There are a number of advantages accruing from the adoption of an SQC system—like conservation of materials, production of a larger volume of better quality goods at

lower cost, fuller utilisation of available resources, and, above all, customer satisfaction which is the goal of the modern integrated marketing system. Despite these known advantages, one may ask why there had been no acceptance of this system on a large scale by industry in our country, where we need it more for developing the dimension of markets both within the country and abroad. The explanation for this lies in the fact that in almost every sphere of the economy the demand has all through far exceeded supply, and where anything and everything can sell, who would bother about quality. Fortunately, the situation is changing since the country is now switching over from a sellers' to a buyers' market. And when the customer has the final say, naturally we can expect the position to improve, and the producers to keep to standard. Statistics have shown that 90 per cent of new products in America are failures, despite catchy advertisements, which proves that the consumer cannot be fooled, and that he can discriminate.

All industrially advanced countries have been finding increasing application of SQC techniques. There is a growing quality consciousness in our own country, and several industries like steel, engineering, textiles, matches, and pharmaceuticals have benefited from the SQC methods, but those yet to take to Quality Control are so numerous that it is necessary to educate them on the importance of ensuring quality. For this a Quality and Reliability Campaign should be organised on proper lines.

Better quality and reliability certainly raise the productivity and profitability of a manufacturing industry. A nationwide drive to improve quality and reliability may build up attitudes and strengthen a spirit of cooperation which may ensure that Indian industry in the future may be known all over the world for the quality of its products. A compelling reason for such a drive is that we have to increase our exports to other countries. In fact, the production of quality goods has become necessary not only to compete in the national market, but with advanced countries too. There is a great demand for Indian goods outside, and our exports have certainly gone up during the last few years, but the general complaint against Indian exports has been their lack of uniform quality. Sustainance of our exports would only be possible through quality, and cost reduction. India has a vast potential for exports, to many countries, and our aim should be that every fresh consignment should be better than the previous one, both in terms of quality and cost. Our goods should project an image of India's heritage of skilled craftsmanship which is known the world over. If exporters maintain the consistency of quality of their products, there is scope to increase our exports manyfold to the USA, and also to other countries; and India can have a favourable balance of trade, leading to an easing of her foreign exchange problems.

In fact, export earning is an important need of all countries, and to meet the growing competition in export trade the introduction and maintenance of a quality control system in industries is essential. Such a system ensures advantages not only to the industrialists, but also to the nation. The National Productivity Council, the Indian Standards Institution, the Indian Statistical Institute, and a few other organisations have been playing a valuable part in creating quality consciousness, fixing a minimum standard for quality etc. The NPC has been conducting training programmes, seminars, etc., to enlarge the outlook of top management, and to indicate the scope for higher profit through Quality Control. The NPC has also been assisting enterprises in the installation of an SQC system. As part of its APY-1970 programme, it proposes to organise a number of seminars at different centres, and to help enterprises on how to organise a Quality Reliability campaign. In such a campaign, it is necessary to drive home the point that QR is not

the function of any one individual or group, but of everybody within a plant. In fact, it should be the aim of management to make QR everybody's business by ensuring the involvement of everyone in a firm from the boardroom to the shopfloor. Top management should evolve policy guidelines so that the procedures and practices needed to ensure QR are developed. In fact, what is important is the creation of a proper appreciation of the importance of QR whether it be through talks, films, or any other media.

We have the experience of the U.K. in this field. In 1966, the British Productivity Council organised the Quality Reliability Year, and innumerable firms benefited from its programmes. A firm of some 500 employees making thermostatic mixing valves and recording instruments at Cheltenham planned a works campaign as a part of the QRY, and a report in the *Target* stated: "Such was the interest stimulated by the change, and by talks and films on QR given in the works, that when the Department Chief asked who would be interested in an SQC appreciation course arranged by the Gloucester and South Worcestershire QR Group, 21 of an eligible staff of 40 volunteered immediately. They included all the production foremen, the production superintendent and four setters, the complete inspection department, and two of the four quality engineers in the new department. . ." The QRY was a great success, and published figures of savings arising from cost reduction, etc., have been impressive. There is parallel experience in the U. S. A., Europe, and elsewhere.

In a paper on the Assessment of Quality Control programmes in developing countries, published in this issue, the authors have pointed rightly to the need for management to re-examine and assess objectively, from time to time, its quality problems, programmes, and policies. Even a mere recognition of it, they say, would be "a significant step forward in the direction of a breakthrough in modern Quality Control Management".

It is a formidable task to arouse the awareness of management in this regard, but steps need to be taken on an extensive scale. The Government should give adequate attention to the problems of industry, and stress the importance of SQC as a national policy. The professional organisations set up by Government should foster greater appreciation of the concepts and techniques of Total Quality Control to raise productivity and ensure optimum utilisation of resources of men and materials. Industry and SQC experts should be brought together, and efforts made to make available technical information in regard to the latest developments overseas in the field of Quality Control. Further, efforts should be made to develop in workers and consumers an appreciation of quality, because unless they become used to quality goods, there would be no production of quality goods. Consumer protection, consumer enlightenment, and consumer information are all interdependent, and the main aim of consumer education should be to impart the idea of choice, and of rejecting what is unsatisfactory. It should not teach what to buy, but how to set about buying what is needed.

For a country like ours which today is on the threshold of an industrial revolution, the problems are many, and should be tackled speedily, so that, in the not too distant future, the consumer and industrial goods manufactured by us do not lack the assurance of quality which has been a bottleneck in the expansion of exports. Quality is a MUST for the survival of the Nation.

India Launches National Scheme for Supervisory Development

By

Fakhruddin Ali Ahmed

President, National Productivity Council

The key to the success of any industrial enterprise is an adequate supply of intelligent, and socially conscious first and second line supervisors who can motivate their subordinates to turn out better output and better quality of work... And to meet the demands of the situation in India, the National Productivity Council has launched a massive scheme for Supervisory Development the usefulness of which, from the point of raising national productivity, is referred to here by the President of the NPC.

THE National Productivity Council has played a notable part in drawing the attention of both employers and labour in our country to the paramount need for higher productivity in the interest of economic prosperity and well-being of the nation. This is testified by the increase in the rate of utilisation of its specialists' services this year, which have registered a 130% rise over the three-yearly averages before the India Productivity Year of 1966-67. Income from these services has increased even more markedly—by as much as ^{450%} 300%. The Council's fuel efficiency services have uniformly drawn praise from industries. A band of dedicated officers under the guidance of its present Chairman has worked towards this commendable performance.

Set up by the Government of India in 1958, as a tripartite organisation of employers, employees and technocrats, including government officials, during the initial years the National Productivity Council had concentrated its efforts in generating productivity consciousness in the country. Since, in a vast country like ours, the gigantic task of achieving higher productivity cannot be carried through from one centre alone, a number of Regional Directorates and Local Productivity Councils had been set up to shoulder this extensive responsibility, many of which today have proved to be busy centres of activity.

Productivity consciousness, however, is not an end in itself. It had to be followed by the adoption of practical productivity techniques for increasing the operating efficiencies of the enterprises. By 1962, therefore, action was taken to recruit and train industrial engineers and other specialists for providing highly applied training as well as consultancy services, popularly known as Productivity Survey and Implementation Services, so as to solve the problems of the critical areas of enterprise operations which commonly retarded their productivity. A trainer who is incapable of demonstrating the practical know-how could seldom be effective for imparting applied training. The NPC, therefore, attached a good deal of importance to this work, seeking to combine training expertise with consultancy in one and the same person, which, in turn, enriched the quality of both. The NPC's field services are being continuously improved upon, and in many directions these have reached a high degree of qualitative excellence. As a result, such services have become immensely popular both in the private and the public sector enterprises as well as in public utilities and government departments. The NPC has also made a good beginning in providing international service—to the countries of Asia and Africa—a service which in the years to come is expected to expand further.



Fakhruddin Ali Ahmed

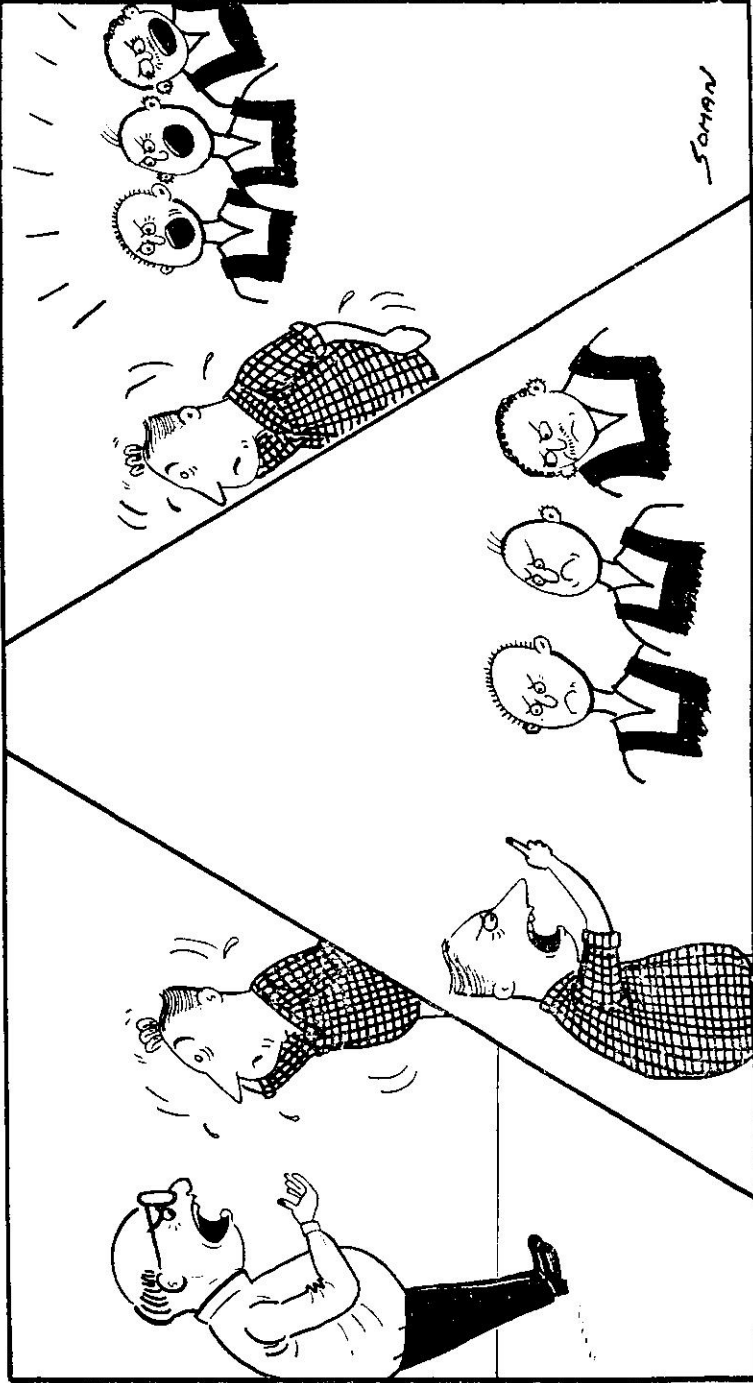
In spite of such commendable achievements of the NPC, people may well ask as to why the overall productivity of our country compares so unfavourably with several other countries of Asia. I must at once correct such an assumption by stating that the productivity achievements of a country, in order to be realistic, must be assessed in terms of its own parameters, and not against those of other countries whose historical background, demographic pressures, capital and resource dispositions, per capita foreign assistance, etc., might be altogether different. For

example, as the Pearson Commission has pointed out, the per capita foreign assistance received from the Western countries and Japan, by India was 2.5 Dollars, as against 4.2 Dollars by Pakistan, 7.1 Dollars by South Korea, 31.6 Dollars by Liberia, and 36.6 Dollars by Jordan. Many of us are old enough to remember the state of economic development of the country before Independence, and should refrain from unreasonable if not unseemly criticism of the achievements of many a dedicated person, both in the public services as well as outside, amidst the vagaries of nature, and various imperfections all around. An objective observer like Dr. Gunnar Myrdal, in his important work *Asian Drama*, has stated that "India's three Five-Year Plans represent the most serious attempt at economic planning in South Asia, or in any underdeveloped country outside the Soviet orbit." The Pearson Commission, in its report to the World Bank, has mentioned that "India's achievements during the past two decades have been dramatic and important, but problems rather than achievements have been usually highlighted." We are, however, not complacent because of such compliments, and fully realise that a long and arduous journey lies ahead of us before we reach the standard of the developed economies.

The primary responsibility for improving the productivity of an enterprise rests with the managers and the workers, and a supervisor is a link between these two for transmitting the productivity techniques to the shop-floor. We in the NPC believe that one of the most critical areas which has retarded industrial productivity is weak and ineffective supervision. Apart from its own value in translating the managerial concepts to the shop-floor and providing much-needed leadership and guidance to the workers, Supervisory Development is a stepping stone for providing opportunities for the vertical rise of the deserving workers to managerial positions over a period of time. Whatever might be the organisational or structural arrangements for workers' participation in management, through trade unions or otherwise, I feel that this is an issue of basic importance in a society like ours, where class distinctions often assume pathological proportions. Every Indian worker must be made to feel that hard work and merit will be rewarded,—that opportunities exist before him for going up in life through training and self-development.

A supervisor can be deemed to be competent only when, besides knowing his job, he possesses the necessary skill to organise team work for attaining the objectives set before him. In this task, he must clearly be aware of his authority and responsibilities. The necessary attributes to achieve the desired result are the maintenance and promotion of discipline, and

THE ROLE OF A SUPERVISOR.....!!



Till a few years ago, a Supervisor or Manager could command, demand, and reprimand workers, with confidence of achieving results... That type of supervision may result in explosion today... A modern Supervisor, apart from technical skill and professional competence, should also practice the science of human relations...

the motivation of workers through proper guidance, demonstration, and training to meet the ever-growing and varying demands of an organisation. Unless he inspires the confidence of those working under him in his ability, a supervisor will never get the best out of them. A modern supervisor has also to maintain constant surveillance over cost and quality. To sum up, he should be proficient in the technical and managerial skills along with the social skills, i.e., disciplining, motivating, and instructing the workers, applicable to his work centre. It is rather unfortunate that while the work of a supervisor is becoming more sophisticated, demanding new orientation, there has not been adequate recognition of the need to equip him with the requisite professional knowledge as a manager of a work centre.

The size of the Supervisory Training problem in India is immense. The present strength of supervisors and the future demand for them in our developing economy indicate the size of the Supervisory Development problems. The existing supervisory strength is estimated at 3,00,000, and, on the basis of the present rate of industrial growth, the country would require annually 16,000 more supervisors.

Taking into account the above facts, it would be obvious that mere institutional training cannot possibly cater for the large number of the needed supervisors. A basic solution to the problem of such massive dimensions could only be achieved by progressive managers throughout the country with the promotion of supervisory development schemes of a fair standard, on a self-study-cum-tutorial basis, which will enable supervisors to qualify at the National Certificate Examination. Much of the tutorials could be given by the enterprises themselves; also the assistance of the National Productivity Council and the Local Productivity Councils may be sought for providing additional inputs by way of specialists, course materials, etc.

In conclusion, I would like to add that the fullest cooperation of the management of the industrial units and the trade union leaders is vital for the success of the scheme. I hope they will appreciate the importance of this scheme towards the betterment of the individual worker, the betterment of the industrial units and their efficiency, and of the economy of the nation at large, and give their fullest measure of support in the introduction and development of scientific supervision at all work centres throughout the country.

—Broadcast from Delhi Station of AIR

ASIA's Decade

By

Ichiro Oshikawa

Secretary-General, Asian Productivity Organisation

In this paper, Mr Ichiro Oshikawa, who has rendered signal service to the cause of productivity, remarks that productivity improvement throughout Asia "is a more vital pre-requisite for sound economic growth and development than it has ever been", and says that, in this decade and in the ones to follow, its importance will continue to increase rapidly. He analyses the three goals set for APY-1970, and has called upon National Productivity Centres to try to improve existing ties and forge new ones with Governmental as well as private interest at all levels.

WE all have heard, any number of times, that the decade of 'seventies will be Asia's decade, Asia's age. I myself, as my Indian friends know, have consistently sided with those holding that view. But we know that there are no guarantees, that there are many 'ifs'. And that is why Asian Productivity Year is so significant.

The improvement of productivity throughout Asia is a more vital prerequisite for sound economic growth and development than it has ever been—and its importance will continue to increase rapidly in this decade, and the ones to follow. Because of reasons, including the trends for internationalisation in many areas, in the immediate future there will be all the more need for reinforcing and building upon the sound foundation of regional cooperation which has marked our past and present activities in regional productivity movement.

Task Ahead

We must outdo by far the very substantial contributions made thus far to the economic growth and development of Asia by the productivity movement. If the task is great, so are the stakes. But I am convinced—and I hope that my Indian friends share this conviction—that the great distance we have come



Ichiro Oshikawa

together has prepared us well for the task of improving productivity throughout our part of the world.

This, then is the background for our Asian Productivity Year. As has been widely published throughout Asia, we have set out during this year to achieve three goals:

1. To achieve greater prosperity through productivity;
2. To increase consciousness of productivity; and
3. To intensify productivity action for accelerating economic growth.

Concerning the first goal, we can cite many instances of an enterprise's success in immediately reducing costs, or improving the quality of products through the proper introduction of productivity techniques. And it is generally and widely accepted that the presence of a vigorous national productivity campaign, spearheaded by a national productivity organisation, makes a real and appreciable difference in a country's economic growth and development. But I would also like to draw your attention to the need for also maintaining a long-range view, in connexion with this goal.

Concerning the second goal, let me stress here the need to carry the productivity move-

ment further afield and more thoroughly, in each member country. Productivity Year, or a Productivity Week, or Productivity Day, are all certainly fine endeavours—but productivity consciousness must be an integral part of all we do. Finally, the need to intensify Productivity action is particularly an important task of the national productivity organisations, which must strive to improve existing ties and forge new ones with governmental as well as private interests, at all levels. For APO itself, in part this means a time of intensified activities, as is already reflected by our programmes for 1970, and also intensified coordination of programmes and activities with not only the national productivity organisations in each member country, but also with other regional organisations, international organisations, and development-related entities of all kinds.

Productivity Congress

In late August, we will hold the Asian Productivity Congress, in Tokyo, at which time I hope to welcome many friends, old and new, from India, as we sit together to discuss the role of productivity in economic growth, and the role of different agencies in promoting productivity action. By that time we should be able to look back on the major portion, timewise, of the Asian Productivity Year, and it is my firm hope and even expectation that at that time we will be able to identify many significant contributions, tangible and intangible, of India's productivity leaders to the regional movement. Of course, there is no doubt that on the national scale as well there will be a myriad achievements deserving the attention and applause of Congress participants from other countries, and, indeed, this should be true for each APO member-country.

By any measure, the APO has come a long way, and as the end of our first decade draws near, I think we have as good a perspective of our second decade as we could expect to have. To the extent that we live up to the overall objectives behind APO's founding, that second decade should by all means be a bright one, with improved productivity contributing greatly to our prosperity.

Computer Aids Diagnosis

A computer installed in the California Pacific State Hospital can predict and in some cases help doctors prevent death. While a doctor or hospital staff could miss a relationship between certain symptoms, the computer will not miss anything, if properly programmed. This would aid doctors in adopting the line of treatment to prevent avoidable mortality. The California computer keeps records of over 13,000 patients ranging from infants to the elderly.

Competition and Cooperation

By

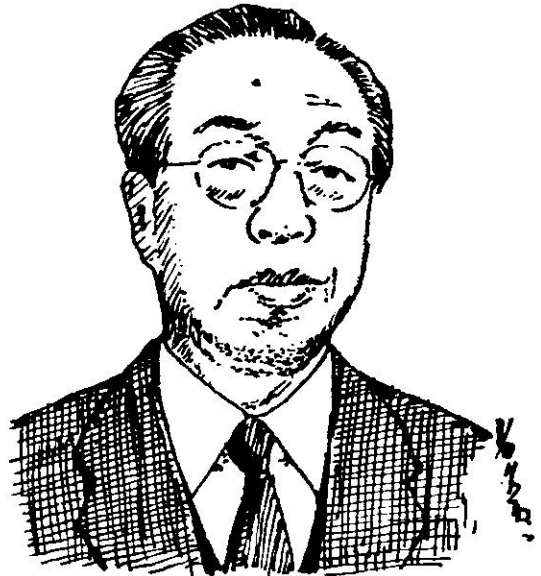
Ichiro Nakayama

APO Director for Japan

The world of the 'seventies may be quite challenging, and, in this thought-provoking paper, Dr. Ichiro Nakayama, Emeritus Professor, Hitotsubashi University, and APO Director for Japan, remarks that this decade "will be one of more keen competition among nations than during the preceding decade." He stresses that the ultimate aim of increasing production in the face of international competition, could only be achieved with continuing productivity improvement in its real sense, draws attention to the fundamental relations between productivity and competition, and asserts that "to promote productivity is, in its last resort, to increase the power of competition." It is his view that world cooperation has been first promoted by the most Competitive of nations, and he poses the question of how cooperation can be coordinated in order to improve the living of the people. Though he regards this as a problem for the world at large, he concludes by stating that "it applies to the region of Asia as well . . . especially because of the diversity in the stage of development, population growth, natural endowment, etc. of each nation."

WE have now launched the Asian Productivity Year (APY) with our common goal of attaining prosperity through productivity. In Japan, the Japan Productivity Center is celebrating, together with APY, its National Productivity Year. The first JPC meeting for this was held on Jan 29, 1970 in Tokyo. I am happy to see our long-cherished dream thus being realised step by step by the concerted efforts of the APO member-countries.

The Productivity movement was first introduced, as is well known, in Europe after World War II. It was a part of the Marshall Plan which aimed at the rapid rehabilitation of the economies of European countries for the sake of world peace. The drive had been energetically pushed by the European Productivity Agency (EPA), with headquarters in Paris, which resulted in the establishment of 16 National Productivity Centres in Europe by 1950. Five years later, on March 1, 1955, the Japan Productivity Centre was inaugurated to undertake



Ichiro Nakayama

the same activities as in European countries which already had shown by that time remarkable success in several important areas of industry. Of course, Japan was not alone in this drive. Many other Asian countries were found to be in the same campaign. And it is quite natural that these individual efforts led at least to the formation of APO in 1961.

Real Problem

Now we are concluding our first decade with success, I believe, at least in disseminating the ideas of productivity, and finding out effective means of promoting productivity through regional cooperation. But I think the next decade beginning with the year 1971 will be, and should be, more significant than the first. In the first place, this is the year when the second Development Decade Plans and activities of the United Nations are being finalised after the first Development Decade of the 'sixties, with many valuable experiences concerning aid and development on the part both of aid-giving and aid-receiving countries which are most relevant especially to the developing countries of Asia. Secondly, the world in the 'seventies seems to be one of more keen competition among nations than during the preceding decade—which has rather important efforts on the nature of the productivity drive in this region.

The real problem lies in the relation between competition and cooperation which sounds at first glance rather contradictory.

To be clear about the significance of APY, and the broad objective of the drive in the coming decade, it will be worthwhile to give some thought to the true meaning of productivity in its essence. In this connection it seems to me absolutely necessary to distinguish between production and productivity. The principal aim of the drive in Europe was not merely to increase production, but to promote productivity in the sense of efficiency of input compared with the output. It was indeed the large difference of productivity, in the sense as defined above, between Europe and America, which

struck the countries of Europe immediately after the war.

US Experience

Study teams were sent to America to learn the effective technologies which had been developed and improved there in spite of the involvement in the war; and pamphlets and journals were published for the dissemination and exchange of useful ideas and methods to promote productivity. Productivity centres were set up to promote cost consciousness among entrepreneurs of various kinds of business. All were to narrow up the gap in productivity. This was not taken to mean that production could be neglected. On the contrary, the improvement in productivity should eventually be realised in the increase of production which is the ultimate objective of the drive. In practice, moreover, it may be difficult to distinguish production from productivity, or productivity from production. In the time of an emergency in particular, we must admit that there is no room to distinguish between the two to answer the vitally necessary demand for some particular commodities such as staple foods. But still it is not only necessary, but also quite useful to bear in mind the difference between the two, because the ultimate goal of increasing production in the face of international competition can only be achieved with the continuing improvement of productivity in its real sense.

Power of Competition

Here we can recognize the fundamental relation between productivity and competition. To promote productivity is, in its last resort, to increase the power of competition. In the case of Europe, the drive meant the augmentation of competitive power against the United States; in the case of Japan, against the world in general. The direct objective of the drive in each nation may differ from one another, yet we cannot understand the true meaning of productivity if we overlook its impact on competition. In the case of developing countries especially, the keen interest manifested towards the productivity drive might have been the basic

reason in this connection. Competition may not be limited to international markets. It may exist and function among different industries of the same nation, between agriculture and industry, for example. According to the power of competition based on productivity, labour moves from one sector to the other, and prices may be cut relatively. This goes on both domestically and internationally, and this is really the source of human progress in general.

It is true that the productivity drive will lead sooner or later to the competition at home and abroad. Every productivity drive is supported by the hope of increasing the power of competition in the long run. This does not mean that the competitive power should always be directed to competing with a foreign rival in the world market. The power may be used mainly for the betterment of living of the people of the relevant country, and the region in general. The power is one that can be used either way, the real point being that without power which is based on improved productivity, nothing can be achieved.

APY Theme

In this connection, I must hasten to add some remarks about competition in order to avoid possible misunderstandings. I repeat here the power of competition based on improved productivity, excluding cut-throat competition or competition which aims at the monopoly of the market at the expense of others in general. Such a competition may be executed by merely dumping the increased products into markets or through some other means without referring to the productivity. But this is not the competition which always leads to the progress of human economy. Here we should remind ourselves of the theme of the APY, that is Quality and Reliability. It is the competition with quality and reliability that really matters. Not only by the increase of production, but rather by the constant improvement of the quality and reliability, we can compete with each other for raising standards of living.

We may have stayed too long on this matter of competition. Some may doubt about the

feasibility of cooperation among nations of the region because of the excessive emphasis placed on competition. It is needless to say that cooperation has been the very foundation of our organisation. If there had been no possibility of improving productivity through regional cooperation, there could not have been such an organisation at all. The necessity, the possibility, and the effectiveness of cooperation has been repeatedly reminded, confirmed, and stressed. The APY is nothing but another occasion to reconsider its fundamental importance.

So, if competition seems to contradict cooperation, we may lose our way at this critical moment. But fortunately enough, there is no contradiction between the two. Theoretically, this has been sufficiently proved by the theory of division of labour and the theory of comparative cost in foreign trade. Practically this has been proved by the experience of both EPA and APO. Each National Productivity Center may be oriented rather competitively, but this does not impair the advantages of cooperation among them. The only thing we must make clear in this connection is the need to recognise the power of competition as the basis of real cooperation. As has been said before, the power of competition may sometimes be misused, but if we do not lose sight of the real virtue of cooperation, its power can only be the source of promotion of it. Just look at the world order of our time! World cooperation has been first promoted by the most competitive of nations; the larger the power, the more it competes with others, and the stronger the ties of cooperation joining them. We should not forget the fact that both competition and cooperation should be based on the improvement of productivity in the real sense. But so far as this is true, there can be no discrepancy between the two.

Looking Ahead

Looking ahead to the years to come in the world of the 'seventies, which may be expected to be highly competitive years, I should like to draw attention to the basic relations between

competition and cooperation. How to coordinate them with regard to improving the living of the people is a question we are to face. This is, of course, the problem of the world at large. But it applies to the region of Asia as well. Rather it applies to Asia, especially because of the diversity in the stage of development, population growth, natural endowment, etc., of each nation. We know all this very

well. Through ten years' experience we have learned of the difficulties which lie ahead of us. We have also learned how to break through our own way, and surmount such obstacles in order to achieve the noble cause of our drive. I believe, the success of APY is already assured if we continue to go this way steadily with firm conviction in the future.

FOOD FOR THOUGHT

...Integrity without knowledge is weak and useless, and knowledge without integrity is dangerous and dreadful.

—Samuel Johnson

...In order that people may be happy in their work, these three things are needed: They must be fit for it; They must not do too much to it; And they must have a sense of success in it.

—John Ruskin

...In my younger days I used to blame the older generation for the trouble they got us into. Now here I am in the older generation, and trouble is still with us.

—Mike Mansfield

...The "great" commitment all too easily obscures the "little" one. But without the humility and warmth which you have to develop...to the few with whom you are personally involved, you will never be able to do anything for the many...Love...would remain...powerless against the negative forces within you, if it were not tamed by the yoke of human intimacy and warmed by its tenderness...

—Dag Hammarskjöld

...Even in politics, an evil action has evil consequences. That, I believe, is a law of Nature as precise as any law of physics or chemistry...

—Jawaharlal Nehru

...If the world were merely seductive that would be easy. If it were merely challenging, that would be no problem. But I arise in the morning torn between a desire to improve (or save) the world and a desire to enjoy (or savor) the world. This makes it hard to plan the day...

—E.B. White

...Love must be learned, and learned again and again, there is no end to it. Hate needs no instruction, but waits only to be provoked...

—Katherine Anne Porter

...The need for authority reflects a distrust of human beings. The essential philosophy of democracy...tells us to trust a person until he proves himself untrustworthy. The prejudiced person distrusts every person until he proves himself trustworthy...

—G.W. Allport

...It is good to collect things; it is better to take walks...

—Anatole France

A Decade of Organised Effort to Improve Asian Productivity

APO & Its Achievements

The Asian Productivity Organisation has come a long way . . . and in the first decade of its existence it has contributed a lot for the propagation, acceptance and application of productivity concepts and techniques in the Asian region. In fact it was recognition of the importance of productivity as a determining factor of economic growth that led to its establishment in 1961. Today, it has grown in membership, and in the scale and scope of its activities. And it was to mark the close of its first decade, and to set the pace for the second, that it decided to designate 1970 as Asian Productivity Year.

This write-up attempts to highlight APO's contribution to enhance the understanding of the importance of productivity in Asian development. It does not attempt to catalogue various achievements, but certainly it gives glimpses of the activities undertaken by APO since 1961. APO has grown to the extent that it now has 14 countries as members, and its programmes involve hundreds of managers, engineers, consultants, and trainers every year. An indication is also given here of the activities which APO has programmed to undertake under its Five-Year Plan expected to end in 1974.

ASIA has shown remarkable economic advancement since 1961 --the year in which the Asian Productivity Organisation (APO) was established. It would be rather difficult to measure APO's accomplishments by calculating the aggregate of productivity increase achieved by its activities, and express the same in terms of statistical figures. Productivity involves such a wide range of activities and factors that any attempt to show direct results would be futile. It is, however, generally accepted that the pace of economic development in countries having productivity organisations is faster than those without, and that the propagation of productivity concepts and the application of productivity techniques invariably accelerate the rate of growth.

Eight Asian Governments signed the APO Convention in 1961 to establish this organisation. By the end of 1969 membership stood at 14, the Governments of which exercised sovereignty over more than one billion people and nine million square kilometers (three-and-half million square miles) of territory. A breakdown is shown in Table 1.

According to U.N. statistical data, most of the APO member-countries showed encouraging growth in terms of national and per capita product over the period 1961-66. Although it is difficult to establish a direct relationship between such growth and the endeavours of the APO and the various National Productivity Organisations in member countries, there is no

denying that the productivity movement has made definite contributions. For instance, a recent survey conducted by ECAFE, communicated to APO, shows "a wide realisation, basically as the result of the efforts of your organisation in the recent past of the importance of management, particularly in industrial enterprises".

Table 1
Population and Area of APO Member Countries, 1967

	Population (1,000)	Area km ²
Ceylon	11,701	65,610
Rep. of China	13,142	35,961
Hong Kong	3,732	1,034
India	511,125	3,268,090
Indonesia	110,079	1,419,564
Iran	26,284	1,648,000
Japan	99,918	369,765
Rep. of Korea	29,784	98,477
Nepal	10,500	140,717
Pakistan	107,258	140,797
Philippines	34,656	300,000
Singapore	1,955	581
Thailand	32,680	514,000
Rep. of Vietnam	16,973	173,809
TOTAL :	1,009,787	9,054,405

Source : Statistical Yearbook, 1968, United Nations.

Regional Cooperation

APO promotes regional cooperation through its member-governments and respective National Productivity Organisations in the

development of management skills and productivity technology, covering agriculture, manufacturing industry, and servicing industry. Regular meetings are held among member-countries to exchange information on productivity activities, to review past efforts, and to make plans for the future. APO also maintains contact with various international organisations and bodies, not only to promote the productivity movement in Asia, but also to help member-countries with information on advanced management concepts and new innovations in technology through various media. In 1963, it entered into formal relationship, on a reciprocal basis, with the ILO, and an agreement was signed. Similarly, it keeps close contact with the Colombo Plan, ECAFE, OECD, FAO, UNIDO, ADB (Asian Development Bank) etc. It has been granted consultative status by the Industrial Development Board, Governing Organ of the UNIDO, and, to better serve the needs of its member-countries, it has also tied up its information activities with the technical inquiry services of such international organisations as UNIDO, FAO and OECD.

Manpower Development

One of the main fields of APO's activities is in manpower development through symposia, seminars, study missions, fellowships and other training projects, including the Small Business Management Trainers' and Consultants' (SBMTC) course, and the Production Level Engineers' Training (PLET) course. Moreover, APO deputed experts from both within and without the region to member-countries upon request, to give guidance to specific problems. A total of 365 projects was implemented from 1961 to 1969, and the number of participants stood at 6,669 by the end of that period. During the same period, 180 experts were deputed to offer technical assistance to member-countries, or to lead seminars or conduct training courses therein.

These experts were drawn from both within and without the region. As a result, many industrial enterprises increased their productivity, and a few examples are cited below :

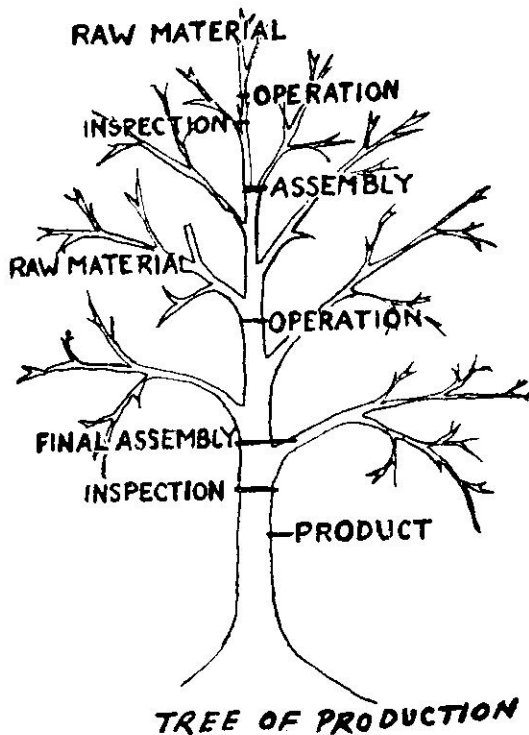
A textile machinery factory in China introduced cost control with the help of an APO expert, and increased its sales by 30 per cent, whereas a nut and bolt factory increased its sales by 60 per cent as a result of its improved design and packaging, both introduced by an expert. In Thailand and Vietnam, APO experts were instrumental in establishing faculties of metallurgy in universities. A ceramic factory in Pakistan constructed modern kilns and took measures to improve quality, while at the same time increasing its operating rate by 25 per cent. Another APO expert helped to improve milling techniques in Nepal, thus reducing the rate of loss of rice grains.

In 1966, APO started taking up agricultural projects. It is still too early to assess the impact made in this sector, but among APO's endeavours in this field surveys may be men-

tioned: In 1967, a survey on agricultural machinery was implemented in member-countries, followed by a symposium in Tokyo attended by the concerned government officials and engineers. A report published subsequently met with enthusiastic reception. It is being widely utilised as a source of reference in APO member-countries as well as by international organisations and concerned parties in advanced countries. In 1968, a storage and transportation of food grains survey was conducted, the results of which were acclaimed by the Research Institute of the Ministry of Agriculture and Forestry, Government of Japan.

Multiplier Effect

Participants in all APO projects are achieving a multiplier effect throughout the region. They are all eligible for membership in the



APO Society, and receive APO publications regularly. These former participants in one way or another, have created a tremendous impact on the productivity movement of their respective countries. To cite a few examples:

In the Philippines, 55 former participants in APO projects formed the APO Society of the Philippines Inc., in 1967. It organised seminars, held monthly meetings with guest speakers on various aspects of productivity, organised plant visits for its members, and laid down plans to intensify its multiplier effect through the establishment of a permanent secretariat to issue publications, to sponsor productivity exhibits and to offer voluntary consultancy services to small-scale industries and small farmers, etc.

Hong Kong has sent, through the Hong Kong Productivity Centre, numerous management/technology trainers, to APO training projects, and these trainers, upon their return, have conducted numerous training courses in Hong Kong. In 1968, the Centre conducted 20 training courses with over 500 participants, 90 per cent of whom came from small and medium-scale manufacturing enterprises. Of these participants, more than 500 formed an Industrial Engineering Group under the aegis of the Centre to further exchange views and disseminate knowledge.

In Ceylon, a former participant in APO's Production Level Engineers' Training course applied the techniques acquired during his 1967 training in his factory, and made an improvement in efficiency of 130 per cent. In Iran, another former participant in the same course is now the head of the industrial engineering department of a leading manufacturer of chemical products, and has been applying modern engineering methods with success.

Information

One of the main objectives of the APO is to constitute itself as a clearing house of knowledge. Under its information programme, the APO produced, from 1961 to 1969, 291,900 copies of publications, in addition to its monthly bulletin *Asian Productivity*, and 180 sets of

slides/filmstrips to propagate the idea of productivity and to introduce newly developed techniques. To effect a wider dissemination of newly developed productivity knowledge, it also undertakes translation work to make available to its member-countries materials written in languages other than English, mostly in Japanese. Both the Japanese Government and the USAID give support to this project. A Regional Information Unit was established in Manila in 1967, with the support of the USAID and the Government of the Philippines. Following this, APO accelerated its information activities to identify the need for both general and technical information materials in member-countries and to take concrete steps to meet such needs.

Following the decision to observe Asian Productivity year-1970, a Poster Contest and an Essay Contest were launched in 1968.

Future Activities

Ever since its inception, APO has placed emphasis on training for top management, the modernisation of small and medium-sized industry, and the improvement of industrial relations. Since 1966, it has been concerned with agricultural affairs, with emphasis on the economics of applying advanced agricultural management methods and technology. These lines of activities will be pursued by the APO in the future.

Top management plays a vital role promoting productivity consciousness and accelerating economic growth, and APO programmes will continue to provide opportunities for members of the top management in member countries to assimilate the latest managerial developments and technological innovations. On the medium and small industry side, APO's project will not be limited to the training of managers and engineers, but will include the development of entrepreneurial talents and guidance in the development of industries themselves. Concerning the improvement of industrial relations, the importance of labour/management cooperation and the means of promoting better understanding between labour and management will be stressed.

The APO is now planning its activities on a five-year basis. A Five-Year Plan, which extends through the calendar year 1974, was adopted in 1968, and is now in the course of implementation. To highlight this plan, Asian Productivity year is being observed with special programmes in all member countries.

Also, during these years, it appears evident that the APO network will move forward progressively towards a more substantial role in the economic development of Asia and improvements in the standard of living of its peoples. The APO will make every effort to become increasingly involved in programme coordination, joint project implementation with and provision of technical services to other Asian regional and multi-lateral development entities, especially the ECAFE, the ILO, the ADB, the Asian Institute of Management, the Asian Agricultural Research and Development Center, the South East Asia Education Ministers' Council, and the FAO. Realisation of the true potential of the APO programme during the coming years will also, inevitably, require extended support from its own member-countries, both in membership contributions and in programme participation.

Another development, which is expected to increase the capability of the APO, should be the addition of several ECAFE member-countries in South and East Asia who are not yet APO affiliates.

Major developments in APO programme activity during the coming years are expected to include:

1. The initiation of research and training in basic aspects of the relation of productivity to economic growth, technically-sound measurement of productivity, and sound analysis of the factors affecting productivity levels and dynamics, including social and cultural as well as the physical and technological factors. The APO is already tentatively assured of future special support on such efforts by several of its member countries (espe-

cially Japan and India) as well as by the East-West Center, the Rand Corporation of the U.S.A., the OECD and the U.S.AID

2. An expansion is foreseen in the provision of APO-sponsored fellowships for leaders and specialists in Europe and the United States, and in the provision of experts—especially from Europe—for work with NPO's in APO member-countries. With the anticipated closer working relationships with other regional development entities, it is contemplated that U.S., European and Asian experts will share their time in Asia between service to NPO's and to other in-country, regional or multi-lateral organisations working with and supporting the APO.

3. The APY and following years are expected to witness the development by the APO network of a highly desirable cross-exchange of managerial and technological information in printed and visual form, in line with earlier recommendations of the Governing Body at several past meetings. It is hoped that this effort will receive the support of the U.S., the OECD, and other donor entities, and that it can coordinate effectively with the work of UNIDO, the FAO, the ADB, and the organisation of American States in Latin America.

4. As APO's regional, technical and general information publications and visual aids programme matures and develops, it is anticipated that its programme will be an increasingly important source for resources and materials for the member-country and regional training courses, seminars, symposia, and fellowship projects. It is also expected to draw from and to service the publication programmes of each member country, to assure a multiplier effect for useful materials.

5. If present anticipations are realised the APO, within the next two years, will be able to provide a technical enquiry service (of at least limited scope) to its members, together with a film and small visual-aid loan library service, in support of seminars, training projects, and related activities.

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- * This is a scheme that offers the management an objective means of assessing the suitability of employees to fill up supervisory positions, and thereby strengthen supervisory cadres on a continuing basis.
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A Photo Feature

ON

APY-1970

The Asian Productivity Year-1970 was launched in India and in 13 other member countries of the Asian Productivity Organization early this year. As part of its programmes for the year, the National Productivity Council sponsored a 15-day Training Programme in New Delhi on the Measurement of Productivity, the first of its kind to be held in this country. A number of participants from member-countries of APO, Indian Universities, etc., attended. Photo on this page shows Mr NN Wanchoo, Chairman of NPC (*right*), welcoming Mr Ichiro Oshikawa, APO Secretary-General, who specially flew in from Tokyo to meet the participants.





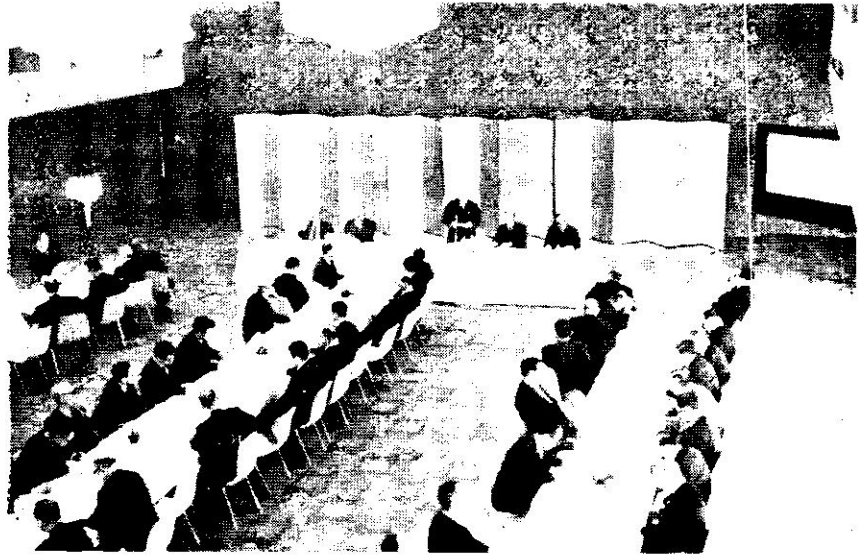
Above, Mr R Venkataraman, Member, Planning Commission, and Mr Wanchoo chatting with Mr Mario L Cabanero (extreme right), a participant from the Philippines. Mr Venkataraman inaugurated the Training Programme. Below, Mr BN Bhattasali, NPC Executive Director, greeting Mr H Hirukawa, participant from Japan. On the extreme right is Dr. S Yamada, a Faculty Member.





Participants of the Training Programme on the Measurement of Productivity (standing) photographed with members of the Faculty, the APO Secretary-General, Mr Oshikawa (sitting fifth from left), Mr Wanchoo (fifth from right), and Mr Bhattasali (fourth from left).

First meeting of the Promotional Committee of the Japan Productivity Center composed of leaders of labour, management, university and government circles.



The Japan Productivity Center, the largest Productivity body in the world, celebrated its 15th Anniversary in March. Simultaneously, it also held the inaugural ceremony of Japan Productivity Year.

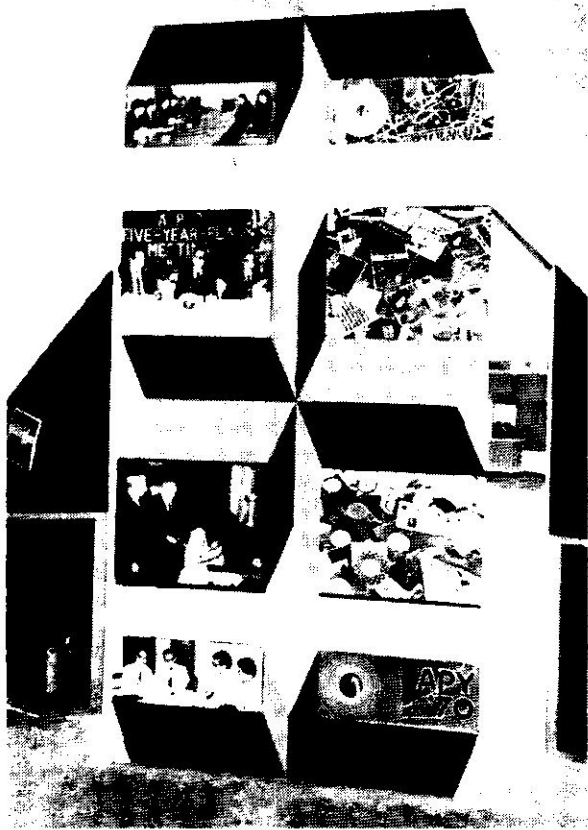




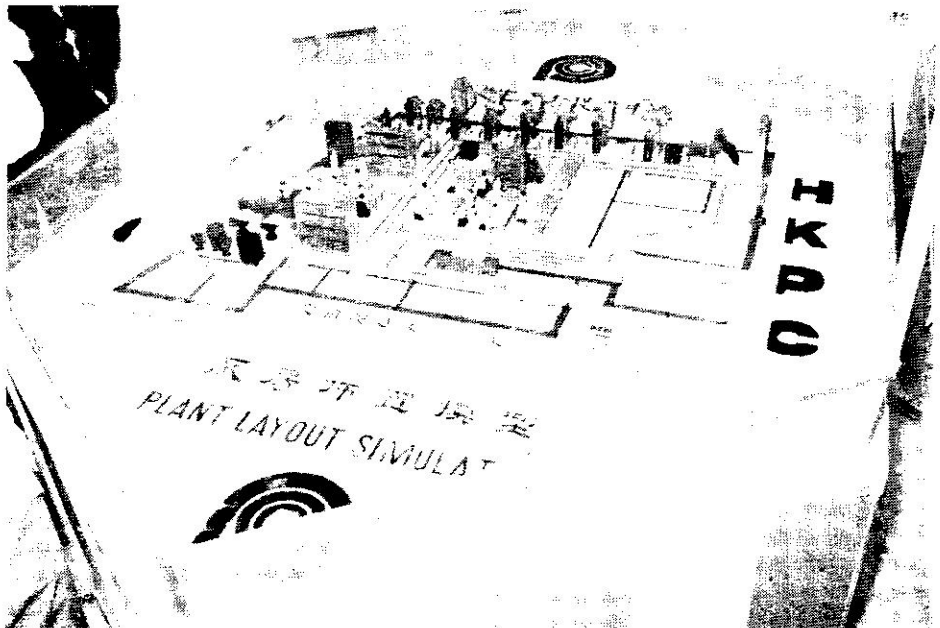
Above, Directors of the Japan Productivity Center discussing with Ministers of the Japanese Government JPC-Government Cooperation.

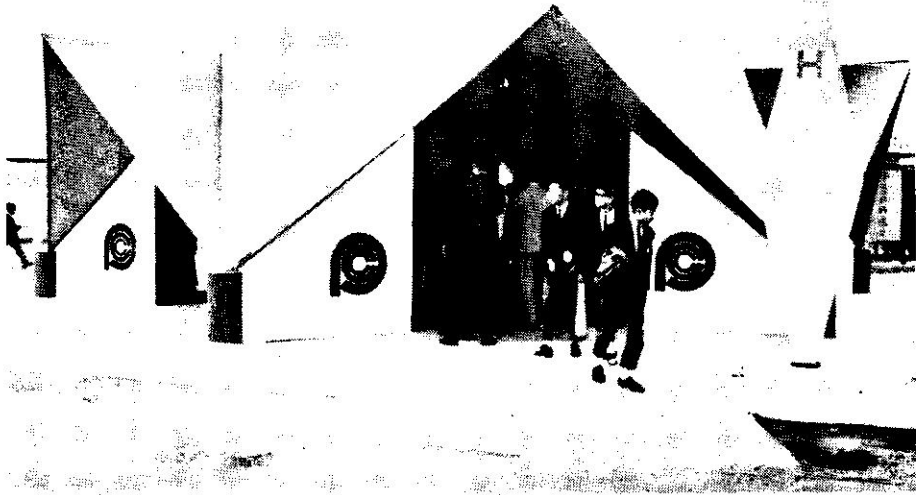


The Hong Kong Productivity Center participated in the Annual Exhibition of the Chinese Manufacturers' Association, the opening of which synchronised with the launching of APY-1970 in Hong Kong. Photo (left) shows the Acting Governor of Hong Kong, Mr Hue Norman Walker, arriving to visit the Exhibition.



Photos on this page show some of the exhibits put up by the Hong Kong Productivity Centre in its pavilion at the Annual Exhibition organised by the Chinese Manufacturers' Association.





Above. the Hong Kong Productivity Center's pavilion as seen from the outside at the Annual Exhibition held in Hong Kong by the Chinese Manufacturers' Association.

Below : Members of the Japanese Regional Productivity Promotion Mission which visited India in February as part of APY-1970. The team visited the Headquarters of NPC and had discussions with the Executive Director and other officers.





The NPC Executive Director, Mr. BN Bhattasali, explaining to members of the Japanese Productivity Promotion Mission the working of the National Productivity Council. He is seen showing them a copy of the PRODUCTIVITY Journal, one of NPC's important publications.



As part of the Asian Productivity Year, the Patna Productivity Council organised a Seminar on Training in Industry in which representatives of Government, Industry, and Labour participated. *Top* Mr KSV Raman, ICS (Retd.) delivering the inaugural address. *Left to right* are Messrs GS Srivastava, Deputy Director of Training, SR Adige, Director of Training & Employment, and P Havrlant, President, PPC. *Below* A section of the audience.



A number of functions were organised by the various Local Productivity Councils in India in connection with the Asian Productivity Year-1970. *Top* Mr Somnath Panditha, I.A.S., addressing a Seminar on the Importance of APY-1970, organised by the Agra Productivity Council, at Firozabad on March 14. *From right to left* are Messrs MM Agarwal, Executive Secretary, Agra Productivity Council, PC Kulshreshta, Assistant Labour Commissioner, who presided, SN Panditha, P.D. Paliwal, Secretary, Agra Productivity Council, K. Nath, Director, Social Welfare and Rehabilitation, and Bal Krishna Gupta, Agra LPC Treasurer. *Below* Mr DR Chavan, Minister of State for Petroleum and Chemicals, inaugurating a Seminar on Cost Reduction through Cost Control and Quality Control organised by Delhi Productivity Council in March 1970.



Productivity In Asian Countries

By

R Venkataraman

Member, Planning Commission

The author stresses that productivity is a factor of immense practical importance as is evident from the close relationship existing between the rate of economic development achieved by the various countries and the improvements which these countries have secured in productivity. He points out that, in the context of international commerce and trade, quality improvements through productivity techniques can bestow rewarding returns in terms of larger exports and foreign exchange earnings. In referring to Productivity Measurement, an important tool of economic and social analysis, he says that in capital-scarce, labour-rich underdeveloped countries, "a more appropriate concept for measuring productivity would be the one related to the minimum use of capital for a given output", and in calling for the planning, evaluation, and formulation of measures for improvement in productivity, he has stressed the need for "a number of well-tailored productivity indices which would throw distinct light on progressive changes over time in the efficient utilisation of labour, capital, and raw material."

IN broad terms, productivity means the efficient utilisation of the available resources for the production of goods and services required by the community. It aims at the optimum utilisation of the available resources, and the maximisation of the benefits therefrom.

Productivity is thus a key factor in economic planning and economic development. Hence, the improvement of productivity is of universal application, and is of significance to all countries. But it is crucial to underdeveloped countries which suffer from inadequacy of capital, material, and skilled manpower resources. The resources being limited, these countries can hardly afford to neglect their optimum utilisation. To the extent higher productivity can secure larger outputs, it brings about savings in resources which can be utilised elsewhere in the economy. Higher productivity through the rational use of labour and material,

and by improved manufacturing and managerial techniques, is thus basic to the acceleration of capital formation, and, consequently, to economic and material welfare.

Wider Connotation

There is still another dimension to the productivity concept. Productivity is not merely an increase in production per unit of resources employed, though, no doubt, this quantitative aspect is important. The emphasis should, however, be equally applicable to the qualitative aspect of productivity. Thus, for a given unit of resources, even if there be no improvement in the quantity of output, but its quality is enhanced, that would still reflect a better productivity; for, in terms of wealth produced, the value of such quality output is bound to be higher than that of the same quantity of poor quality product turned out previously. Pro-

ductivity has thus a much wider connotation, and, in the context of international commerce and trade, quality improvements through productivity techniques can bestow rewarding returns in terms of larger exports and foreign exchange earnings.

That productivity is not merely a theoretical concept, but is a factor of immense practical importance is evident from the close relationship that exists between the rate of economic development achieved by the various countries, and the improvements these countries have secured in productivity. According to the data available for the period 1965-66, the growth rate of labour productivity in the manufacturing sector in Japan was 8.1%, West Germany 5.2%, France 4.7%, U.S.A. 3.8%, and UK 3.4%. The countries which have maintained high growth rates of productivity have also been the countries which have shown rapid rates of economic development. Thus, one of the most important factors responsible for the rapid growth of the Japanese economy has been its commendable achievement in increasing productivity. As against these growth rates in other countries, certain rough estimates of the improvements in industrial productivity in India places the rate of growth during 1951-63 at about 3.4%, and during 1963-68 at about 4.4% per annum.

Important Tool

Productivity measurement is, therefore, an important tool of economic and social analysis. As a means to secure larger outputs of better quality products, productivity measurement can assist business undertakings and the Government in arriving at appropriate decision and formulation of suitable policies. Inter-plant variations in productivity can spellight the weak points, and help in the general improvement of the productivity of the industry as a whole. The scope for improvement will thus be well-defined, and measures directed to remove deficiencies. Over a period of time, productivity measurement would indicate changes in the economic structure, and can serve as a tool for detailed economic planning. Thus, at various levels, whether it be concern-

ed with general economic analysis, or in terms of the decisions to be taken at the corporate level, or by way of formulating governmental policies, it is important to have well-recognised methods of measuring productivity.

Productivity is often measured in terms of output per man or per manhour or manday. Thus the physical output in relation to labour input is generally adopted as a norm for the measurement of productivity. While this is a relatively simple concept, and easy to follow and measure, it is necessary to guard against some of the pitfalls in this type of measurement. Often enough, this type of measurement may lead to the presumption that the worker alone is responsible for productivity, and improvements in productivity can be secured only by an increase in the output per worker. In fact, productivity has a much larger dimension, and while labour productivity is, no doubt, an important element, several other factors also contribute to improvements or declines in productivity. The level of technology and the efficiency of management are factors which are equally important in the productivity concept. It would be wrong to put the blame on the labour alone for the ills of low productivity. In the absence of an enlightened and progressive management, any extra labour or increased workload will not yield higher productivity. Just as labour productivity needs to be improved, there is also considerable scope for improvement in productivity of the management through rationalisation and reconstruction.

Labour Output

Similarly, the output per worker is dependent on the level of technology adopted. Considering the very different technological and economic environments, it would be highly misleading to compare the labour productivity of the developing countries with that prevailing in the developed countries. In the developed countries, where labour is a scarce factor, necessarily the concern is to ensure the best use of this scarce factor, viz., labour. Hence productivity studies have been primarily oriented to labour productivity. Accordingly, these countries have adopted technologies where

the input of labour required is minimum. This has led to the adoption of highly mechanised industrial operations, and the introduction of automation. Conditions are entirely different in the capital-scarce, labour-rich underdeveloped countries. The scarce resource in these countries is capital, and therefore, a more appropriate concept for measuring productivity would be the one related to the minimum use of capital for a given output. The fact that labour productivity in these circumstances is not up to the levels prevailing in highly developed industrialised countries can be no reflection on the quality or skills of the manpower. I have tried to stress this point in order to prevent the generally erroneous and misleading conclusions which are often drawn on a superficial examination of the so-called lower productivity in the underdeveloped countries.

Sharing the Gains

Another related aspect in this context is that sustained labour-management relations geared to improvements in productivity can be secured only if there is an equitable distribution of the gains of productivity among the entrepreneur, the labour, and the consumer. Admittedly, there is some considerable difficulty in precisely measuring the contribution made by the different factors of production in raising productivity. No national, industrial, or regional formula has commended itself for acceptance in this regard. Different formulae have been suggested by expert bodies, but no agreed solution has so far been found. While there is general recognition of the principle of equitable distribution of the gains of productivity in a manner as would lead to increased remuneration to labour, higher returns on investment to the entrepreneur, and cost reduction to the community as a whole, the formulation of a detailed workable arrangement based on this principle has presented many problems. However, any formula that might be devised should be one which is acceptable to the labour, as without their cooperation no productivity improvement is possible. Given the goodwill, it should be possible to arrive at a mutually acceptable arrangement for the shar-

ing of the gains of productivity, and further efforts in this direction should be continued.

We have made some considerable advance in this country in introducing productivity techniques, and securing general improvements in productivity. Concrete and well-directed activities connected with improvements in productivity began with the establishment of the National Productivity Council in 1958. Apart from the NPC at the apex, near about 50 local Productivity Councils have also been set up at all important industrial centres. That NPC activities have made significant contribution in raising productivity and improving the efficiency of the industrial units is evident from the fact that industry and labour are taking active interest in the activities of NPC and LPCs. The services of the Councils at the local level and at the apex are now in considerable demand. Over a period of time, the NPC has expanded its activities, and now covers *inter alia* training programmes, productivity survey, fuel efficiency service, agricultural productivity, and productivity research. The expertise developed by NPC has now been well-recognised in the international field and NPC is assisting other countries in their productivity effort.

Productivity Gap

The small enterprises have an important role in the developing countries. The need for a larger diffusion of industrial enterprises over all the regions, the compulsions of finding employment to a growing population, and the general scarcity of capital resources all point to the desirability of laying a greater emphasis on promoting a viable and technologically competent small-scale sector. At the same time, in order to ensure that such small units are economically efficient, considerable importance would need to be attached to their productivity. In the context of the situation that prevails in the developing countries, it is necessary that particular effort should be made to deal with the problems of productivity in the small-scale sector. On the data presently available, there is a great deal of difference in productivity between large enterprises and

small ones. According to the Annual Survey of Industries 1964, the value added by manufacture per unit of employment which may be taken to serve as a rough measure of productivity, worked out to Rs. 2510 in the small-scale, Rs. 3460 in the medium, and Rs. 4870 in the large-scale sector. This underlines the productivity gap between large and small enterprises which we must try to close as far as possible. Of course, comparisons between small and large enterprises are not always fair to the former, since the economy of scale, mode of operation and resources available for both in terms of money and men are widely different. However, since small enterprises may have an increasingly important role to play in a country like India, considerable attention needs to be paid to the problems of raising productivity through the modernisation and rationalisation programmes, and adoption of better management techniques.

Worth Emulating

Japan is one country where a much closer integration between small-scale and large-scale

industries has been brought about with considerable beneficial effect on her economic development. The trend in Japan has been to encourage the small-scale enterprises to develop a spirit of self-reliance through technological improvements and modernisation of production methods so as to enable the small units to compete on equal terms with large industries. There is a good deal to be learnt by a detailed study of the measures adopted in Japan to bring up a closely integrated and viable small-scale industry, competitive and modern, without sacrifice to the large economic interests and efficiency. The achievement of Japan in the field of productivity has been unique and is worth emulating.

In our present stage of development, we need a number of well-tailored productivity indices which would throw distinct light on progressive changes over time in the efficient utilisation of labour, capital and raw material. —*Excerpts from the Inaugural Address to the APO Training Programme on Measurement of Productivity, held at New Delhi in January, 1970*

INDIA'S STEEL DEMAND MAY QUADRUPLE IN 10 YEARS

India's steel demand is likely to reach 25 million tons of ingots in 10 years from now, according to Dr. W. Bading, Chief Superintendent of the Rourkela Steel Plant. He says that the per capita consumption in India at present is only 12 kg., while it is 674 kg. in West Germany, and 47 kg. in Brazil. Since the latter is undergoing a transformation process from an agricultural to an industrial economy like India, he argues that India should achieve the same per capita consumption as Brazil, which would necessitate quadrupling the present production of 6.5 million to 25 million tons of ingot steel.

The Rourkela Steel Plant in 1969-70 will most probably show only a marginal profit. According to the plant authorities, this is due mainly to about 10 major strikes and labour unrest which affected production during the last year. Important units like coke ovens, blast furnaces, and rolling mills had repeatedly to be shut down to avoid damage.

Two leading German steel experts, who recently visited Rourkela as members of the Abs-delegation, described the steel plant as most modern in both layout and equipment. They felt that, with marginal expenditure, the production at Rourkela could be increased from the present 1.2 million to about 3 million tons of ingot steel per year. Relatively low development investment could boost the production to 5 to 6 million tons without addition to the present labour force of about 31,000.

Major Factors Affecting Productivity In Israel

By

Israel Meidan

Director, Israel Institute of Productivity

Industry in Israel is relatively new, and management has had little time to gain experience. Despite this, a tremendous progress has been made in the field of productivity there, and, in this paper, the Director of the Institute of Productivity sets out the major factors affecting productivity. "In the last ten to twelve years," he says, "we have seen an annual average increase in output per worker of some five to six per cent. Today, following a period of recession, indicators show an increase of close on 12 per cent per worker—a considerable performance." Mr Meidan is confident that the present-day trends in his country's economy point out to a slow but steady move in the right direction, and remarks: "We are forced, to a considerable extent, to adopt original approaches and solutions. And, in formulating, testing, and implementing solutions, we are working on a long-range time schedule."

ISRAEL'S approach to efficiency has run parallel to that of every other developing nation. With the establishment of the State, the whole matter was put aside: the major problems were the acquisition of capital, the integration of immigrants, and the development of production. Here and there, some attempts at rationalisation and efficiency were made, but they were isolated instances, and passed almost unfelt. The 'cost plus' concept on which the economy was operated did little to intensify the drive for efficiency.

A glimmering of the idea dawned in 1952 when attempts were made to move from a system of price controls and a policy of frozen wages to some sort of free economy. The concept of productivity and efficiency was strongly tied to labour output. It was assumed, somewhat naively, that, once we succeeded in raising labour productivity, all our economic

problems would be solved. Most of the managerial effort was in the direction of more efficient methods of execution, while little attention was given to planning. The major thrust was directed towards the measurement of labour output, and the introduction of incentive pay systems. The overall results of these efforts brought about the concept of tying wages to productivity: organisational patterns and production processes were hardly changed.

'Total System' Approach

This phase, however, made people realise that introducing incentive pay systems did not in itself solve economic and managerial problems. The importance of efficient managerial practices was gradually recognised. Disciplines, such as Production Planning and Control and Method Improvement and Labour

Layout, were introduced into industry. We saw a slow evolution of middle management, while special training schemes were devised for foremen, technical staff, and functional managers. This activity led, in turn, to the development and application of more sophisticated management techniques, such as the use of Operations Research and Value Engineering.

At the outset of the 'sixties, we began to see the connection between management strategy and the rational use of resources, between initiative in innovation, product policy and marketing and its effect on productivity. Here we witnessed the emergence of the 'total system' approach to productivity, taking into consideration all the factors—both external and internal—affecting enterprises. Changing economic conditions during the 1965-66 recession strengthened this development. In my opinion, this approach has to be spread even wider. We have to change our overall strategy in order to utilise our resources more fully. This process will take time; but the trend has been established, and we can already see some encouraging results.

The major factors affecting productivity in Israel are :

- (a) management, and decision-making processes,
- (b) technological knowledge and application,
- (c) size of plants and utilisation of capacity,
- (d) marketing and distribution,
- (e) product policy and quality control,
- (f) methods of production,
- (g) levels of operative and supervisory skills,
- (h) quality of administration, services and physical infrastructure,
- (i) industrial relations.

Management has been placed at the top of the list as the most important: all the others are affected by it. This is not to belittle the level of managerial skill in Israel; however, it leaves much to be desired. It is a difficult problem. Industry in Israel is relatively new, and management has had comparatively little time to gain experience. In addition, the rapid developments which have taken place throughout the world demand constant study. Some

managers, when catapulted into positions demanding knowledge and experience, have done well. But others, in spite of considerable technical knowledge, lack any conception of logistics. If it were possible to train managers through schools alone, we could quickly solve the problem. However, while there is certainly room for formal theoretical training, the art of management can only be learned by a combination of theory and practice. We must expand management training, and educate new generations of managers through the universities; but subsequent experience is also needed, and that takes time.

Technological Knowledge

Managers are conditioned by their social and economic environment. The overall development policy for Israel has, however, not been primarily concerned with productivity. Managers discovered that pressure to obtain a subsidy or a change in economic policy often brought better results than those to be achieved by the long struggle to improve plants from within. Then there was the emphasis on getting things done, regardless of cost. It is difficult to come along 15 or 20 years later and tell managers that they must now mend their ways and turn their eyes on internal plant efficiency. One may conclude from this that, in addition to developing management training, we must also examine every Government policy decision to see what are likely to be its effects on management, and the direction in which management will develop as a consequence of it.

The extent of scientific knowledge on our academic campuses is considerable. Scientists already at work, plus those still being trained in our institutes of higher learning, are capable of solving many problems. The real trouble is that we still fail to involve the scientist in the economic structure of our society. We perpetuate a framework of production based on a concept of manual labour. We do not yet take sufficiently into consideration the increase in productivity and output which can be achieved through a more scientific approach. Hence we must base our economic structure far more on skilled engineering and technical

staff. This is not an easy matter, and presupposes Government initiative in encouraging scientists and other professionals to interest themselves in the problems of productive enterprises and service institutions.

Marketing

The more one produces of a given commodity, the more one is likely to achieve maximum utilisation of the productive potential. Israel is limited by the fact that the local market caters to a population of only 2.5 million. Basing industries on the chance of their exporting a substantial part of their production is a risky business. In addition, there are many instances where several small factories produce the same commodity. A check on one branch of manufacturing in 1964 revealed that all six factories producing the same type of goods were utilising only between 20 and 25 per cent of their capacity. In 1963, Prof. Harold Martin of the Ransler Institute in the USA visited Israel, and carried out research on the utilisation of productive capacity in 13 of our industrial enterprises. His findings revealed that the average exploitation of potential was only some 57 per cent of the optimum in these factories, all of which were working only one shift. Such wastage is a structural failing. I do not believe in the use of administrative controls to solve this problem; but I consider it essential to permit the laws of economics to work in their own way in bringing about the optimal use of the means of production.

The connection between marketing and production should, in fact, be clear. However, in practice, it is seldom that one sees a recognition among Israelis of the mutual dependence of these factors. We are still far from realising that marketing should serve as a means of rationalising production, and that production itself must be sufficiently flexible to meet the demands of the market. Improvements in marketing cannot be effected overnight. The whole subject is one in which there is a need for training, guidance, and the development of marketing organisations and market research.

It is a common mistake to suppose that

quality control implies that the product should be of an incomparably superior standard. Quality exacts a price: there are occasions when an improvement in quality becomes unprofitable and even beyond the functional purpose which the product seeks to fulfill. There are markets both for the Ford and the Cadillac. The problem here is to achieve that level of quality which is suited to the market for which the product is intended, while, at the same time, ensuring that this level can be achieved rationally. Much of Israel's goods and services are of a satisfactory quality. What is questionable is the price paid to achieve this. In one factory, we found 80 per cent of rejects as a result of the final inspection. These goods were subsequently returned to the production line for repair. Had the same factory operated a system of quality control beginning from the receipt of the raw material and continued through all stages of manufacture, it could have doubled its output. Incidentally, there has been considerable effort invested in Israel recently in introducing new techniques of quality control. While we are still far from having reached a satisfactory standard, the results show that increases in output and productivity, and our consequent ability to compete in overseas markets, are far greater than one might have expected. Here, too, there is room to harness scientific and research institutes to the service of the economy, to provide increased training for engineers and technicians in control methods, and for the Government to adopt a policy which will make it worthwhile for the manufacturer to institute proper quality control procedures.

Systems Improvement

In the last few years, there has been a worldwide revolution in the harnessing of quantitative mathematical disciplines to the needs of production and its planning. It is possible to determine the optimal production policy, testing alternatives by the use of techniques, such as operations research or value engineering. In Israel, even simple techniques of conventional industrial engineering are not widespread. Some factories have introduced extremely sophisticated models to aid in

production planning. In others, little use is made of planning and control of the processes of production. Attempts so far have shown that the introduction of correct planning systems is likely to produce results which, compared to the investment itself, will yield far greater returns than otherwise in raising the level of operations. Experiments have been carried out in the use of linear programming models for production planning in a number of *kibbutzim*; increased output and considerable profit margins have resulted. Even if we did not use the most sophisticated systems, but applied quite ordinary methods familiar to our engineers and professionals, we would still gain the enormous profits which are merely waiting to be achieved.

If what we are after is a rationalization of production and an increase in output, then we must expend considerable effort in persuading manufacturers to note the value of production planning by qualified professionals. We must refute the attitude that claims that added professional manpower for these functions is an unjustifiable burden on an enterprise. We will also have to see that management is trained to appreciate planning techniques, the organization of planning and the benefits which they can reap from them. Incidentally, a similar problem exists with the determination of policy. Planning of economic development is generally in the hands of economists who do not coordinate their work sufficiently with engineers and behavioural scientists. A greater use of interdisciplinary teams at this level would improve decision-making process.

There is need for vocational training for labour. Whatever has already been achieved in Israel in this direction is very creditable: our investment in training has been relatively large. However, we have no industrial traditions and must continue to expand our training schemes. But we still lack several things. Most of the training is left to the Government and the school system; little has been done in the factories themselves. Vocational and technical training schools can teach the elements of a subject; but further study of how to carry out a job with the maximum efficiency can

only be had in the plant itself. A second omission is our failure to appreciate the role of the managers of works and services in ensuring the correct level and quality of training. Without considerable training of foremen in this direction, we shall not be able to infuse dynamism and professional know-how into our training teams. A third failing is that we have not developed sufficient flexibility in transferring workers from one occupation to another. We are an economy which must rely on the most advantageous use of our human resources. We talk a great deal about the mobility of labour, but, in fact, we have done little to provide opportunities for job retraining. There is doubt that an advisory service would raise the professional level and mobility of our labour force. This advice should be available in both schools and factories.

Service Infrastructure

For some reason, raising productivity in Israel was always regarded as a function of the industrial complex (which is, of course, competitive) to ensure bigger exports and hence an improvement in our trade balance. Too many of us ignore the connection between the quality and efficiency of the service infrastructure and those of the producer. Rising costs and inefficiency in the substructure constitute a burden on industrial enterprises, which cannot be ignored. Transport and haulage services, the supply of information needed for determining plant policies, means of communication, and methods of financing and banking, must all be as efficient as the productive enterprises themselves. Here, too, greater efficiency does not necessarily depend on cutting down on manpower. Of course, there is no point in continuing to employ surplus hands. From the point of view of morale, the labour force in the service industries should be well-balanced and not top-heavy. But the danger stems from another source. The trouble with such efforts is that they are liable to lead one astray, and induce a mistaken feeling that, once surplus workers are laid off, the problem has been solved. In fact, improving efficiency in the services means taking steps similar to those effected elsewhere: improving management decision-

making, planning execution and supervision, and the judicious use of all the advanced organizational techniques. It is, however, difficult to measure some of these improvements, and they must be studied in depth. It is precisely this sector of our economy that needs professionals well-equipped with all the latest technical devices, including computers. Because of the diverse nature of the different branches of the economy involved, it is impossible to lay down a uniform solution to the whole problem. Surveys and research are needed for virtually every one of the components, in order to arrive at the best methods to be adopted in each individual case.

Industrial Relations & Labour Output

There are shortcomings here which must be remedied. Full employment over the last few years, on the one hand, and the network of labour relations built up by collective labour agreements, on the other hand, have led to a slackening of work ethics among certain sections of our labour force. At the same time, nothing could be more unfair than to discuss this subject in generalities. The picture is far from identical in all areas. Conditions in each factory affect work discipline and output per head. Shortcomings in the intricate web of institutional relationships must be repaired: nevertheless, morale and productivity are for the most part determined within each enterprise. They are frequently the consequence of management and employment policies. Research on absenteeism—an indicator of work morale—shows a correlation between the size of the enterprise, the existence of sound employment policies, encouragement of worker identification with the enterprise, on the one hand, and the level of absenteeism on the other. Similar correlations exist between the extent of responsibility and trust and absenteeism, and between absenteeism and the means of communication. Findings of this nature reinforce the conclusion that management and leadership determine employee morale and attitudes to work.

A great deal of attention has been paid recently to work norms. They have even played a part in determining Government policies. Israel's labour force varies in size between eight hundred and nine hundred thousand

persons. Of these, some 650,000 are wage-earners. If we subtract from this number all those found in the agricultural collectives (*kibbutzim* and *moshavim*), we arrive at a number which is somewhat less than half a million. Of these, only some 200,000 are employed in those areas where it is possible to measure productivity. About 85,000 are today employed on a basis of norms, or—more correctly—on a system of payment which links wages to output. These are for the most part in manufacturing, although some are also employed in service industries and agriculture. Of these 85,000, only 45,000 are employed on norms which professionals term 'objective'; the remainder work on fixed output contracts determined by agreement, without any pretence of objective assessment. A check by the Israel Institute of Productivity of the norms system in use showed that its introduction had led to an increase in productivity of up to 60 per cent per head. In my opinion, this increase is largely a by-product. In every case where the system had been introduced, management had to undertake work study, method and planning improvements, and the introduction of inspection and supervision. Premiums paid to employees, as a result of productivity above the objective norms average some 20-25 per cent of their wages. This shows that the introduction of objective norms forces managements to adopt a more rational attitude. However, the determining of norms entails a string of problems. It creates opposition to any change; it demands constant maintenance to ensure that there is no falling off, and it becomes increasingly important as machinery becomes more advanced. Norms also create weighty social problems. Since the system cannot be applied universally, it creates pressures to equalise wages which are not always easily withstood. Nevertheless, with all these limitations, over the next few years its advantages will outweigh its disadvantages. There will be room for its wider application, on condition that it is based on previous research and with an eye always on the accompanying dangers. But we cannot regard the extension of norms as a substitute for a direct attack on the basic problems of organization and management.

Economic Programming In The Philippines

By

J T Pardo

*Managing Director
Productivity & Development Centre, Philippines*

The Philippines, where traditionalism exercised a mighty force until recently, has made impressive breakthroughs in agriculture, especially in the growing of rice. The country is now on the take-off stage of its industrialisation, and is making vigorous efforts to blaze new trails in the economic field. The author, who deals briefly with Productivity and the Productivity Movement in his country, says rather optimistically that "the 'seventies are certain to be the most exciting so far in Philippines' development efforts. The challenges are as interesting as they are great. The people must face them with courage and confidence if they have to find their destiny to greater progress and achievements."

WHAT is Productivity? There are many definitions, but they all mean the same thing—getting the maximum output with the minimum input, or turning out the most goods and services with the minimum of investment. Dr. Ichiro Nakayama, Emeritus Professor, Hitotsubashi University, defines productivity as "the principle of realising a maximum effect with a minimum cost. Or, expressed in the simplest of terms, productivity is producing more and more from less and less, for more and more people."

As a general rule, productivity is enhanced: first, through technical manpower programmes which help make every worker produce more for a given time; and, second, through the employment of the machine which multiplies the quantity of goods and services that can be produced in a given period. Productivity, in turn, makes it possible, for the average worker to earn much more than he would if the productivity of his industry be poor. Thus, in the olden days, when men laboured without the benefit of

the machine or the latest technical know-how, his daily wage was hardly sufficient to provide him with the basic necessities of life.

APO's Aim

The Asian Productivity Organisation was launched precisely at the beginning of the last decade to assist in raising the level of productivity in Asia. Asians were virtually condemned to a marginal standard of living. It was believed that if the Asian countries could get together and exchange productivity knowledge and information, and avail of the latest technical know-how from the advanced countries, they would be in a better position to accelerate their economic development and raise their standards of living. It is for this reason that APO is now involved in a long-range information and public relations programme designed to effect greater and more efficient dissemination of knowledge among the member-countries.

It is a truism that Asians, many of whom have gained political sovereignty only during the post-war period, have been living in a deplorable state because their colonial past has deprived them of their ability to shape their own economic destiny, and, perhaps, because they lack the means with which to improve their living standards. In a large measure, their poverty is due more to the lack of knowledge of modern production techniques and pecuniary impoverishment than to anything else.

Antiquated Methods

Even today, in many places in Asia, one can still see antiquated methods being used in production—methods similar to the ones employed centuries ago. Beasts of burden, for example, are still being used to pull the plough in tilling the fields. As a result the farm yield falls short of the desired goals. This fact aggravates the situation. For, while the production of food remains stagnant, population, on the other hand, continues to mount from year to year, causing hunger and misery where there should be none.

The output of handicrafts has also been very meagre due to the obsolete equipment used, and the work techniques employed in production. Because the small output gives scanty return for the labour employed in turning out any given item, the people in many places barely earn enough to keep their body and soul together.

The APO sincerely believes that this situation, which is causing untold hardships, and even tragedy, to many Asians, can be corrected and that Asians deserve a much better deal than what they have been getting so far. In fact, if one delves deeper into history, he will discover that mainland China was already enjoying much greater prosperity, and a much higher degree of civilisation, when Europe and America were still in wilderness. What China could do centuries ago, I believe, could still be duplicated, provided Asians adopt modern techniques that would yield more abundant results in terms of goods and services and bring exuberance and meaning to life itself.

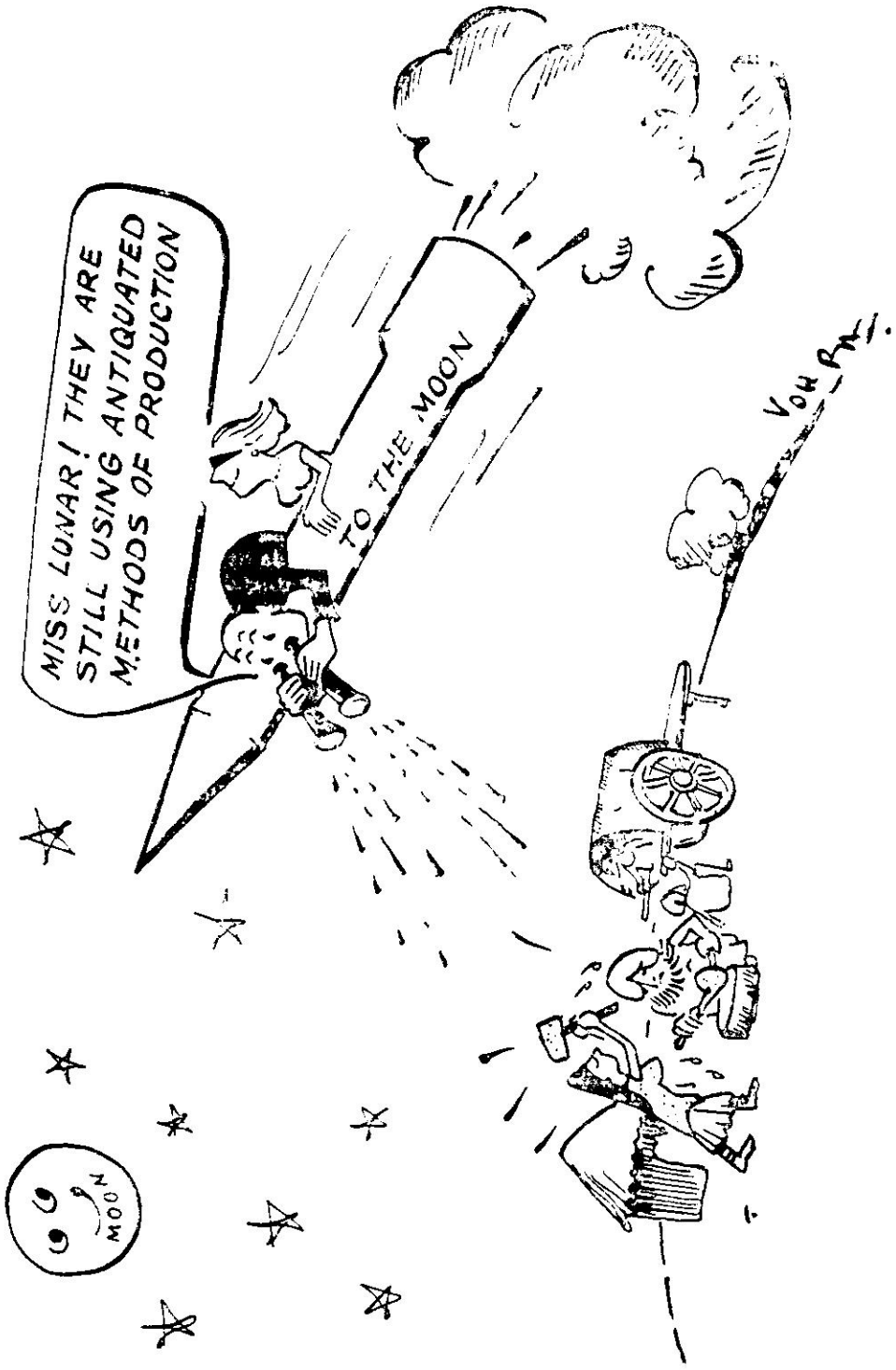
Even the Philippines, where traditionalism exercises a mighty force that has yet to be overcome, has never been immune to this problem which infects people in many other developing countries. Her social, political, and economic thinking and practices are still being dominated by her colonial experience in the past. Getting rid of this experience poses much difficulty which the country is overcoming. Without fear of contradiction, it may be stated that only after the last war were the Filipinos able to cast away the anchors that tied them with the past, and to blaze new trails in the economic fields. Economic programming, for instance, and implementation of the projects approved and adopted are now being synchronized and pushed through relentlessly and systematically to provide greater benefits to her people.

Through the Productivity and Development Center (PDC) and the Information Unit in Manila, APO is working in close collaboration with the Philippine Government in enhancing economic prosperity in the country through greater productivity, and the production of goods that can boast of quality and reliability.

The Outlook

There seems to be general agreement that the next four years, and, in fact, the present decade will witness substantial and meaningful gains in the Philippines' economy. The re-election of President Marcos, who will no longer play politics since he is not likely to run again for a re-election, should usher in a new era devoted largely to the full development of the nation's resources and potential. All indications are for a wiser and more judicious use of the available resources. First, the administration will be tightening on the utilisation of both her currency and foreign exchange resources. The kind of controls now being imposed may contribute to the channelling of resources to the more productive sectors.

Good management of resources also requires the establishment of a favourable climate under which business can flourish, and the economy can advance on a sustained and long-range basis. Philippines has, therefore, to over-



haul also basic national policies to draw out more of the hoarded native capital, and to attract more of the risk foreign capital to augment her limited available resources. Even as she adopts temporary negative policies to conserve peso and dollar resources, she should take positive steps that may stimulate private enterprise and boost productivity.

No Reason to Despair

Philippines has made impressive breakthroughs in agriculture, especially in the growing of rice. Her performance in infrastructure improvement has been phenomenal. And, for all practical purposes, the country is now on the take-off stage of its industrialization programme.

There is no reason to despair. On the contrary, there is every reason to be optimistic that the country can surmount the problems ahead and that it can sustain growth.

The 'seventies are certain to be the most exciting so far in Philippines' development efforts. The challenges are as interesting as they are great. The people must face them with courage and confidence if they have to find their destiny to greater progress and achievements.

Because APO objectives parallel closely with the policies of the administration, President Marcos readily accepted PDC's request to serve as one of the patrons in the celebration of the Asian Productivity Year which started in January.

STRENGTH OF MALAYSIAN ECONOMY

The biggest item of expenditure in Malaysia is still education at M \$542 million. Education constitutes 21 per cent and debt servicing 13 per cent of the Budget for 1970. Wages of Government servants have gone up to M \$735 million and are expected to go up further by about M \$100 million when the salary increases recommended by the Suffian Commission are implemented.

The strength of the Malaysian economy is indicated by the increases in expenditure for the last decade from 1960 to 1970. They are: Defence from M \$180 million to M \$380 million; education, M \$174 million to M \$471 million; rural development from M \$19 million to M \$27 million; health from M \$79 million to M \$157 million; and personal emoluments from M \$236 million to M \$735 million.

During this period the prices have remained rather steady, with the cost of living going up only slightly. Unemployment is still not a problem, but the educated youth seeking jobs in urban areas could create a social and political problem. The Government is concerned with this and the work permits scheme is expected to solve this in some way.

The Government "accepts with regret" the need to increase defence and security expenses in view of the British pull-out and the May riots. It has also tried to cut expenditure in other sectors like social services, natural resources, commerce and communications. The savings are to be used for economic development to provide "wider and equitable distribution among all peoples of all races".

Tun Abdul Razak, Director of Operations, said that in 1970 Malaysia can expect even greater economic achievements than in 1969 when the foreign exchange reserves reached M \$1896 million, about M \$603 million more than in 1968.

Rise and Growth of Japanese Productivity Movement

By

Takeo Tamarushima

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Japan Productivity Center*

The one and the only key to the success of the Japanese economy, not favoured with resources in capital, has been the all-out Productivity Movement throughout the country in the last 15 years. The author, who is the Managing Director and Secretary-General of the Japan Productivity Center, which is the largest productivity body in the world, deals here with the characteristics of the Japanese Productivity Movement, and points out that the marvellous progress which Japan has been able to achieve is due to the fact that both government and civic circle and labour and management similarly understand the importance of higher productivity, and are engaged in the movement as a national drive.

IT is a privilege for me to write, at the request of the National Productivity Council of India, on the history of the productivity movement in Japan, and what we are going to develop in the future. This, I hope, will be found helpful in promoting the productivity movement in India as well as in Asia.

The year 1970 is the fifteenth anniversary of the Japan Productivity Center, and coincides with the Asian Productivity Year. Taking this opportunity, I think it significant to reflect on the achievement we have made, and to consider about the future direction of the movement.

During these 15 years, the Japanese economy has made a considerable progress. Japan is now ranked third in terms of GNP, next to the U.S.A. and the U.S.S.R. In particular, she is ranked first in manufacturing and export of ship-building, second in automobile manufacturing, and third in steel production. In terms of the annual growth rate of economy, Japan has marked more than 10% successively

for the past decade, which is more than twice those of the U.S.A. and other advanced countries.

No Special Secret

There is no special secret for such marvellous progress of Japanese economy which is not favoured with resources and capital. The one and only key to success is the all-out productivity movement throughout the country. Much is due to the fact that both government and civic circle and labour and management similarly understand the importance of higher productivity, and are engaged in the movement as a national drive. The achievement in Japan of such higher level of productivity will, I believe, lead to the confidence of the Asian people in a prosperous future.

The Productivity movement in Japan was launched in 1955 when she began to seek a self-sustaining economy after the post-war period of rehabilitation. At that time the modernisation of business administration and

labour-management relations and improvement of industrial structure were our main concern. We promoted the international exchange of ideas and techniques, and the education of the industrial people of every strata. The scope of exchange and education was such as had never been seen before. Its effects were also marvellously great.

The high economic growth rate was a new experience to Japan. Industrial and employment structure were changed, internationalisation of economy was promoted, and innovation occurred, both in the production method and distribution, through automation and higher utilisation of transportation machineries. Unemployment as a result of automation, which was feared by labour unions, at the commencement of the productivity movement, was found groundless. The labour shortage of today was not foreseen then. This fact should attract the attention of Asian nations, now on the road to development.

Use of Computer

Very recently, the use of computer has been highlighted, opening a new era for productivity. The high economic growth has, however, given rise to not a small friction. The rise of commodity price, etc., have now been threatening human life. Our spiritual life is also very much disturbed. It is a contradiction that while Japanese economy has achieved higher productivity and high economic growth, it is plagued with problems of human beings.

Higher productivity should be for the benefit of the man. The productivity movement should not be separable from the expansion of freedom and equality in man, and promotion of closer collaboration. It will lose its ground vastly if it does not aim at the realisation of justice and challenge to poverty. Being aware of it, one must have a firm belief in human progress, and a determined attitude to challenge a change in relation to the productivity movement. In this sense, the scope of the problems which the movement should tackle with will be extended in width and depth.

JPC's Goal

At the beginning of 1970, which is the Asian Productivity Year, we set the following objectives:

1. To promote the rule of equality and consultation practice between labour and management not only at company level, but also at industrial and national levels, and to establish modern labour-management relations, commensurate with technological innovation.

2. To establish an organization and administration system in an enterprise, equal to the so-called information society.

3. To introduce new management techniques from abroad and to adapt them to the social and economic environment of Japan, and further to disseminate information for the modernization of management.

4. To make small businesses play a proper role in the scene of national economy, to remove backwardness in distribution structure; and so achieve fair competition, removing the demerits of monopoly.

5. To give a new role to the productivity movement in Japan which has achieved a lot in technical exchange with advanced countries, and work for the welfare of mankind, hand in hand with the developing countries especially of Asia.

Productivity Congress

Now I like to refer to the JPC programmes for 1970 in relation to the Japan Productivity Year (JPY). As mentioned earlier, this year is the 15th anniversary of the JPC. The proposed Asian Productivity Congress will be held in Tokyo from August 18 to 22, and it will be attended by representatives of government, industry, labour unions and academic circles in the APO member-countries. The Congress will discuss about the role of productivity in economic growth, and the role of the respective bodies for the promotion of productivity. Among other programmes are the dispatch

of six Japanese top management teams to some APO member-countries, receiving study teams and trainees from Asian countries, co-operation with those countries in relation to the exchange of publications, audio-visual and other reference materials, etc. Domestically, again we will hold an assembly of those who participated in our team-sending programme which will exceed 10,000 this year. National debate meetings of labour unionists, and of young workers, have also been planned. In commemoration of JPC's 15th anniversary, there will be prize contest for a Productivity Song, Slogan and Symbol.

Apart from the programmes for JPY, the following programmes are also scheduled for 1970:

(1) Management Development programmes: 20 long-term courses, and some 300 short-term seminars, with 25,000 participants expected.

(2) Labour Education: 300 courses, with 20,000 participants expected.

(3) Consultation in about 130 small businesses.

(4) Dispatch of Study Teams: 28 teams to the U.S.A., 16 to Europe, and 4 to South-East Asia (besides APO programmes) and one to the U.S.S.R., and receiving of about 10 study teams from abroad.

(5) Research and Study on (a) how to strengthen managerial capability, (b) development of integrated accounting information system, (c) productivity statistics, and (d) value-added productivity.

(6) Publication of about 35 books and weekly newspaper (50,000 copies circulation).

(7) Audio-Visual Activity: production of slide, film, and VTR, and reproduction and sale of recorded tape, etc.

Largest Productivity Body

To promote the productivity movement in Japan, there are 8 regional centers and 14 prefectural councils throughout the country, besides the Japan Productivity Center. The number of employees of JPC is about 300, and its annual

budget is 1,600,000,000 Yens (US \$ 4,00,000). If those of the regional productivity centers and prefectural councils are all included, the number of employees will be more than 500 and the annual budget 2,100,000,000 Yens (US \$ 6,000,000), being the largest productivity body in the world.

In concluding this article, I like to summarise the characteristics of the Japanese productivity movement as follows:

1. A great many study teams were dispatched to overseas countries to study cases of increased productivity. (The number of participants is expected to exceed 10,000 by October 1970.)

2. With the successful cooperation of labour and management, the productivity movement was promoted as a national drive.

3. Special emphasis has been laid on management and labour education, with a view to modernise labour-management relations, and to innovate business administration.

4. The movement was developed as a voluntary private drive, with powerful leadership of top-level managers and labour union officials, while government subsidised a part of it.

A Wonder

It is not only a surprise to foreign countries, but also a wonder to the Japanese people themselves that the Japanese economy has achieved a rapid and smooth progress such as this, despite the fact that she had not a small obstacle to be solved. While overseas economists have given comments on our rapid progress from various points of view, my view is as stated above.

As the Indian Prime Minister, Mrs. Indira Gandhi, said recently, a great gap between countries in terms of technology and wealth would pose a tension in the world to come. She called upon the people of the world to strive together for technical progress and economic prosperity, and we, Japanese, feel that we should share our prosperity with the Asian people.

I believe that we, Japanese, should at least be a bridge between the developed and the developing countries for the cause of world peace and human happiness.

Production Planning & Control In Rourkela Steel Plant

By

NS Datar

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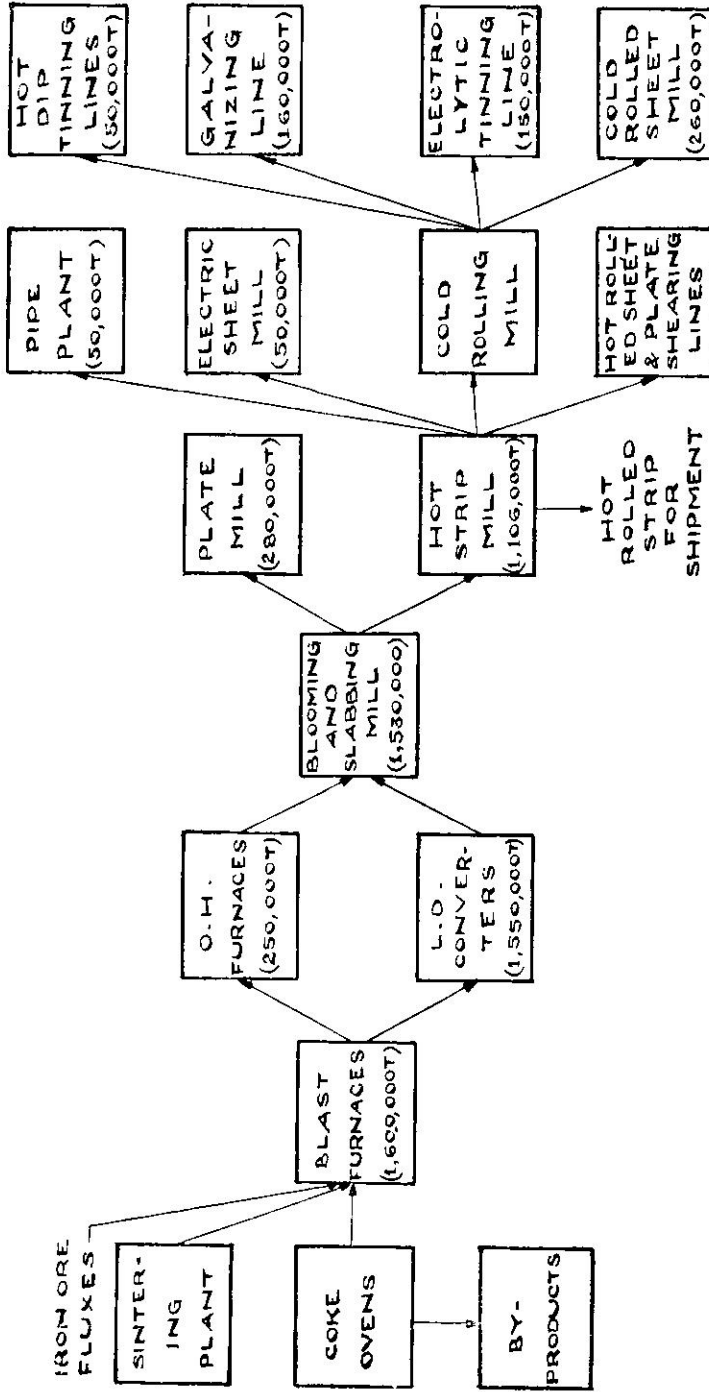
In recent years, a number of industries, including steel, have well recognised the importance of a Production Planning and Control system. The author, who describes here the working of the system in the Rourkela Steel Plant, points out that "the increased complexities and huge investment, make it necessary to have better customer-services, maximum utilisation of the equipment and investment, so that a better image can be projected. The effectiveness of a production planning and control system can be measured by comparing periodically the rupee volume produced or, in other words, the sales realisation with the capital invested in the business. A number of new techniques have been developed in recent years which may be used intelligently to exercise an effective production planning and control function. The Rourkela Steel Plant proposes to have a computer for production planning and scheduling work, as at the expansion stage it will be a most difficult task to do the job manually.

THERE are various parameters which may affect planning in a steel plant. Having a separate organization for production planning and control in a steel plant, the goals of management can be better realised, as there is always a conflict between the requests of the sales staff and the production management who would like to have long runs without much disturbance. There is always a lack of clear criteria that can be applied to clarify the inevitable Sales/Production conflicts. It is necessary, therefore, to develop such unambiguous criteria and realistic systems for providing information, so that a correct decision can be taken. The profitability angle should be the criterion for solving such conflicts.

The complexities of the planning of the flat

product mills in an integrated steel plant have been well recognized in most of the steel plants in the world. The Rourkela Steel Plant is mainly producing flat steel products, viz., plates, hot rolled sheets, cold rolled sheets, hot dip and electrolytic tin plates, galvanised sheets and electrical steel sheets. Rourkela has also a Pipe plant, producing large diameter E.R.W. pipes. The flow chart is shown in Fig. 1. Every flat product mill has to follow a certain pattern of rolling schedule which is necessary from the point of the quality of products, economics, and equipment life. The various qualities of steel for feeding in the various mills need different treatments. The lead time may vary from mill to mill. To take care of all these aspects, it is necessary to have a centralised Production Planning and Control Department which will look into the

PPC IN ROURKELA



Production Flow for Rourkela Steel Plant
Fig. 1

interest of all the mills from the organizational point of view as a whole, and supply steel of the right quality and quantity in the right time to the various mills, and maintain the optimum inventory level for the smooth functioning of the production units.

From the initial period of steel industries, planning and scheduling systems have existed in one form or another. The planning used to be done by giving a handful of operation details by the people working under the Mill Superintendents. Due importance was not given for the amount of pre-planning which was necessary and the working schedules were mostly based on intuition. Elaborate planning was not being done. In the modern days, particularly in the integrated steel plants, the activities are much more complex, the dimensions of the problems are of much higher magnitudes, and the equipments are much more costly. In view of this, for the efficient utilisation of the investment, it is very necessary to have a production planning and control system on a very sound footing. Also to have a better customer relation and to project a better image as a public sector organization, it is essential to supply the material to the customers in right time, particularly for carrying out projects of national importance.

Planning & Scheduling

The Planning and scheduling activities are done in stages identified in terms of time scale, market forecast, and the delivery requirement of the order. This is done on five-yearly, annual, quarterly, monthly, weekly, and finally daily basis. The degree of detailed working of each planning varies with the variation of time, and increases from five-yearly basis to gradually daily basis when the final execution of the orders is being done.

Long-term Planning : The production pattern for the various mills in the product categorywise is worked out on a five-yearly basis, which is again broken down into yearly basis, indicating further details. These five-yearly and annual production plans are worked out taking into account the plant's capacities,

limitations, and equipment availabilities, major shut-downs such as relining of blast furnace, the sales forecast, and the future expansion programme. In order to make this plan realistic, it is essential to have a detailed market study to evaluate realistic forecast, both in the internal as well as in the export market demand. These five-yearly and annual plans are done on the basis of long-term organisational goal; and so it is very essential to prepare such planning, taking into account the management's policies, and also the new needs of the various developing industries.

Sales forecast plays a vital role in preparing the base for such long-term plans. When the sales forecast indicates that there is an increasing trend of demand for a certain category of product, it has to be analysed whether we shall be able to meet this increasing trend of demand in the future, and, if necessary, suggest to management to create extra facilities for taking care of such needs. For example, when the steel plant was built, the facilities required for the production of killed quality steel were not envisaged. But, with the increasing complexity of the country's industrialisation, the demand for killed quality steel is increasing. Hence it has become essential to acquire certain additional facilities on a long-term basis—so-called balancing facilities—in order to effectively cater to the demands of the market, so that the imports of such materials are kept to the minimum level. Thus long-term planning is based on the present production capacities, expected development, major shut-down, and the capital repairs of long-term company policies.

The raw materials requirements are worked out on the basis of the aforesaid long-term planning. To work out the raw materials requirement, the norms for the consumption of such items are used. Also, the losses in handling and due to other reasons are also taken note of. About 40% to 50% of the total cost of a product in the steel industry is due to the raw material cost and, hence it is essential that the planing of such items as coal, iron ore and limestone are worked out very carefully. The

requirements of the Steel Mill Shop (S.M.S.), such as, the iron ore, limestone, dolomite, ferro-alloys, and other additional elements, are also worked out well in advance, so that the procurement action can be taken up in right time, and right inventories are maintained so as to protect against production loss due to shortage of such items, and also see that an undue amount of inventories are not maintained, thereby tying up a huge amount of capital.

This kind of long-term planning for raw materials helps in getting into long-term contracts with the various suppliers. This has manifold advantages, such as steady supply of material, and better bargaining position for price fixation. Such contracts may also be made with more than one supplier, so that the organisation need not be entirely dependent upon the supply of raw materials from a single agency. The long-term planning also helps in exercising a better budgetary control.

The day-to-day planning of raw materials is, however, at present entrusted to a separate agency.

Short-term Planning: The annual production plan, which has been discussed earlier, is further worked out in detail in the quarterly production plan for the various mills, for the different categories of products. While executing the orders, a certain amount of arisings are there at various stages of processing. While working out the quarterly production plan, the anticipated amount of such arisings are also worked out, and indicated to the Sales Department for procuring necessary orders for their disposal. However, this quarterly production programme does not actually meet our day-to-day requirement due to deviation taking place at various stages of processing from the planned action, and also due to the breakdowns of the machinery and other short-term maintenance/repairs, and hence this quarterly programme is again worked out into further details in the form of monthly production programme, weekly production programme, and finally daily production programme. While working out the monthly production and despatch pro-

grammes, the equipment availability and other technical limitations, the availability of orders in hand, and availability of raw materials are taken into consideration. The day-to-day planning is made on the basis of actual inventories which could be made available for processing the rush order, and other regular orders in hand, the mill conditions, etc.

Planning of Iron & Steel Group

Coke Ovens & By-products: It is necessary to maintain a steady production level in the coke ovens, despite blast furnaces having fluctuations in production or shut-downs. This is important because of the fact that apart from supplying coke for the blast furnaces, the coke-oven gas is required for the Fertilizer Plant, and also for heating purposes in the Rolling Mills and other units of the plant.

In the By-products Plant, a number of by-products are made from the cokeoven gas. The profitability for each product varies, and so the product mix is revised from time to time in order to maximise the sales realisation.

Blast Furnaces & Sintering Plant: The production target for the blast furnaces is worked out on the basis of the requirement of hot metal in the S.M.S., the handling capacity for producing pig iron out of the excess available hot metal, the inventories of pig iron, and the internal requirement, and the requirement for outside market including the export market. Technologically, it is not desirable to change the production level in the blast furnaces very often. The shutting down of blast furnaces and putting them back into operation is a very costly affair, and hence a careful analysis is to be made for taking decision on such matters well in advance. The blast furnace gas is also used for power generation purposes, and other heating purposes, after mixing with coke oven gas. When enough hot metal is not available during the time of relining of blast furnaces, the open-hearth furnaces have to operate on cold charges and as such it has its own effect on steel production, both from the quantity

and quality point of view. Hence, when the blast furnace is to be taken down for relining purpose (which will have a prolonged effect on the various units of the steel plant), careful analysis is made of all these aspects, and the management advised on making a suitable decision. The production target for the Sintering Plant is worked out as per the sinter requirement for the blast furnaces.

Steel Melting Shop: The Rourkela Plant is producing a number of qualities of steel in Indian specifications and also in some foreign specifications, for catering to the needs of the various categories of products. The S.M.S. is equipped with open hearth furnaces and LD converters. Each of these steel-making processes has its own advantages, and such advantages are exploited while processing steel from these equipments. Most of the steel for the cold-rolled and hot-rolled products produced in the Hot Strip Mill are made in LD converters, while most of the steel for boiler quality materials, killed quality specification, thicker plates, API quality steel for making E.R.W. pipes, and shipbuilding quality steel, are made from open-hearth furnaces.

The S.M.S. operates on the basis of the day-to-day steel order given to them, depending upon the requirements of the rolling mills, and other factors like processing of priority orders, etc. While ordering steel, the difficult and relatively easy specifications are ordered together as far as possible, so as to allow opportunities for absorbing the steel in the relatively easier specifications when the heat goes off the specification while attempting the difficult quality steel. Also, a close liaison is maintained with the S.M.S. and the production planning centre in the Blooming & Slabbing Mill, to take care of such off-the-schedule heats as far as possible.

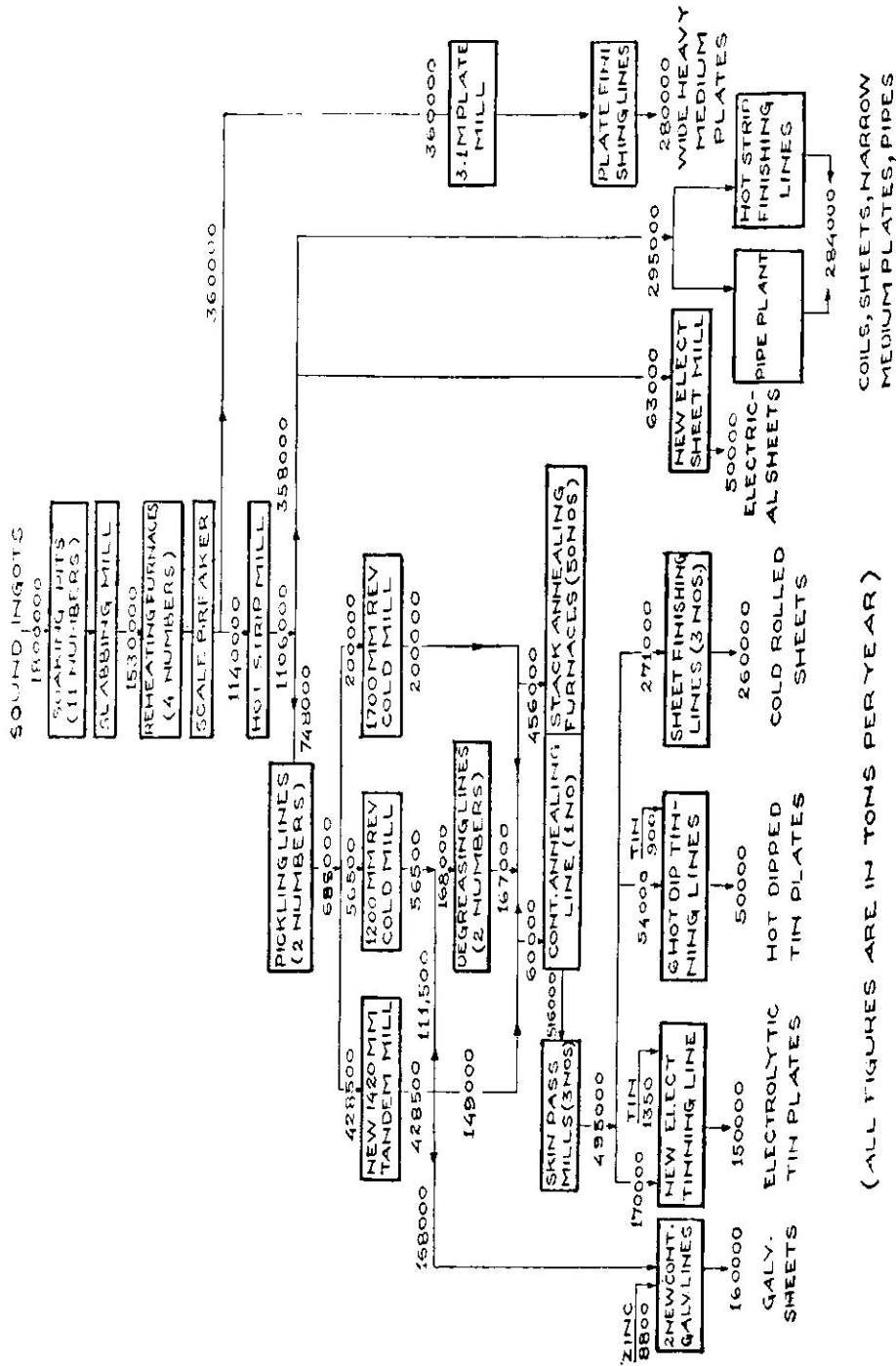
There are five different types of moulds in use for processing all different types of products. While ordering steel, it is also seen that a sufficient number of moulds are available in those particular sizes for which steel is ordered. The selection of mould sizes for processing a particular size of orders is done in such a way

as to achieve the highest productivity in the Rolling Mills, and also to achieve the maximum yield. The reduction in a number of varieties of mould sizes will help on the one hand the Steel Melting Shop, while on the other the productivity in the Rolling Mills will be affected greatly. In view of this, the varieties of moulds for use are to be determined, so as to achieve the optimum results, considering the interest of the Steel Plant as a whole.

Planning & Control in Rolling Mills

After the orders have been received from the Sales Department, the details of planning are worked out depending upon the delivery period required as per the orders. All these orders are converted into slab orders according to the qualities. The slab orders are prepared in such a way as to achieve the highest productivity in the rolling mills, and also to obtain the maximum yields and minimum losses in the process. From these slab orders, the steel requirement is worked out and finally utilised for ordering steel in the S.M.S. as discussed earlier.

The flow of materials on an yearly basis in Rolling Mills is shown in Fig 2. The steel ingots are rolled into slabs in the Blooming and Slabbing Mill. The slabs are inspected and conditioned as and when required, depending upon the qualities of the material. These are then transferred to the slab yards of the Hot Strip Mill and Plate Mill as per the orders. The daily rolling schedules are made for these mills, depending upon the mill requirements, order position, priority orders, and the stock of slabs. The rolling schedule in general is started with the wider products, gradually narrow down, and finally ends with the narrowest products for a roll change cycle. This pattern of scheduling is followed in all the flat rolling mills, starting from the hot-rolled to the cold-rolled products. It is necessary to follow this system of scheduling from the point of quality and shape of the material, roll life, and other equipment lives. In order to follow this particular pattern of schedule, it is necessary that a certain amount of inventory of slabs should



Material Flow Sheet For Rolling Mills
Fig. 2

be maintained in the slab yards, and this inventory is to be kept under rigid control.

Similarly, at every stage of subsequent processing units, certain amounts of inventories are maintained for the smooth working of these production units, depending upon their lead time and the daily rolling schedules.

Although the delivery schedule is not quoted for many of the orders, even then a number of orders are to be processed on a priority basis, like defence orders, materials for national projects, and on the basis of the priority status accorded by the Joint Plant Committee. All the orders, in particular the rush orders, are to be followed up very closely at each stage of processing. Corrective actions are to be taken for such orders which deviate from planning while executing them. There are uncertainties in many stages, like the variation of yield from ingot to slab, the rejection of slabs due to surface condition, the materials failing in testing and final inspection. All these factors, in addition to the missing identities, lead to deviation from regular planning, and hence the feed-back of information is done at various stages for taking corrective actions. The downgraded materials, which do not fit into the requirement for which the material was originally processed, usually create problems as to their suitable disposal. This is taken care of either by processing the material for stock, or by procuring orders in advance by indicating the anticipated arisings to the Sales Department. However, the market demand of such categories of products is very limited, and hence a number of times such materials are held up in stock for a long time.

For processing the export orders, the planning is done for each stage of operation in greater detail. The follow up of such orders is also done very closely. Failure to meet the delivery schedule leads to heavy penalty, and so, a close follow up of the processing of such orders is essential. Extreme care is also exercised so as not to produce in excess, and also to see that the materials are not ready much ahead of schedule, and they do not unduly

lie in stock for a long time, bringing adverse effect.

Weightment of Materials in Flow

There are a number of weigh bridges at various locations, for weighment purpose. These are located at the entryside of the plant for weighment of the incoming raw materials; at cokeovens for the weighment of coke; at blast furnaces for the weighment of hot metal; at S. M. S. for the weighment of steel; in the soaking pits for the weighment of slabs; and at various stages of semifinished processing units in the finishing mills for the weighment of loaded wagons prior to despatch. Also, there are facilities for the weighment of various types of scraps before sending to the S. M. S.

These weigh bridges serve to collect the following data regarding the operations in the steel plant :

(a) The collection of information and control on the incoming and out-going materials, for the purpose of accounting with suppliers, customers, and transporting agencies. This further serves the costing system of many units.

(b) For collecting the information and control on the in-plant material flow for accounting the individual plant units within themselves, and to find out the changes in terms of materials through processings: for example, the scrap arisings, loss of yield, and rolling and scarfing losses.

(c) Control function by determining the input materials, the processing time, and piling up of materials of semifinished and finished products, according to the weight against the various orders, and according to the various processes.

Scrap Balance

The S. M. S. requires a certain amount of scrap for making steel. It is also necessary that the S. M. S. gets the right type of scrap at the right time for steel making, to achieve higher productivity. There arise scrap materials at various stages of processing, and these scraps have market values depending upon the categories of the materials. So, from the point of view of economics, the balance of scrap has to be scrutinised from time to time, and the con-

sumption of scrap and the arisings of scrap have to be matched. If the scrap arisings fetch higher sales realisation, such scraps may have to be sold, depending upon the scrap balance of the plant. Also, if the scrap material is available at a lower price from outside sources, it may be advisable to purchase such scrap materials from the outside, and to dispose off the scrap arising from the plant to outside agencies which have a better sales realisation.

Standardization & Product Mix

In the earlier days, hundreds of sizes of plates and hot and cold rolled sheets used to be produced in the Rourkela Steel Plant. This created a lot of problems with regard to the processing of such materials, and the disposal of the residual production. Under such circumstances, meeting the delivery schedule and keeping track of such materials at every stage of processing becomes extremely difficult. In view of this, variety reduction and standardisation of the products have been done. This has resulted in manifold advantages. Orders can be processed in bulk, right from the steel-making stage to the finishing stage, by combining the requirement of the various customers for similar products. Thus, the processing time is also reduced, since the processing equipments can be set for processing a larger quantum of material at a time. There is also a flexibility of diverting the material processed for one order to another order, depending upon the need. Due to this flexibility, the delivery period can be shortened, and also this facilitates the working of the shipping department. Inventories at various levels are also reduced.

After the standardisation of products, steps have been taken to determine a suitable product mix. The various factors affecting the cost of production have been identified, and efforts made for cost reduction. To processes some categories of products, additional processing has to be done, and there are extra losses in material, time and production, additional use of consumables, etc. and these involve additional cost. Such areas have been brought out for

revising the extra charges for these additional work. Taking all these factors into consideration, a suitable product mix has been worked out for the various mills in order to have maximum sales realisation and equipment utilisation.

Scope of Development

Computerisation of Production Planning and Control system : In the last few years, developments have taken place all over the world to computerise the various operations. In most of the steel plants in other countries, the production planning and control system has been fruitfully computerised. In the production planning and control department, computers can be used for making annual long-term forecasts, based on the plant capacity and the market demand. In day-to-day planning also, it can be used for putting out detailed work schedules for different mills of the plant. In this particular case, the computer is fed with the details of orders against the particular category of steel, and the computer is pre-programmed in respect of plant capacity and limitations of production, particularly dimensions, sizes and categories of products. In addition, the computer is fed with the preferred sequence of processing and other planning details, so that when the inputs with regard to the steel and slab availability are put, the rolling schedules can be obtained. After feeding the above inputs, the computer can be asked to calculate the delivery dates, the position or the status of any ingot or slab. It will thus be possible to maintain an up-to-date record of the progress of each order from the slab stage to the finished product stage, and to give prompt replies to queries in respect of despatches or the balance position of a particular order. The information needed right from steel-making to the finished product, at all stages, can be obtained, and this can be used whenever deviations occur, to bring out a better rolling schedule as well as for using the diverted steel to the best possible advantage of the company.

In the future, the Rourkela Steel Plant may also have a computer for the production planning and scheduling work. The optimi-

sation problems of production planning can best be solved by having a computer to do the jobs. At the expansion stage, as well as for future expansions, it will be most difficult to do the job manually, and to take actions and decisions right at the stage something happens, instead of doing the postmortem and taking such remedial measures for the future only.

The cost involved for hiring a computer can be set against the savings which can be achieved by reducing the inter-processing inventories, maximising the uses of equipment capacities of the plant, and also by winning the goodwill of the customers for the prompt delivery of orders.

Variety Reduction for Steel Quality: Presently, a large number of qualities of steel are being produced to meet the various customer's requirements. The differences in the properties of materials required for manufacturing the end products are not always far off, and in many cases, the properties required for the end uses of the material are overlapping. This shows that there is a scope for variety reduction as far as the qualities are concerned, and the steel plant may have its own codes covering a group of specifications according to manufacturing processes and the end use requirements of the materials. However, the variability cannot be exploited without proper codification and standardisation of steel-making practices.

Delivery Schedule : The flourishing of the business depends largely on customer relationships, and the ability to meet the delivery schedules for the orders. It is important to quote a realistic delivery schedule.

If it prolongs, the business of the company goes down in the competitive market. A shorter delivery period, although advantageous for increasing the business, runs the risk of not being able to meet the delivery schedule also, which has an adverse effect in the com-

petitive market, and hence it is very essential to determine the realistic delivery schedule which will strike the optimum between the opposite forces.

Steel industry being a key industry, it is important to meet the delivery schedule not only from the point of view of maintaining better customer relationship, but also from the point of view of national economy. If the customers can rely upon the quoted delivery schedule, they can maintain lower inventories in their organisations without running the risk of shortage of material. Steel being a costly item, a high amount of working capital will have to be blocked up in their end for maintaining a high amount of inventories if the material availability position is uncertain. Hence in the interest of the national economy, it is essential to work out a realistic delivery schedule. A computer can be used gainfully not only for the working out of a realistic delivery schedule, but also for the proper follow-up of the material, and to derive the other advantages as discussed earlier.

Conclusion

The importance of a Production Planning and Control system has been well recognised in the steel industries. The Rourkela Steel Plant has already such a system which is being followed for production planning and control, as discussed above. The increased competitiveness, complexities, and huge investment, make it necessary to have better customer services, maximum utilisation of the equipment and investment, so that a better image can be projected. The effectiveness of a production planning & control system can be measured by comparing, periodically the rupee volume produced or in other words, the sales realisation, with the capital invested in business. A number of new techniques have been developed in recent years, which may be used intelligently to exercise an effective production planning and control function.

PRODUCTIVITY IS EVERYBODY'S BUSINESS

Management Trainee Selection Test Battery

By

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This paper describes the development of the Management Trainee Selection Test Battery used for selecting students at the Indian Institute of Management, Calcutta, and also the follow-up study for this group. Leading organisations have evinced interest regarding the type of tests used, and their validity, etc., and this study may meet a felt need in the field of industrial and management training. The Institute selects students for their two-year Post-Graduate Training Programme in Management on the basis of four variables, viz., Educational Qualification, Personal Factors, Interview Evaluation, and Selection Tests. The predictive validity of these variables were studied by considering a group of 57 students selected in a particular year, and the authors conclude that "the selection test scores, though not able to predict success in a few subjects covered, have fairly high ability to predict the remaining ones."

THE Indian Institute of Management, Calcutta, has been conducting a post-graduate programme in management for young graduates, since 1961. This training course aims at providing "the rapidly growing need of private industries and government for managerial manpower through the provision of well-designed and well-directed programmes of professional education."¹ The number of applicants for admission being quite large, and the seats being limited, it was necessary to develop an efficient screening device and select only those who were really suitable. In this work of developing a suitable selection procedure, the Psychometry Unit of the Indian Statistical Institute helped the IIM, and the present study was undertaken to evaluate the efficiency of the selection tests which were developed in this connection.

Selection Procedure

At the outset, we shall give a brief description of the selection procedure:

The selection procedure took into consideration different types of information about each prospective candidate in addition to considering his performance in the selection test.

(a) *Educational Qualification*: On the basis of educational qualification, each candidate is given a mark whose maximum limit is 100. Of these 100 marks, 20 marks are meant for his performance in the Higher Secondary or its equivalent examination. A candidate who has passed this examination in the third division gets a score of 5, in second division a score of 10, and in first division a score of 20. Sixty marks are reserved for the Bachelor's Degree, and the remaining 20 for qualifications above Bachelor's Degree.

(b) *Personal Factor*: This includes such aspects as age, recommendations (from three persons), work experience, proficiency in English, and compatibility of the candidate's career-goal with the objectives of the training.

The maximum marks a candidate can earn in this is also 100 as in the earlier cases.

(c) *Interview Evaluation*: This evaluation is based on the marks independently given by members of the interview board. The number of members is usually five. Here also the maximum possible marks that a candidate can get is 100.

(d) *Selection Tests*: The tests are objective in nature, and the scores obtained by the candidate on different tests of the battery are converted into stanine grades. A composite stanine grade is also obtained by suitably combining the scores on different tests.

Development of Selection Test Battery

In 1964, objective tests were introduced for the first time while selecting the candidates for the Post-Graduate Programme of the IIM. A battery of tests in which Mathematical Comprehension and Graph & Table Reading (constructed by the authors) were included, was administered to the group of applicants. For certain reasons, the validity study of this selection could not be done by the authors. Since 1965, both the authors have been revising and developing the selection test battery for this training course of the IIM.

An examination of various tests of foreign origin and of candidate's manual of tests used for similar purposes indicated that these two tests, viz., Mathematical Comprehension, and Graph & Table Reading might be of value. On the basis of this information, and ideas gathered from several days of discussion with the concerned teaching staff of the Institute, a decision was taken about the nature of the tests to be included in the battery. Accordingly the two tests referred to remained, and, in addition, several other tests were constructed, and this battery of tests was used to select the candidates for admission to the course in 1965. A brief description of the tests included in this battery is given below.

Breadth of Knowledge: This was a test of General Knowledge, though not of the usual type. It required

broad understanding and knowledge of various things which any educated and cultured person was expected to know. The students of this training course were expected to deal with various types of persons in their future career, and hence broad general knowledge was expected to be an asset in establishing interpersonal relations. This test contained 38 items, and was to be answered in 30 minutes.

English Knowledge & Comprehension: The selected candidates were going to have English as the medium of instruction in the training course, and hence those with good command of English language would naturally have an added benefit. Moreover, it has been empirically found in several other studies and the ability to understand written English is a good predictor of success in different training courses. So, such a test was included in the battery. This test contained 66 items, and the total time allowed was 60 minutes.

Mathematics: Mathematics was one of the major subjects taught during the training period. Some of the candidates had little background knowledge in mathematics, while there were several candidates with good knowledge in this field. The institution concerned had decided to make up this deficiency in the case of those selected from the former group during the training course. Naturally, instead of testing the knowledge in the field of mathematics, it decided that mathematical comprehension of the candidates be tested. Thus, even those who had little background in the subject earlier, but had adequate aptitude in this direction, should be able to earn good marks in this test. The test contained 25 items, and the total time allowed was 60 minutes.

Graph & Table Reading: This test was intended to measure the candidate's ability to read and interpret the data presented in a tabular or graphical form. Some of the subjects covered in this course required such ability on the part of the students. Moreover, the position which these students were expected to occupy in future would also require an understanding and interpretation of data presented in graphical or tabular form. The total time allowed was 60 minutes, and the number of items in the test was 29.

Quantitative & Verbal Reasoning: To measure the General Ability, both of the Verbal and Numerical types, these two tests were used. These tests contained 24 and 30 items, and the total time limits were 20 minutes and 25 minutes respectively. Of this test, Part I was Verbal Reasoning and Part II was Quantitative Reasoning.

Biographical Questionnaire & Interest Attitude Check List: In addition to the above tests, a Biographical Questionnaire along with an Interest-Attitude Check List was used before the administration of the aptitude tests, primarily with the idea of settling the candidates before they started the actual test.

Administration of Tests (1965)

The battery of tests was administered on the same day and, at the same time, at eleven different centres in India. To do away with the advantage that a few candidates might have over the rest on account of familiarity with the objective type of tests, a manual was sent to each candidate explaining the nature of the test, the types of questions to be used in the tests, and the manner in which these questions were to be answered by them.

As the tests were administered at different centres, it was important to maintain uniformity in the testing procedures at all the places. Scores of candidates from different centres could be compared only if the same schedule was followed, and the same type of instructions were given to the candidates at the various centres. Hence, a manual was written for the supervisors, which discussed the supervisor's duty, including what instructions he had to give to the candidates during the test.

Scoring

As the items included in the tests were of the multiple-choice type, it was possible for a candidate to hit the correct answer to some of the questions by choosing the alternatives suggested at random, even if he did not actually know the correct answer. So, there was the need for correcting the "right" score (i.e., the total number of correct responses given by the candidates) for guessing, and the correction formula using the omission score (i.e., the total number of items omitted by the candidate) was employed.

These scores were then converted to stanine grades, and a composite stanine was also obtained by adding the individual test stanines. It may be mentioned here that the stanine grades range from 1 (Low) to 9 (High). These grades are obtained by dividing the raw score distribution into nine parts, so that, on the basis of the normal probability curve, the corresponding areas assure equal intervals.

As stated earlier, the students were selected on the basis of the scores obtained by them on

the four factors, viz., Educational Qualification, Personal Factor, Interview Evaluation, and Selection Test scores. Thus about 60 students were admitted to the course out of 1058 applicants in 1965.

Analysis of Selection Test Scores

To find out the predictive ability of the selection test battery, suitability of the tests for the group concerned and other relevant statistics pertaining to the nature of the tests used, it was decided to find out the means, standard deviations, and intercorrelations among the tests, in addition to finding out the relationships between the selection test scores and class performance as indicated by the examination marks obtained by the selected students during the training period.

In 1965, the number of candidates who took the admission tests was 1058. Instead of considering the entire data, 200 of the 1058 cases were selected at random, and the means, etc., were calculated as indicated above. The obtained values are presented in Table I.

Examining the figures presented in Table I, it appears that the test of Mathematical Comprehension was a bit easy for the group, whereas the tests of Verbal Reasoning and Graph and Table Reading were relatively difficult. The other three tests were of average difficulty. The standard deviation of the tests indicated that the ranges of distribution of the scores were adequate from the point of selection. The obtained reliability values, which are presented in Table I are fairly high.

Item Analysis : In order to determine the nature of the items included in the tests, and to find out whether further improvements could be brought about in the individual tests, item analyses were done for all the selection battery. For this purpose, 370 cases were selected at random from the total available 1058 cases, and by using the upper and lower 27% of this group (i.e., 100 cases in each group), the difficulty level and the discriminating ability of the test items were estimated. The abac developed by Harper² was used in

TABLE I

Intercorrelations, means, standard deviations, maximum possible scores etc., for the selection tests used in 1965 (based on 240 cases)

N=200	Math.	EKC	QR	VR	GTR	B.K.
Math.	—	.37**	.60**	.37**	.48**	.25**
English Know. & Comp.	.37**	—	.10	.45**	.35**	.07
Quantitative Reasoning	.60**	.10	—	.46**	.39**	.27**
Verbal Reasoning	.27**	.45**	.46**	—	.33**	.37**
Graph & Table Reading	.48**	.35**	.39**	.33**	—	.22**
Breadth of Knowledge	.25*	.07	.27**	.37**	.22**	—
Mean	16.47	31.17	14.77	11.19	10.09	19.92
Standard Deviation	5.12	8.51	5.13	3.67	4.50	4.70
Reliability	.82	.78	.74	.58	.70	.59
Max. Possible Score	25	66	30	24	29	38

* & ** indicates significant at the 5% and 1% levels respectively.

this connection. The distributions of the obtained difficulty and discrimination values are presented in Table II.

items would have to be either dropped out or replaced by modified items.

Predictive Ability of Selection Test Scores

Before discussing the validity of the tests, it is necessary to give some idea regarding the criterion against which the tests were to be validated.

Brief description of the course : The duration of this training course is two years, and each academic year is divided into three terms. At the end of each term, the performance of the students is evaluated for each of the subjects taught. During this period, the following subjects are dealt with. In the first year, the subjects covered are (a) Mathematics, (b) Statistics, (c) Behavioural Sciences, (d) Finance, (e) Financial Accounting, (f) Economics, (g) Organisation & Administration

Examination of the figures in Table II indicates that the items in the mathematics test were relatively easy, and at the same time had high discrimination values. The range of distribution of the discrimination values was short for the two tests, viz., Breadth of Knowledge and English Knowledge Comprehension, in comparison to those of the remaining tests. From the distribution of the discrimination values of Graph & Table Reading, it seems that the items were quite difficult for the groups, as in only 38% of the items the difficulty values were 50 or above. It was observed that if the items with discrimination values equal to or above 20 were retained in the revised version of the tests, then only about 28% of all the

(h) Operational Research (i) Production Management (j) Marketing, and (k) Personnel & Union Management Relations. In the second year, the following subjects are taught: (a) Management Policy, (b) Social & Economic History of Modern India, (c) Indian Legal System, (d) Business & Government, (e) Two Optional Subjects for specialisation or a thesis.

Method of Grading and Subject Evaluation: In connection with the evaluation, "the factors to be weighed by the faculty members in-charge of the subjects may include examination results, research papers, performance in semi-

nars and group discussions, and any other means appropriate to the subject.

The objectives of the evaluation are to inform the student of the extent to which his work meets the required standards of performance, to enable the members of the faculty to determine where an individual student needs assistance, and to provide a record of achievement which will be considered with the student's performance in the comprehensive examination for the purpose of award of the diploma."¹

The grade given to each subject ranges from Superior to Unsatisfactory performance,

TABLE II
Distribution of difficulty & discrimination values for the items included in different tests of the selection test battery used

Test Range	Math.		B. K.		EKC		QR		VR		GTR	
	D*	D**	D*	D**	D*	D**	D*	D**	D*	D**	D*	D**
15 and below	..	..	1	7	..	16	1	2	..	4	3	9
16—20	..	..	..	4	..	11	2	1	..	2	2	3
21—25	..	..	..	10	1	9	2	2	..	3	3	2
26—30	..	3	4	10	2	12	1	3	..	..	4	3
31—35	..	2	..	2	8	11	2	2	2	3	4	5
36—40	1	4	4	5	11	3	1	3	3	2	1	1
41—45	..	4	3	..	12	4	3	4	6	1	2	3
46—50	5	3	8	..	10	..	6	4	5	1	4	1
51—55	3	2	5	..	6	..	4	5	2	2	2	2
56—60	6	4	6	..	9	..	3	4	3	3	3	..
61—65	6	2	1	..	5	..	2	..	1	2	..	..
66—70	3	..	4	..	1	..	3	..	2	..	1	..
70 and above	1	1	2	..	1	..	..	..	..	1	1	..

*Difficulty

**Discrimination

which is expressed in the nine points from 1 (Low) to 9 (High). "The total grade points earned for the term, and cumulatively, will be the sum of the products of the number of credit hours for each subject multiplied by the number of grade points earned for that subject."¹

Reliability of Criterion: One of the most essential factors in the validity data is the reliability of the criterion itself. Unless the criterion is a reliable or stable one, even high validity coefficient would be quite useless as an index of predictive ability of the test battery. If the criterion itself undergoes change from time to time, the fact that the test proved to be a valid measure on one occasion would be no guarantee of its serving so on a future occasion.

It is already stated that there are six terminal examinations during the two academic years, over which the course is spread. To

start with, the intercorrelations among the six grade-point averages obtained in these six examinations were calculated, and these might be considered as estimates of the reliability of the criterion scores. If the six-grade-point averages vary too much among themselves, then it would be difficult to get a battery of tests which would predict all of them accurately. Obtained intercorrelations are presented in Table III. The correlations of the six grade-point averages with the final cumulative grade-point average are also presented in the table.

From the obtained values presented in Table III it can be concluded that a fair degree of correlations existed among the terminal examinations i.e., the GPA's.

Further scrutinising the nature of the examinations revealed that for some of the subjects two sets of examination marks were available. Hence, in order to obtain the reliability of

TABLE III

Intercorrelations among the six grade-point averages and the cumulative grade-point average (N=50)

Grade Point Average	T E R M S						Final C G P A
	1st	2nd	3rd	4th	5th	6th	
1st Term	....	.57**	.56**	.58**	.28*	.23	.73**
2nd Term	.57**	....	.46**	.61**	.46**	.57**	.61**
3rd Term	.56**	.46**	....	.63**	.23	-.02	.66**
4th Term	.58**	.61**	.63**	....	.40**	.33*	.67**
5th Term	.28*	.46**	.23	.40**	....	.47**	.55**
6th Term	.23	.57**	-.02	.33**	.47**	....	.39**
Final CGPA	.73**	.61**	.66**	.67**	.55**	.39**	....

*indicates significant at the 5% level.

**indicates significant at the 1% level.

different subjects, the correlations between these two sets of scores were calculated, and these values are presented in Table IV. Two sets of examination marks were not available for other subjects, and hence such correlation could not be calculated for them.

The figures in Table IV show that the correlations between the two sets of scores for the three subjects were not sufficiently high.

Validity of the Selection Test Battery : To begin with, it was decided to find out the relationship between the terminal GPA's and different selection tests.

Correlation Coefficients Between the Terminal GPA's and Selection Tests : Here the grade-point average and the cumulative grade-point average earned by the candidates were considered as criteria. In addition to finding out the relation of the test scores with these criteria, other variables influencing the selection, viz., (a) Educational Qualification, (b) Personal Factor and (c) Interview Evaluation were also taken into account, and their predictive abilities with reference to future performance during the course were also studied. The obtained correlation coefficients are presented in Table V.

It may be seen from the figures in Table V that among the selection tests Verbal Reasoning, Quantitative Reasoning, Graph & Table Reading had fairly high predictive ability, while the

corresponding correlations with Mathematics and Breadth of Knowledge were all insignificant. Though English Knowledge and Comprehension Test failed to predict the GPA's (except 6th Term GPA), yet was significantly correlated with the final cumulative grade-point average. With respect to the other variables considered in selection, it can be seen that Educational Qualification and Personal factors were significantly correlated with some of the GPA's, but for Interview Evaluation none of the correlations was significant. It should be mentioned here that though Interview Evaluation ratings and scores on the Breadth of Knowledge test were not related with the GPA's, yet it would not be advisable to scrap away these two variables as these may turn out to be more effective in determining future success in life when these students would be called upon to deal with people effectively. The criterion available and used here was concerned with academic success only, but success in later life for these candidates would require something more than academic brightness. If some follow-up study could be done beyond the academic years in terms of positions occupied, satisfaction in job situation, etc., then the results would be more interesting and useful too. It is already stated that the test of mathematics was quite easy for the group, hence it is natural that it would not be able to predict the GPA's sufficiently accurately, because most of the selected candidates got equal marks in this test. So, while revising the test, it should be made more difficult, so that its discriminating ability is increased.

TABLE IV

Correlations between two available sets of examination marks for subjects that had two sets of marks available (N=54)

Correlation	S U B J E C T S		
	Mathematics	Statistics	Economics
	.42**	.44**	.26*

*indicates significant at the 5% level
**indicates significant at the 1% level

TABLE V
Correlation coefficients obtained among the six GPA's and each of the selection tests and other factors considered for selection (N=50)

Test & other Factors	GRADE-POINT AVERAGES						Final
	1st	2nd	3rd	4th	5th	6th	C G P A
Educ. Qual.	.21	.26*	.12	.26*	.03	.14	.09
Pers. Factor	.18	.15	.09	.30*	-.09	.13	.26*
Interview Eval.	.22	.10	.01	.17	.11	.08	.15
Math. Compre.	.20	.06	.17	.07	-.05	-.03	.12
Breadth of Know.	-.01	-.25	-.09	-.09	.01	-.09	-.04
Eng. Know. Comp.	.09	.22	.09	.09	.04	.35**	.35**
Quant. Reason.	.33*	.24	.25	.21	.30*	.26*	.39**
Verbal Reasoning.	.25	.20	.34*	.20	.34*	.15	.49**
Graph & Table	.23	.11	.40**	.19	-.10	-.20	.25

*indicates significant at the 5% level.

**indicates significant at the 1% level.

Validity of the Tests Against Different Subjects Taught During the Entire Training Period : Next, the correlations among different subjects taught in the course and the selection tests were computed. As stated earlier, in the first four terms there are several common subjects for all the trainees, but in the last two terms only the special subjects are tested. So the common subjects included in the first four terms only were considered. These values are presented in Table VI.

From Table VI it is clear that the correlations among different subjects and the selection tests were not equal. Among the selection tests GTR had the maximum number of positive significant validity coefficients. Quantitative Reasoning was the test which had the next highest positive and significant validity coefficients, and was followed by Mathematics and Verbal Reasoning. None of the obtained correlations for the English Comprehension

test was statistically significant. It is interesting to note that for the Breadth of Knowledge test all the obtained validity coefficients were negative, and some of them were statistically significant.

It can also be concluded for the figures corresponding to subjects like "Indian Legal System", "Organisation and Administration", and "Marketing" that some new tests were to be added to the battery for predicting future performance in these subjects.

In order to investigate the predictive ability of the other three factors, viz., Educational Qualifications, Personal Factor, and Interview Evaluation, the same procedure was followed, and the correlation coefficients thus obtained with different subjects are presented in the lower three rows of Table VI.

An examination of the figures in Table VI indicates that for the following subjects, viz.,

MANAGEMENT TRAINEE SELECTION

TABLE VI
Showing the correlation coefficients of the selection tests and other factors considered at the time of admission, with different subjects taught in different terms during the two-year course

Selection Tests	Subjects taught in 1st Term N=57			Subjects taught in 2nd Term N=54				Subjects taught in 3rd Term N=54			Subjects taught in 4th Term N=52			
	Math.	Stat.	Econ.	Incl- Beha. Rel. Scin.	Math.	Stat. II	Org. & Admns.	Fin. Acc.	Econ.	Oper. Res.	Mark- citing Acc.	Mang Poli.	Soc. & Eco. History	
Mathematics	.61**	.53	.32	.07 .00	.38**	.09	-.08	-.01	-.01	.23	-.26	.03	-.01	.00
Breadth of Knowledge	-.08	-.05	-.14	-.12 .02	-.36**	-.41**	-.22	-.48**	-.38**	-.16	-.05	-.11	-.32	-.25
English Comprehension	.17	.19	.14	.05 .19	-.08	.00	.24	-.16	-.06	.09	.03	.18	-.10	-.03
Quantitative Reasoning	.27*	.35**	.16	.15 .16	.15	.33**	.13	.07	.04	.15	.06	.17	.31*	.27*
Verbal Reasoning	.18	.32*	.10	.13 .34*	.07	.31*	.23	.16	.22	.25	.18	.34*	.10	.12
Graph & Table Reading	.42**	.56**	.18	.11 .44**	.32*	.31*	.03	.30*	.07	.32*	.14	.33*	.17	.19
Educational Qualification	.27*	.27*	.40**	.02 .18	.08	.23	-.05	.33**	.29*	.22	.16	.14	.36**	.33*
Personal Factor	.19	.22	.18	.07 .26*	-.03	.06	.09	.26*	.00	.21	.32*	.26*	.03	.08
Interview Evaluation	-.39**	.35**	.11	.00 .20	-.10	-.02	.12	-.12	-.15	-.12	.10	-.05	-.14	.00

*indicate significant at the 5% level

**indicates significant at the 1% level

Mathematics, Statistics, Behavioural Sciences, Operation Research, and Management Accounting, one or other of the selection tests were able to predict performance, and the obtained validity coefficients were statistically significant, and that the prediction was more accurate than that obtained by using any one of the other factors, viz., Educational Qualification, Personal Factor, and Interview Evaluation considered for admission purposes, in addition to the selection test scores. For Economics, the predictive ability of "Educational Qualification" was better than that of the selection test scores. Of these three other factors considered, it could be generally said that Educational Qualification and Personal Factor were related to success with some of the subjects taught, whereas Interview Evaluation, as observed earlier, was not able to predict any one. Success in subjects like Marketing, Management Policy, and Social & Economic History could not be predicted on the basis of the selection test scores, whereas they were positively and significantly related to Educational Qualification. The coefficients obtained against Personal factor were, however, significant at the 5% level for four of the subjects, viz., Behavioural Sciences, Financial Accounting, Marketing, and Management Accounting. The Indian Legal System was the only subject which was related neither to the selection tests nor to the other three factors. Hence, from the point of view of further improving the selection test battery, some new tests which could be able to predict success in subjects like Economics, Operation Research and Indian Legal System may be included in the battery, and for this purpose some exploratory study is required. The results obtained from further follow-up studies based on the revised version of these tests would be reported in due course. It should be kept in mind that these validity coefficients are based on a small section of the group of students tested, and due to this restriction of range the obtained values would be lower than the actually existing relationship.

Development of the Regression Equation for Maximising Prediction of Future Success :

Finally, it was decided to investigate the nature of the regression equations which could be used to predict the grade-point averages or the cumulative grade-point average on the basis of the selection test scores. Instead of considering the six grade points separately, the following three criteria were obtained by combining them. The final cumulative grade-point average was also separately considered. Thus there were four criteria, viz.,

- Criterion I : Average of the grade points earned in the first three terms.
- Criterion II : Average of the grade points earned in the last three terms.
- Criterion III : Average of the grade points earned in all the six terms during the two-year period.
- Criterion IV : The final cumulative grade-point average.

The predictor variables, i.e., the factors considered during selection were first divided into two groups. The first group consisted of the three factors other than the selection test scores, whereas the six selection test scores were put in the second group.

Regression equations and corresponding multiple correlation coefficients were calculated with the four criteria mentioned above. The two groups of predictor variables were considered together and separately in this connection. The obtained regression coefficients and the corresponding multiple correlations are presented in Table VII.

It was found from the figures presented in Table VII that the multiple correlations were all significant when the predictor variables contained the selection tests. The other three selection factors failed to predict the success in the training course when considered separately (as all such multiple correlations were insignificant), and the increases in the multiple

TABLE VII
 Showing the regression coefficients, multiple correlations of the predicted variables against the four criteria used for the group of students selected in 1965

Variable	Criterion I (N=54)		Criterion II (N=54)		Criterion III (N=54)		Criterion IV (N=50)	
	First 3 Var.	Next 6 All 9 Var.	First 3 Var.	Next 6 All 9 Var.	First 3 Var.	Next 6 All 9 Var.	First 3 Var.	Next 6 All 9 Var.
1. Educational Qualification	.130	.129	.097	.071	.112	.092	.271	.550
2. Personal Factor	.035	-.001	-.035	-.033	-.035	-.049	.387	.201
3. Interview Evaluation	.002	.003	-.006	-.013	-.014	-.010	.039	.034
4. Mathematical Comprehension	.004	.004	.002	.001	.002	.001	.000	.003
5. Breadth of Knowledge	.002	-.012	-.011	-.005	-.004	-.009	.000	-.081
6. English Knowledge & Comprehension	.002	.003	-.006	-.003	.002	.000	.041	.034
7. Quantitative Reasoning	.002	.000	.007	.006	.007	.005	.022	.013
8. Verbal Reasoning	.009	.011	.018	.018	.017	.017	.089	.103
9. Graph & Table Reading	.011	.010	.006	.004	.006	.005	.021	.020
Alpha	40.819	35.576	19.638	76.744	38.449	51.719	68.529	35.263
Multiple Correlation	.34	.62**	.67**	.35	.54*	.59*	.34	.55*
Variable with Max. Predictive Value	.30(1)	.41(9)	.41(9)	.30(3)	.40(8)	.40(8)	.26(3)	.41(8)
	*	**	**	*	**	**	*	**
								.65**
								.49(8)
								**

*indicates significant at the 5% level

**indicates significant at the 1% level

correlations by adding these three factors to the selection tests were also statistically not significant. This shows that the precision of the prediction was not increased by considering the three factors along with the selection tests. The multiple correlation was highest when the criterion was the final cumulative grade-point average, and this was desirable. Again, the prediction of the first-year grade-point average was more accurate than that of the second year as indicated by the values of the obtained multiple correlations. It can be further observed that except for the first three terms' GPA's, the test of Verbal Reasoning had the maximum correlation with the criterion. But no definite conclusion should be drawn on the basis of this result, as these were obtained with a single group of trainees.

Unless the consistency of the obtained results is proved by analysing the data based on several successive groups, no major conclusion should be taken.

So, it can be concluded that the selection test scores, though not able to predict success in a few subjects covered, have fairly high ability to predict the remaining ones. Moreover, these scores alone have more predictive ability than the other three factors considered for selecting the candidates, including Educational Qualification.

The test battery is being improved each year on the basis of item analysis, etc., and it is expected that the predictive ability of the selection battery for the subsequent selections would further improve.

Computerisation of Inventory Control Suggested

In an average industry the cost of materials is as high as 55%. Any economy in this field, therefore, gives a major gain in the whole economic yield of the organisation. Economy in materials can be achieved by: (1) reduction in purchase cost; i.e. every purchase must be—(i) of the right quality, (ii) of the right quantity, (iii) for the right price, (iv) at the right time, and (v) from the right source. (2) Reduction in inventory: The efficiency of any commercial undertaking is assessed by the rate of return the company earns on the total capital investment—(i) Reduction in inventory itself will reduce the denominator as it will reduce the capital lock-up, (ii) Reduction in the inventory will increase numerator as the inventory carrying charges are reduced. These charges comprise of (a) interest on the capital, (b) insurance, (c) storage and handling, (d) loss due to pilferage, spillage or deterioration, (e) loss due to obsolescence,—and amount to about 15% of the cost of materials. (3) If (a) the rate of consumption remains always constant; (b) the suppliers deliver the materials according to the scheduled deliveries; and (c) there are no rejections.

In pointing out the above, Mr. P.G. Patankar, Controller of Stores, B.E.S.&T. Undertaking, Bombay, has, in an article in *IBM Report*, stated that India, where manpower must be predominantly used, can have computerisation on a selective basis in areas of overwhelming public interest—in areas where mere use of manpower cannot produce desired results in a desired time-limit. The field of inventory control is such where manual efforts produce either too little information and always too late, and after the event. Computer, therefore, comes very handy in this field.

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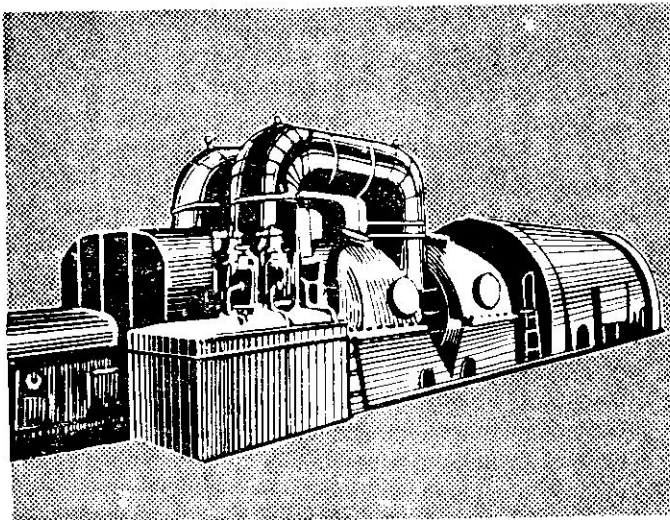
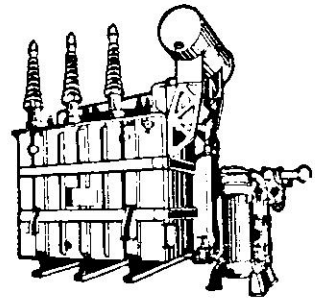
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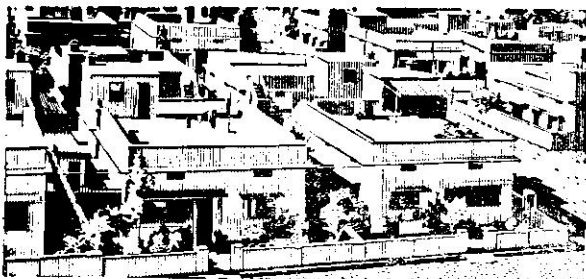
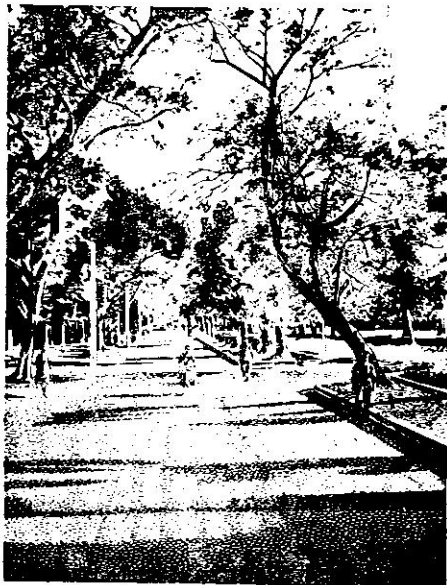
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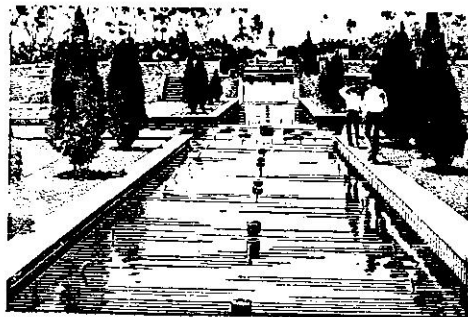
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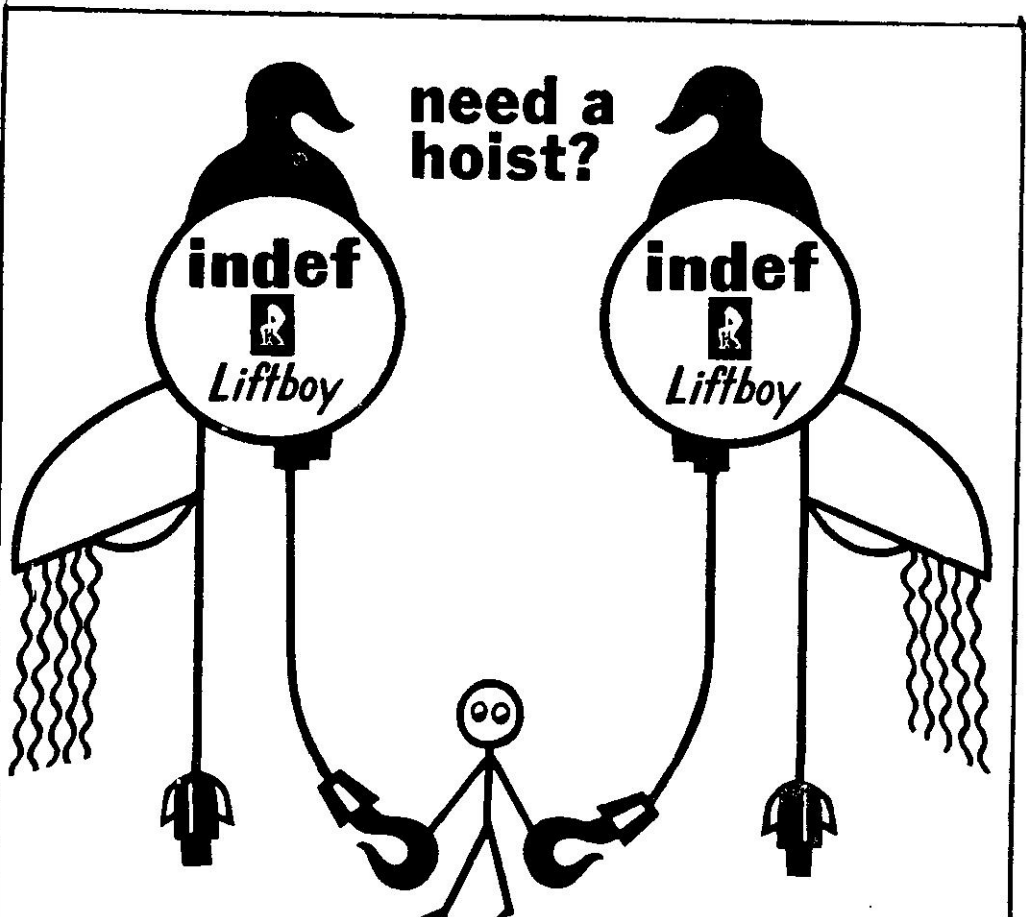
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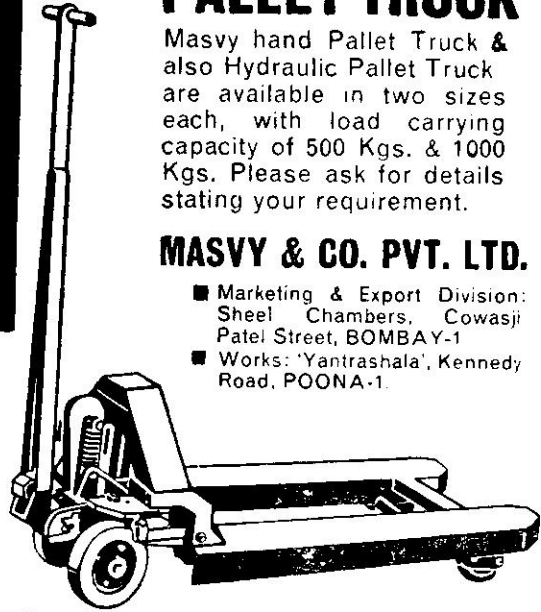
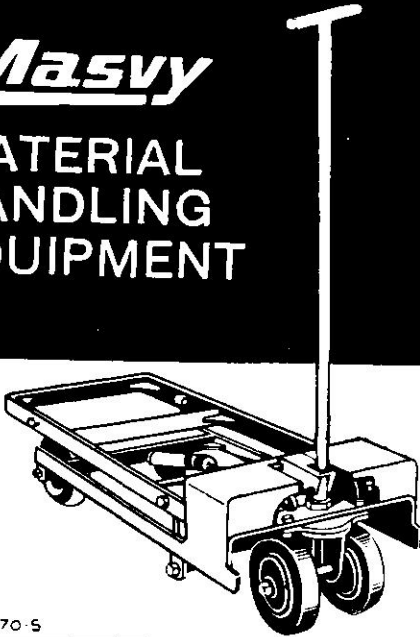
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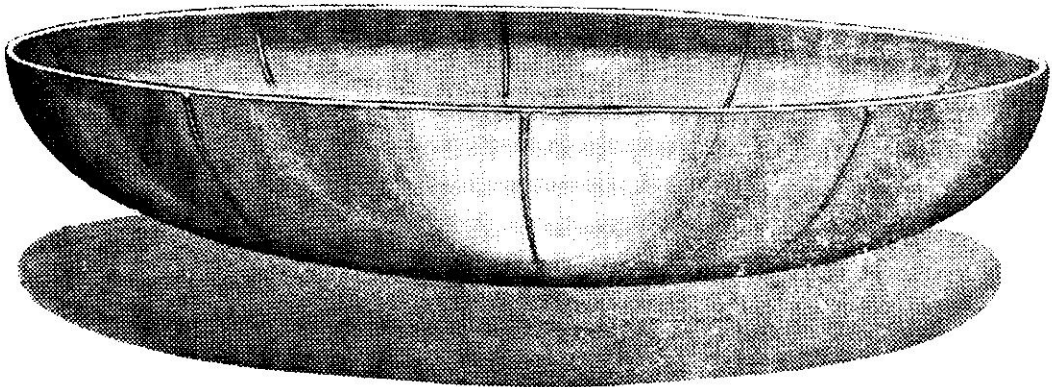
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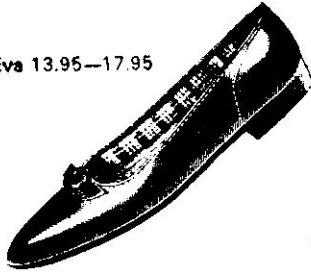


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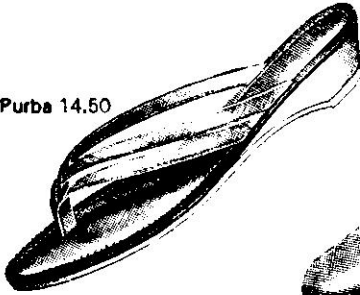


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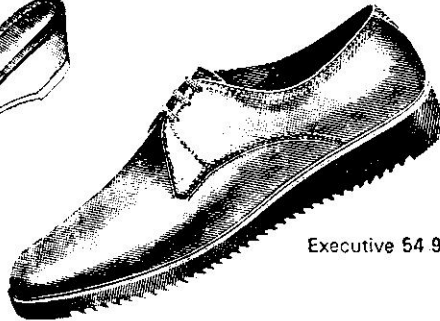
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The Residual Factor and The New Economics

By

DH Butani

Director of Research, NPC

This is part of a paper read by the author at the APO Training Programme on Productivity Measurement, held early in January 1970 at New Delhi, and deals with what is known as the Residual Factor in Productivity Measurement, concerned largely with Education and Health, as operative elements in National Income generation processes; also, with the emerging New Economics, which treats the Human Factor as the centre of the piece.

PLANNING in India, and other underdeveloped countries, has been seriously concerned with the contribution of such factors as Education and Health to Productivity Growth. What portion of the increase in the Gross National Product is attributable to Education, taken, of course, in its widest connotation? Precisely, of Productivity increase, how much is attributable to the Residual Factor, when account has been fully taken of additional capital investments, and the increase in the manpower employed?

As usual, in our answer to the problem posed by planners, we first sought refuge in intangibles, then in the practical impossibility of segregating Quality from Quantity, meaning thereby that it was already reflected in the Quality of Labour, and its utilisation of capital. We all know how difficult it is to work out a specific measure of productivity, in the sphere of educational (and health), not to speak of the analytically more difficult task of breaking up Total Productivity into the Productivity of Capital, the Productivity of Labour, and the Productivity of the Residual Factor.

Difficulties

Probably, the difficulties involved in building up a measure of Productivity in the sphere

of education¹ and health have been best dealt with by Prof. Myrdal who says in his *Asian Drama*:

"Any attempt to measure educational levels in terms of the financial resources devoted to education or the facilities provided, such as the teachers employed, is bound to fail for a number of reasons. To measure the 'output', the 'inputs' of resources would have to be more specifically defined. But even if a certain 'education-mix' were assumed, the output of education both in the imparting of abilities and the improvement of attitudes would bear no definite relation to the inputs of resources. . .

"Moreover, neither health nor education can be dealt with in isolation. To begin with, conditions of health and education are closely interdependent. On the one hand a child's ability to take full advantage of the schooling provided him depends on his health, and an adult's ability to use the knowledge and skills he has acquired depends on his mental and physical fitness. On the other hand, the extent to which health conditions can be improved depends on people's knowledge of and attitude toward hygiene. Standards of both health and education depend, in turn, on the whole societal milieu. . . .

"A propaganda campaign, directed towards a specific purpose—for instance, the spread of birth control—may be launched. If the purpose is achieved, this is, of course, an educational improvement, even though brought about by means not usually thought of as educational efforts.²

Probably this is like Keynes's duck: "The wild duck has dived down to the bottom—as deep as she can get—and bitten fast hold of the weed and tangle and all the rubbish that

is down there, and it would need an extraordinary clever dog to dive after and fish her up again."³

We have really got tangled up; and we had better clear up the position in academic terms.

"Prof. David and Klundert say: 'It is by now generally conceded that the presence of a large residual element in the growth of aggregate output, an element that is not accounted for by the growth of inputs of capital and labour measured in a more or less conventional manner, is aesthetically unsatisfying in explanations of the supply side of economic growth. Moreover, the simple labelling of that residual element as the consequence of technical progress, or an equivalently broad and imperfectly understood phenomenon does not prove practically helpful in guiding decisions about policies aimed at influencing the aggregate growth rate. . . . In this situation it is hardly surprising that the notion that there is some sense in which inputs just equal output would acquire strong appeal. Indeed, this has been the line taken by much of the recent interesting work with aggregate production functions. The residual has been treated as the consequence of the mismeasurement of the inputs; conventional measures of inputs of labour and capital are regarded as inadequate because they fail to reflect *alternations in the economic quality of physical units of the factors of production*. As this approach is currently being pursued, the object of the game is to make the offending residual disappear by contriving new (and more appropriate) measures of the growth of labour and capital inputs which will, between them, fully account for the growth of output. . . . It leads to the embodying technical change in capital inputs, on the one hand, and, on the other, to the *embodying of ostensibly superior knowledge and skill in the labour force through agency of education*'."⁴

As a general statement of the position, the above analysis is unexceptionable. However, in terms of the problems of Economic Growth that we face, the issue stands out somewhat differently, and may probably be understood better, in the language of Prof. Arthur Lewis: The central problem in the theory of economic growth is to understand the process by which a community is converted from being a 5 per cent to a 12 per cent saver—with all the changes in attitudes, in institutions, and in techniques which accompany this conversion."⁵

Problem

Now the problem, from our point of view, whether we can differentiate the impact of changes in attitudes, institutions and techniques, and build up relevant and specific meas-

ure of productivity. I was about to write down a reply in the negative, when my attention was drawn to a recently published work of the United Nations Research Institute for Social Development at Geneva, where they have tried to build up "a new general index of socio-economic development. This index is intended to cover social factors and structural factors more adequately than does the per capita national income."⁶

Of course, even in the models with which we are familiar, certain modifications are being made. I shall again draw upon Myrdal:

"New models have been constructed. Most of these have attempted to isolate the contributions to growth made by expenditures on education, but some have also included health and other factors previously rejected as 'non-economic'. The starting point has usually been the addition of a term to the Cobb-Douglas production function, making it $Y = a K^{\alpha} L^{\beta} H^{\gamma}$, where Y is national income, K Capital, L Labour, and H a ragbag term for 'human factor,' including 'improved knowledge', better organisation, economics of scale, and so on; α , β , γ are constants; and $\alpha + \beta = 1$. Thus whatever is not caught in variations of K and L is attributed to H. 'Improvement in knowledge' is another name for what has been called the 'coefficient of our ignorance.' Whatever the value of these models for advanced Western countries, and however welcome their attempt to get away from concentration on physical investment, their application to the problems of underdeveloped countries has bred confusion".

Of course, Myrdal has gone equally at the Harrod-Domar Model, with its capital-output ratio, which has been the basis of macro-planning in India and other developing countries in South Asia; and he has discovered in it all conceivable fallacies: adapted *ceteris paribus*, automatic *mutatis mutandis*, one-factor analysis, misplaced aggregation, illegitimate isolation. I shall not waste your time on the logic of Prof. Myrdal's position.

Statistical Problems

However, we, in India and other similarly placed countries, cannot escape the statistical problems involved in the measurement of capital and output:

"How are planned public 'development expenditure', not all of it investment in the normal sense, and estimated

private investment lumped together to arrive at capital input? In addition, there is the question of the correct valuation of capital and output in economies where restrictions and direct controls are ubiquitous. The specificity, heterogeneity, complementarity, and indivisibility of capital in South Asia make aggregation impossible. When the productivity of newly constructed capital goods changes, the question arises whether the capital goods should be measured in terms of output or of input. Measurement in terms of output is useless for our purpose, for it would make the capital output ratio a tautological constant. The difficulty with the input measure, on the other hand, is that despite the increase in the productivity of these capital goods, the value of the resources used in their production may not have changed.⁸

This would, as you know, lead to endless discussion; and we would be only going round and round. Probably, all this is indicative of a struggle towards a new economic theory, first stated by Keynes in his *General Theory*:

"I sympathise with the pre-classical doctrine that everything is produced by labour, aided by what used to be called art and is now called technique, by natural resources which are free or cost a rent according to their scarcity or abundance, and by the results of past labour, embodied in assets, which also command a price according to their scarcity or abundance. It is preferable to regard labour, including, of course, the personal services of the entrepreneur and his assistants, as the sole factor of production, operating in a given environment of technique, natural resources, capital equipment, and effective demand."⁹

Prof. Galbraith also has been working towards some such theory, probably an improvement on Keynes's position of 1935. In his *Liberal Hour*, Prof. Galbraith says:

"Both technological advance and improved skills and abilities are the product of personal development. Machines do not improve themselves...most technological advance is now the result not of the accident of inspiration or genius, but of highly purposeful effort. Once we had to wait for the accidental appearance of Edisons and Wrights. Now through education and organised effort in a laboratory or experimental shop, we get something approaching the same results from such more common clay. So it comes to this: We get the larger part of our industrial growth, not from more capital investment, but from improvement in men... We get from men pretty much what we invest in them...."

In his *New Industrial State*, Prof. Galbraith treats knowledge and technology as the Central Factor and others as subsidiary, in modern economic development. Probably, we are veering round to the Marshallian position,

though modern economists have the sensation that they are creating something new. Mr. H.P. Gideouse says:

"Much of the past discussion of economic growth—in development as well as in underdeveloped countries—appears to be as obsolete as the abandoned and useless furniture in the attic of an old family homestead... Clearly, a new concept of 'capital'—and a new political economy—is in the process of formulation since the old concepts, which were limited to tangible property, are now manifestly inadequate. The main shift in the present development is characterised by the tendency to think of the cause of economic growth as the capacity to create wealth rather than the creation of wealth itself..."¹⁰

I have tried to clear up a bit of essential theory, for no progress is possible in what are regarded as practical matters, unless one is clear about the theory of the matter.

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Great Saving in B.E.S. & T. by Reduced Capital locking

The Stores Department in the B.E.S. & T. Undertaking, Bombay, caters to the needs of two major activities: (a) the Bus Transport, and (b) the Electric Supply. The annual purchases are worth Rs. 8 crores, and an effective control on the inventory is of vital importance. There are about 20,000 items. Many of them, which are vital for the running of buses, or supplying electricity to the city, contain substantial foreign exchange element. The tendency, therefore, is naturally to err on the safe side and stock larger quantities. The two services, viz., Transport and Electric Supply, are also of a nature where emergency work is common. The local availability of quality items is also restricted. All this creates a tendency to hoard. Under these circumstances, the inventory control needs a scientific and modern approach, so that both the stocks and the stock-outs are the minimum.

Manual control was not effective at the various stages of the various activities. The reports to the Management were so much delayed that a corrective action was of no avail. The position of the stocks at the end of a month was known only after 4/5 months. We, therefore, decided to computerise the inventory control about some months ago with a view to obtaining (a) maximum timeliness, accuracy and availability of information; (b) prompt procurement action; (c) exception reports to highlight instances of excessive stocks, delays etc., (d) comparative budget vs actual analysis; (e) effective cost control; (f) accurate costing of issues; (g) prompt accounting of receipts; (h) periodic analysis of inventory activity; (i) reduction in inventory costs (j) intergrated, economical, and safe data-keeping; and (k) scientific inventory management techniques.

B.E.S. & T. designed its own system to suit departmental needs. This gave it an advantage. Computerisation could be effected without any disturbance in the working of its departments. "We now propose to improve slowly on this system, so that the outputs could be utilised by other departments for improving the efficiency in their own fields. If we were to change the output formats entirely, this would have needed adjustments in other departments, and would naturally have delayed the scheme. We also trained our own staff for programming. The staff being familiar with the working of the Undertaking could adapt themselves quickly for automation. Training facilities provided by IBM were satisfactory. Three years ago our inventory level was about 15 months, later it came down to 9 months. It is now 7 months and very soon we expect to come down to about 4 months. This itself means a great saving by way of reduced capital locking.—P. G. Patankar, Controller of Stores, B.E.S. & T. Undertaking, in "I.B.M. Report"

Concepts And Measurement of Capital Productivity

By

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BEFORE we take up the subject of capital productivity itself, it will be worthwhile to examine the shortcomings in the concept of labour productivity which indicate the necessity for evolving the concept of total productivity as also of capital and other productivities.

The index of output per manhour is usually subject to an upward bias. If the index relates output to manhours of work done only by 'production-workers'—which is frequently the case for individual industries—there is a further source of error. In that case, the index will usually rise more rapidly than output per manhour of work done by all workers, for 'non-production workers' have, over the years, generally increased in relative importance. This bias results not only from the omission of capital input but also because the usual index of output per manhour fails also to take into account change in the composition or quality of labour. That is, manhours worked by persons of different skills, levels of education, and lengths of experience are treated as if equivalent, thus ignoring important forms of human capital that aid in production and contribute to wage and salary differentials. The index of output per weighted manhour catches some of this intangible capital, for the labour in industries with high rates of pay is given a heavier weight than that in low-pay industries. All the labour within an industry is still assumed to be homogeneous.¹

Thus, at first sight, variations in the productivity of 'labour' may seem to be due to 'labour'. However, if the definition of produc-

tivity is examined carefully, it should be clear that any factor affecting output or labour input may have an influence on productivity. In fact, much of the confusion results from the fact that the number and variety of factors affecting the productivity of labour are generally not fully appreciated². Since labour is only one of the input factors, labour productivity data should be interpreted with the utmost caution. In particular one has to guard against two possible dangers in analysing such data:

- (1) Danger of placing undue emphasis upon what can be done by workers to increase production.
- (2) Danger of giving insufficient attention to problems of what can be done to increase production by making a more efficient use of other factors of production.³

Because of these dangers and its other limitations, the concept of labour productivity has been criticized by some authors. It seems worthwhile to note what these experts have said about labour productivity.

Professor H. S. Davis, pointing out the incompleteness of this concept, asks these questions: Can total input be completely expressed in labour terms? Can the efficiency of industry be fully measured by the ratio of physical output of labour effort put forth, including the sum of actual and embodied labour? Professor Bye provides some help on these questions when he identifies the basic elements of production as: (1) effort, (2) ability,

(3) saving, (4) land space, (5) natural materials, (6) risk-bearing. Of these six elements, it is obvious that manhours can be used to measure only the expenditure of 'effort' and 'ability' and even this measure will be subject to some criticism unless it is accompanied by the acknowledgement that manhours are only a rough measure of these elements, since they do not register variations in the degree of effort or grade of ability expended.⁴

According to John W. Kendrick, the chief objection to output per manhour as an indicator of productivity is that it reflects inter-factor substitution as well as changes in over-all productivity efficiency. Only by relating output to all tangible inputs can it be determined whether there has been a "net" saving in real costs per unit of output, or conversely, a gain in productivity.⁵ To quote Fabricant again: When other resources are used in significant volume, and change occurs in the volume of such resources used (which is almost always the case), a measure of productivity based on a single resource might tell us little or nothing of change in the efficiency with which this resource was being utilized. It might not even point in the right direction.⁶ For example, output per unit of plant and equipment might have fallen because plant or equipment was being substituted for labour or other resources. Yet the efficiency with which plant and equipment was being used might have risen. Even the late Dr. Rostas, a pioneer in the field of international comparisons of labour productivity, had to recognise the importance of other types of productivity measurements in the following words: "But in industries where this proportion (i.e. share of labour in total costs)⁷ is small, and the importance of other factors in total costs high, the measurement in labour productivity only may not lead us very far, without the measurement of other input factors."⁸

The views of different experts cited above seem to carry more weight with regard to underdeveloped countries where labour is cheaper and is abundantly available. A change in labour productivity in such countries as has already been said, might be misleading. For productivity may be increased in an

establishment or industry by purchasing components or partly processed materials from elsewhere, or by installing capital equipment⁹. This not only emphasises the two possible dangers already mentioned, in interpreting labour productivity data, but also belittles the significance of such measurements in the underdeveloped countries. The utility of any concept of productivity in such countries should be judged in the light of the importance of one or more inputs in the economy. As T. Barna also points out: If problems of production are approached from the viewpoint of capital employing labour, the cheapness of labour relative to capital is one of the main factors determining methods of production, and money costs of production are of paramount importance. If, on the other hand, the view is taken that labour employs capital (and not the other way round) to increase its standard of life by capitalistic methods of production, "dear" labour becomes the object of policy and not one of its determining factors¹⁰. From this criterion it seems that the concept of labour productivity alone is not very helpful in underdeveloped countries. To quote S. Tilles: the choice of only one concept of the general term 'Productivity' is unfortunate, since it seems to imply that an increase in productivity necessarily means an increase in production (with possibly concomitant distribution problems) or less labour (with possibly serious technological unemployment). Productivity is by no means limited to this interpretation alone, despite the fact that output per manhour is a convenient index when making economic comparisons¹¹. Tilles uses the concept of productivity as the ratio of output to input in a more general sense. The significance of this general concept, as he points out, is not merely that productivity of other resources may be measured, for measurement of productivity is only the first step. What is really important is the improvement of productivity and, if we insist always on productivity, in the sense of labour productivity, we shall be led by our definition to concentrate primarily on labour-saving techniques¹².

It will be interesting here to know the views of the productivity mission sent to India by the I.L.O. Since the Mission had an opportu-

nity to study the problem of productivity in Indian industries on the spot and as it interrogated various parties, employers, employees, trade unionists, etc., its views should be considered all the more important. Pointing out the confusion prevailing over labour productivity in India, the Mission observes in its Report: To many in India who tended to think of productivity exclusively in terms of labour productivity, the only way of increasing productivity seemed to be the installation of new, labour-displacing equipment. It was thought that retrenchment would be certain and new capital investment necessary. A consequence was that many employers and all trade unionists were wary of the consequences of raising productivity.¹³ Further, pointing out the dangers of too much emphasis on labour productivity, the Mission goes on to say: The usual method of measuring productivity in terms of 'labour productivity', although the most convenient for various reasons, tends to concentrate attention on the productivity of capital equipment. Even in the more advanced countries the growth of automation and the very heavy cost of new plant in many industries is rendering the full utilisation of capital resources sometimes more important than the fullest utilisation of the human ones. It may pay to have a few men to spare if, by doing so, an expensive piece of plant can be more fully utilised. This is even more true in countries where unskilled labour is plentiful and cheap.¹⁴

It follows from the foregoing that the concept of labour productivity, unaccompanied by other related measurements, is not appropriate in underdeveloped countries. We should, therefore, develop some other concepts, according to the importance of a particular input or inputs in an industry. Seeing the present capital shortage in India, it might be helpful to measure the productivity of capital equipment and or of raw materials and fuel in addition to that of labour. But the matter is not so simple as it seems at first sight, for in practice many difficulties arise while measuring total productivity or productivity of any factor other than labour. Nevertheless, our ideal should be to measure the total productivity.

During the two years 1958 and 1959, I myself was associated with the construction of production and productivity indexes with the Indian Data. I wanted to measure the capital input particularly in regard to the fixed capital. I give below the extract from what I had written then:

Although a direct measurement of capital consumption, and consequently of capital productivity, does not seem possible with the Indian data, we can, however, use an indirect measurement for the same. Since plant and machinery are mainly run by means of electric power, the consumption of electricity may be deemed to be in proportion to the amount of services of plant and machinery used. This means the greater the consumption of electric power, other things being equal, the greater the use of plant and machinery in factory, and *vice versa*. This assumption, however, can be rendered inappropriate if a number of factories start generating their own power, instead of purchasing it from outside, and use the same in their manufacturing process. This is because Census of Manufactures will not give such data regarding the generation of electricity and its use within the same plant: our assumption will, accordingly, fail to indicate the true extent of mechanisation. However, the limitation is not only true for electric power, it also holds for any inputs, say, fuel and materials produced and used in the same factory. All the same, it seems reasonable to assume that it is unlikely that in a short period such changes take place on a large scale. As such the assumption may be regarded quite plausible for practical purposes.

It may be further pointed out that the introduction of capital input is considered necessary since in its absence the Material Input Index is heavily weighted. As material is generally the largest single input in an industry, the Material Input Index is likely to influence unduly the other productivity Indices. The introduction of capital input, no matter in this indirect manner, gives appropriate weights to all the partial productivity indices and is, therefore, likely to give better results provided that capital productivity itself does not give a distorted picture.

In his book¹⁵ published in 1961, John Kendrick has introduced the concept of "total factor productivity" or "total productivity" which implies the measurement of output per combined labour and capital inputs. Commenting on this new measure of productivity, Stanley H. Ruttenberg has raised certain basic issues. For example, what is the conceptual basis for the new productivity measure—i.e. Does total factor productivity purport to measure efficiency, in terms of dollar costs to business, alone? Or does it attempt to measure efficiency in terms of costs to the economy as a whole? Again, when the measure does not include other inputs, such as education, science, technology, social organisation, cultural heritage, and quality of human skills, how can it be called as "total factor productivity" or "total productivity"? So much about this measure of "total factor productivity" which forms the subject of another lecture. I will now confine myself to the measurement of capital productivity based mostly on the above work by Kendrick.

The main difficulty in the measurement of capital productivity brings on the concept and measurement of capital input. In the industry, for instance, different types of capital are employed—fixed capital comprises land, building, machinery, tools, transport equipment, furniture and fixtures, etc.; working capital comprises inventories or stocks of material, stores, fuels, semi-finished goods including those in process, products and by-products, cash in hand at bank. In the context of productivity measurement, it is necessary to take both fixed capital and working capital into consideration though some studies have indicated that only fixed investment actually utilised is a more appropriate indicator of capital utilization.¹⁶

The first step in measuring the capital input is to estimate the real net capital stock employed in the various industries; the next is to weight these figures by the base-period rates of return. To estimate the real net capital employed, the capital stock data have to be deflated to eliminate the effect of price changes in such a way that a new unit reflects the base year value.

Age of plant and equipment is another relevant factor, as the repair and maintenance charges mount up with age so that the contribution to net output falls. In other words real value of capital stock *net* of accumulated depreciation allowance is regarded as a more suitable measure of the capital input than the gross stock of capital. The problem of depreciation is, of course, not applicable in case of land as it is generally believed that maintenance expenditure on land preserves its capacity to contribute to output at the same level as in the base year. The real stock of land in each industry is combined with other types of capital, before being weighted by the rate of return to capital as a whole in each industry.

Inventory estimates represent average beginning and end-of-year numbers of units of the various types of goods times the average price in the base year. In other cases, book value estimates are deflated by price indices designed to convert to constant, base-year prices.

TABLE I

Private Domestic Economy

Growth Rates in Real Product and Productivity Ratios, 1889-1957

Period	Real Gross Product	Real Gross Total Factor Input	(Average Annual Percentage rates of change)		
			Product per Labour Input	Unit of Capital Input	Real Gross Product per Man-hour (unweighted)
1889-1957	3.5	1.7	2.0	1.0	2.4
1889-1919	3.9	1.3	1.6	0.5	2.0
1919-1957	3.1	2.1	2.3	1.3	2.6

TABLE II

Private Domestic Economy, Covered-Industry Sector ¹⁷

Growth Rates in Output and Productivity Ratios, 1889—1953

Period	Output	(Average Annual Percentage Rates of Change)		
		Output per Total Factor Input	Unit of Labour Input	Capital Input
1889-1953	3.2	1.7	1.9	1.0
1889-1919	3.1	0.6	0.8	0.1
1919-1953	3.2	2.6	2.8	1.9

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1. Solomon Fabricant: *Basic Facts on Productivity Change*, Occasional Paper 63, National Bureau of Economic Research, 1959.

2. I.L.O. *Methods of Labour Productivity Statistics*, Geneva, 1951.

3. I.L.O. *Higher Productivity in Manufacturing Industries*, Studies and Reports, New Series, No. 38, 1954.

4. Davis H. S.: *The Industrial Study of Economic Progress*, University of Pennsylvania Press, Philadelphia, 1947. (The last observation points out to the same shortcoming of the Labour Productivity Index as was mentioned by Solomon Fabricant, cited earlier).

5. John W. Kendrick: *Productivity Trends: Capital and Labour*, Occasional Paper 53, National Bureau of Economic Research, 1959.

6. Solomon Fabricant: *op. cit.*

7. Words in parenthesis are our own.

8. Dr. L. Rostas: "Alternative Productivity Concepts", *Productivity Measurement*, Vol. I (1955), European Productivity Agency, O.E.E.C.

9. Some specific examples on increase in the productivity by more efficient use of capital equipment, are given

below.

10. T. Barna: "Note on Productivity of Labour—Its Concept and Measurement", *Bulletin of the Oxford University Institute of Statistics*, Vol., 8 July, 1946.

11. S. Tilles: *Productivity in Underdeveloped Countries*: *International Labour Review* (ILO), December, 1955.

12. *Ibid.*

It is interesting to note that in the article referred to, Tilles attempts to measure the productivity of industry in Israel by taking value added as output and foreign currency requirement as input.

13. "I.L.O. Productivity Missions to Underdeveloped Countries", *International Labour Review*, Vol. LXXVI, No. 1, July, 1957.

14. *Ibid.*

An interesting example given in this connection by the Productivity Mission is that of a weaving shed in Pakistan. The output of this weaving shed, which was equipped with automatic looms, was substantially increased by reducing the number of looms to be minded by each worker. In this way higher loom efficiency, i.e. productivity of capital was attained.

Another example given by the Productivity Mission shows how higher productivity, especially of capital equipment, decreases the cost per unit and makes it possible to sell at lower prices. The example is that of the Delhi Transport Services, where improved productivity has enabled the overall time of the buses to be cut substantially so that it would be possible to increase the number in service by 50%, without additional vehicles. With the same capital equipment the travelling public will have better facilities and the improved utilisation of the buses will reduce the cost per passenger-mile of operating them. This is an example of the way in which better utilisation of existing equipment may serve as an effective alternative to new investment.

15. John Kendrick: *Productivity Trends in the United States*, Study by the National Bureau of Economic Research, New York; published by Princeton University Press, Princeton, 1961.

16. See, for instance, *the Report on Trend of Utilization of Labour and Other Inputs* (Labour Bureau, Ministry of Labour, Employment and Rehabilitation, Government of India), 1966.

17. Aggregate of industry segments for which capital and labour input indexes as well as output indexes are available: farming, mining, manufacturing, transportation, and communications and public utilities, trade from 1929 forward.

Total Factor Productivity: Concept & Measurement

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PRODUCTIVITY measures can be broadly classified into two types: partial factor and total factor productivity measures. Partial Productivity is the average productivity of the particular input in question. The productivity of labour has been the subject of study for a long time, both because of the relative ease of measuring it and its welfare aspects. Capital productivity has been investigated by several workers during the last three decades or so. In recent times the productivities of various materials and fuels have also been studied. All these are partial factor productivities in the sense that output is related only to one input at a time, without explicit recognition of the role played by other inputs in the production process. Lately, emphasis has shifted to total factor productivity measures. A measure of total productivity compares output to a weighted combination of inputs, usually labour and capital. This measure, however, leaves out of account several intangible factors, such as, managerial skill, degree of competition in the market, and to that extent it is not truly an index of total factor productivity. The term multi-factor productivity is perhaps a better one. This composite measure of productivity has been given other names like "technical change", "measure of our ignorance" and "the Residual". The importance of the measure is clear from the fact that several American studies, to cite an instance, have shown that 80-90 per cent of the growth of output per unit of labour has been explained by the so-called technical change, the remaining 10-20 per cent being all that capital per unit of labour could claim.

The various studies dealing with measurement of total factor productivity differ in their methods. However, all of these studies use the concept of a production function, either explicitly or implicitly. Some derive measures of productivity by taking the ratio of output (or a weighted combination of outputs) to a weighted combination of particular inputs (usually labour and capital). Other studies estimate production functions for the purpose of measuring productivity. We shall discuss here some important methods of both types. First we shall describe the notation to be used.

Y= index of output in physical units

L= index of labour input in physical units

K= index of capital input in physical units

A= Residual, total factor productivity, or technical change

α = ratio of the value of labour input to the value of output (the relative income share of labour)

β = ratio of the value of capital input to the value of output (the relative income share of capital)

t= time

\bar{Y} , \bar{L} , \bar{K} , \bar{A} = relative (percentage) rates of change of the respective variables per unit of time.

W= wages per unit of labour

i= rental per unit of capital services

The zero subscript indicates base year magnitudes. The price of output is taken as unity.

The Arithmetic Index

The most commonly used measure of total factor productivity is based on the arithmetic index. The index of productivity, A , is given by

$$Y = A (W_0 L + i_0 K) \quad (1)$$

or

$$A = \frac{Y}{W_0 L + i_0 K} \quad (2)$$

A is thus the average productivity of an arithmetic combination of labour and capital with factor prices in the base period as weights. If all variables are expressed as index numbers with a common base period, the weights can be expressed as factor shares (α_0 and β_0), as follows:

$$\begin{aligned} \frac{Y}{Y_0} &= A \left(\frac{W_0 L + i_0 K}{Y_0} \right) \\ &= A \left(\frac{W_0 L_0}{Y_0} \cdot \frac{L}{L_0} + \frac{i_0 K_0}{Y_0} \cdot \frac{K}{K_0} \right) \end{aligned}$$

$$\text{i.e., } \frac{Y}{Y_0} = A \left(\alpha_0 \frac{L}{L_0} + \beta_0 \frac{K}{K_0} \right)$$

$$\text{so that } A = \frac{\left(\frac{Y}{Y_0} \right)}{\alpha_0 \left(\frac{L}{L_0} \right) + \beta_0 \left(\frac{K}{K_0} \right)} \quad (3)$$

The constant prices used as weights in (2) can relate to any one period or can be an average of over several periods. Some of the pioneers of this subject, namely Schmookler, Abramovitz and Kendrick, used this type of index and so Domar calls this the SAK method.

The Arithmetic Index method assumes (implicitly)

- (i) that the production function is linear in labour and capital
- (ii) that competition prevails in the factor markets, and
- (iii) that the firms are in equilibrium with respect to their use of labour and capital. These assumptions are hard to justify: The linearity of the pro-

duction function implies that the marginal products of the inputs are independent of the quantities of inputs and that capital and labour are perfect substitutes in production. The equality of the marginal product of capital with its price calls for long-run equilibrium, "a rather hazardous assumption in a study of economic growth" (Domar).

The price of capital (i) in practice, is not a rental payment for the use of capital, nor the market rate of interest, but the average rate of return.

The Solow Method

Next in importance is Solow's method (1957). Solow begins by assuming that technical change is neutral, in the sense that it leaves the marginal rate of substitution between inputs unaltered but changes the output obtainable from given inputs, so that the production function is of the form

$$Y = A(t) \cdot f(L, K) \quad (4)$$

with $A(t)$ measuring the cumulated effects of technical change. The other two assumptions are:

- (ii) that $f(L, K)$ is homogeneous of degree one, and
- (iii) that factor prices equal to their respective marginal products. By differentiating both sides of (4) with respect to t , we get

$$\frac{dY}{dt} = f(L, K) \cdot \frac{dA}{dt} +$$

$$A(t) \left(\frac{\delta f}{\delta L} \cdot \frac{\delta L}{\delta t} + \frac{\delta f}{\delta K} \cdot \frac{dK}{dt} \right)$$

and dividing by γ ,

$$\frac{1}{\gamma} \frac{dY}{dt} = \frac{1}{A} \frac{dA}{dt} + L \cdot \frac{1}{f} \cdot \frac{\delta f}{\delta L} \cdot \frac{1}{L} \frac{dL}{dt} +$$

$$K \cdot \frac{1}{f} \cdot \frac{\delta f}{\delta K} \cdot \frac{1}{K} \frac{dK}{dt}$$

$$\text{i.e., } \bar{\gamma} = \bar{A} + L \cdot \frac{1}{f} \cdot \frac{\delta f}{\delta L} \cdot \bar{L} + K \cdot \frac{1}{f} \cdot \frac{\delta f}{\delta K} \cdot \bar{K} \quad (5)$$

where $\bar{\gamma} = \frac{1}{y} \frac{dy}{dt}$, $\bar{L} = \frac{1}{L} \frac{dL}{dt}$ etc.,

Now assumption (ii) implies (by Euler's theorem) that

$$L \frac{\delta f}{\delta L} + K \frac{\delta f}{\delta K} = f(L, K)$$

and by assumption (iii)

$$\frac{\delta f}{\delta L} = W \text{ and } \frac{\delta f}{\delta K} = i$$

$$\text{Or } \frac{L}{f} \frac{\delta f}{\delta L} = \frac{LW}{f} = \alpha,$$

$$\text{and } \frac{K}{f} \frac{\delta f}{\delta K} = \frac{Ki}{f} = \beta \tag{7}$$

Substituting (7) in (5), we have

$$\bar{\gamma} = \bar{A} + \alpha \bar{L} + \beta \bar{K} \tag{8}$$

where $\alpha + \beta = 1$, by (5)

$$\therefore \bar{A} = \bar{\gamma} - (\alpha \bar{L} + \beta \bar{K}) \tag{9}$$

The rate of growth per cent of total factor productivity is the difference between the per cent rate of growth of output and a weighted sum of the per cent rates of growth of labour and capital, the weights being equal to factor shares in the current period. Using time series on the discrete analogues of \bar{Y} , \bar{L} , \bar{K} and α , one could derive a time series on \bar{A} and thence on $A(t)$ itself

We can express (9) in a slightly different form:

$$\bar{A} = (\bar{\gamma} - \bar{L}) - \beta(\bar{K} - \bar{L}) \tag{10}$$

The term $(\bar{\gamma} - \bar{L})$ on the righthand side of (10) is the relative rate of growth of output per unit of labour, while $(\bar{K} - \bar{L})$ represent the relative rate of growth of capital for labour unit. Thus the relative rate of growth of total productivity equals the relative rate of growth of labour productivity minus the share of capital times the relative rate of growth of the capital labour ratio.

We note that the Solow method uses moving rather than constant weights. Furthermore, it does not assume that the production

function is linear in inputs with the implication that the marginal products are independent of the levels of inputs.

The Geometric Index

Suppose the production is of the Cobb-Douglas type,

$$\gamma = A L^\alpha K^\beta \tag{11}$$

with constant α and β , and $\alpha + \beta = 1$. Let us assume (i) that competition prevails in the product and factor markets, and (ii) that there is equilibrium. Then the equilibrium conditions are that the marginal products of the inputs are equal to the respective factor prices:

$$\alpha \frac{\gamma}{L} = W \text{ and } \beta \frac{\gamma}{K} = i$$

$$\text{or } \alpha = \frac{LW}{\gamma} \text{ and } \beta = \frac{iK}{\gamma} \tag{12}$$

so that the exponents α and β in the production function (11) are equal to the respective factor shares in every period.

Taking logarithms of both sides of (11), we get

$$\log \gamma = \log A + \alpha \log L + \beta \log K \tag{13}$$

Differentiation of both sides of (13) with respect to t gives the following relationship between relative growth rates:

$$\frac{1}{\gamma} \frac{\delta \gamma}{\delta t} = \frac{1}{A} \frac{\delta A}{\delta t} + \alpha \frac{1}{L} \frac{\delta L}{\delta t} + \beta \frac{1}{K} \frac{\delta K}{\delta t}$$

$$\bar{\gamma} = \bar{A} + \alpha \bar{L} + \beta \bar{K} \tag{14}$$

It may be noted that equations (8) and (14) are quite alike, with the difference that α and β are constant in (14), but not in (8). Thus the operational difference between the Solow and the Geometric Index methods is that the former uses shifting weights while the latter uses constant weights.

We note, in passing, that (11) implies the following:

$$A = \frac{\gamma}{L^\alpha K^\beta}, \text{ with } \alpha + \beta = 1 \tag{15}$$

Equation (15) shows that the measure of total factor productivity, A , is obtained as the ratio of output to a weighted geometric mean of labour and capital with factor shares as weights. Hence the name "Geometric Index".

Domar has pointed out that the difference between the rates of growth of a geometric and an arithmetic index will be small if the period is not long and the rates of growth of labour and capital are not appreciably different. The geometric index should be preferred to the arithmetic for long-term comparisons, for two reasons: (i) since the main interest is in relative rates of growth of the Residual, it is proper to use the rate concept all the way, that is, to combine both inputs and outputs geometrically; (ii) the expression for the rate of growth of total productivity,

$$\bar{A} = \bar{\gamma} - \alpha \bar{L} - \beta \bar{K}$$

is easier to comprehend, manipulate and experiment than its arithmetic counterpart.

Finbergen Method

The point of departure of this method is the *unrestricted* Cobb-Douglas production function,

$$Y = A(t) L^\alpha K^\beta \quad \text{with } \alpha + \beta \leq 1 \quad (16)$$

which allows for the possibility of non-constant returns to scale. Finbergen further specified that total productivity increases at a constant rate, γ so that,

$$A(t) = A_0 e^{\gamma t}$$

and the production function becomes

$$Y = A_0 e^{\gamma t} L^\alpha K^\beta \quad (17)$$

Its logarithmic transformation is

$$\log Y = \log A_0 + \alpha \log L + \beta \log K + \gamma t \quad (18)$$

The parameters, α , β and γ can be estimated by regressing $\log Y$ on $\log L$, $\log K$ and t . The coefficient of t is the estimated rate of technical progress, net of the effect of scale economies which are estimated by $(\hat{\alpha} + \hat{\beta} - 1)$. It is interesting to note that this method attempts to disentangle the effect of scale economies

from that of technical change and that it does not postulate competitive equilibrium. However, this method does not always yield good results on account of the strong time trends in the variables.

Both the Geometric Index and the Tinbergen methods postulate a Cobb-Douglas type of production function, and thus assume that the elasticity of substitution between labour and capital is unity.

Index Based on the CES Function

The merit of this index is that it does not specify the elasticity of substitution to be a particular number, like unity or infinity. All that it assumes is that the elasticity is a constant at all levels of inputs and output. The index is based on the Constant Elasticity of Substitution (CES) production function,

$$Y = A \left\{ \delta L^{-\rho} + (1-\delta) K^{-\rho} \right\}^{-\frac{1}{\rho}}$$

The condition that the marginal rate of substitution equals the price ratio gives the relationship,

$$\log \left(\frac{WL}{rK} \right) = \log \left(\frac{1-\delta}{\delta} \right) + \rho \log \frac{K}{L}$$

which can be used to estimate δ and ρ . Then from

$$A = \frac{Y}{\left[\delta L^{-\rho} + (1-\delta) K^{-\rho} \right]^{-\frac{1}{\rho}}}$$

total factor productivity involves the use of an exponentially weighted harmonic average of input indexes. This method obviously involves difficult calculations and, therefore, has not been extensively used.

Evaluative Comments on the Methods

All the methods discussed above assume that technical change is neutral and disembodied. Technical change is said to be "embodied" if it affects output through the improvement in the quality of an input, usually capital. Technical progress is embodied in new capital

in the sense that "capital formation is a vehicle for carrying technical change into effect" (Solow). The relaxation of the assumption that technical change is of the disembodied type results in the reduction of the magnitude of the Residual. Studies by Solow, Denison, Griliches, and Jorgenson dealing with this aspect will be discussed later.

All the methods, except the one due to Tinbergen, postulate constant returns to scale and competitive equilibrium, which are restrictive assumptions. Release of these assumptions has been found to lead to a smaller Residual, as will be shown later. The earlier studies attributed 80-90 per cent of the growth in output per unit of labour to "technical change", which was nothing but a measure of ignorance. More recent studies have tried to show that improvements in factor qualities, economies of scale, etc., account for a substantial proportion of the so-called technical change.

Treatment of Raw Materials

The production function for a particular industry or sector should include material inputs purchased from other industries or sectors. The correct arithmetic index of productivity in this case is

$$A^1 = \frac{\gamma}{W_0L + i_0K + h_0R}$$

where R is the materials input and h_0 is the price of materials in the base period. In practice, the cost of materials in constant prices is subtracted from both sides of the

production function, and the following formula is used to calculate an index of productivity

$$A^1 = \frac{\gamma - h_0R}{W_0L + i_0K}$$

It can easily be shown that $A^1 \leq A$, the correct index, according to $A \leq 1$, so that the elimination of the cost of materials has the effect of exaggerating the absolute rate of growth of the residual.

Measurement of Output and Inputs

The problems of measurement of output and inputs are the same as in the case of the study of partial productivities and must have been discussed in the context of labour and capital productivities. To avoid repetition and duplication of effort, these problems are not discussed here.

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*Management efficiency is a wishful dream
without competent supervisors in your
team.*

Measurement of Agricultural Productivity in Japan

By

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JAPAN'S agriculture is characterized by the small-scale farming, dependent heavily on rice cultivation, as is the case in many other countries of Asia and the Far East. However, it seems to be noticeably different in the following three points.

Firstly, a far-reaching land reform was implemented just after World War II and nearly all the farmers became owner cultivators. It cannot be emphasized too much that the land reform brought about the democratization of rural communities and resulted in increased productive capacity of food and other agricultural products, which has contributed to a great extent to the reconstruction of the national economy during the period from the mid-1940's to the mid-1950's. It is true that the land reform did change the traditional pattern of ownership of agricultural land fundamentally, but failed to alter the then prevailing small-scale structure of farming. Today, when 20 years have passed after the land reform, domestic as well as international conditions surrounding agriculture have altered almost entirely. It is increasingly recognized that the policy in favour of owner cultivators living on small-scale farms has become an obstacle to a leap of agricultural productivity.

Secondly, land productivity, i.e., yield per unit of land area is at very high levels. For instance, the FAO statistics show that in 1967 paddy yield per hectare in Japan averaged 5.8 tons, and this is about three times as much as in South-East Asian countries such as Thailand, Burma, and the Philippines. This

is made possible, among others, by the huge investment in land improvement projects and the advancement of agricultural technology especially in the field of rice cultivation, together with the development of agriculture-related industries of fertilizers, pesticides, insecticides, agricultural machinery, etc. Nowadays, mechanical power is used widely in agriculture instead of draught animals. For one thing, 96 per cent of the area under paddy is now ploughed by power machines.

Thirdly, the national economy as a whole underwent a surprisingly rapid growth averaging as high as ten per cent *per annum* during the past decade. One of the key factors making possible such unprecedented prosperity of the Japanese economy was undoubtedly an abundant supply of manpower of good quality, of which farm population provided an important source. The Basic Survey of Employment Status indicates that during the decade ending 1968, the number of employees in the nonagricultural sectors increased by 10,543 thousand in all, while agricultural and forest workers decreased by 4,618 thousand during the same period.

Income Objectives of Government Policies

It was not until after 1955 when the Japanese economy entered the period of high rate of growth that agricultural and forest workers began to compare their own incomes or levels of living with those of other workers and become conscious of a wide gap between these sectors. Backed by both

their intense consciousness of income gap and their desire for its rectification and the rapid growth of the economy in general, the Government enacted the Agricultural Basic Law in June 1961, whereby the Government revealed the basic lines of policies to be followed in the field of agriculture.

The Agricultural Basic Law provides in Article I that "... the objectives of the State's agricultural policies shall be to secure agricultural development and raise the status of those engaged in agriculture in line with the growth of the national economy and the elevation of social standard of life, while offsetting the disadvantages of agriculture arising from natural and socio-economic handicaps, with the aim of ensuring that agricultural productivity may increase in such a way as will narrow the gap in productivity between agriculture and other industries and that those engaged in agriculture may earn greater incomes which will enable them to make a living comparable with those engaged in other industries."

To realize parity of levels of living would logically presuppose the achievement of income parity which is generally regarded as an ideal originated in social justice in the modern society. In principle, however, income parity attained by other means than improvement of labour productivity would often prove to be unreasonable from the standpoint of national economy. That is why in the foregoing Agricultural Basic Law, the reduction of productivity gap, instead of income parity, from the efficiency point of view and the parity of living levels from the welfare point of view are juxtaposed as the ultimate objectives of government agricultural policies. In making a comparison of levels of living between farmers and urban wage-earners, however, it is, of course, necessary to clarify sources of their incomes as well.

In reality, it would be impossible to achieve parity of living levels for every agricultural worker with those of nonagricultural workers by means of agricultural income alone. Therefore, one should have to aim at ensuring the improvement of the whole farm income

including income from non-agricultural sources as far as the majority of farm households are concerned. One of the foremost tasks now confronting government agricultural policies is to foster "economically viable farming units," which are defined as highly efficient family farms yielding enough agricultural income for their members to make a living comparable with that of those engaged in other occupations.

Under the provisions of the Agricultural Basic Law, the Japanese Government is required to compile and submit annually to the Diet "the Report on the State of Agriculture" which includes a description on the trend of agricultural productivity and living levels of farmers in comparison with other segments of the economy.

Methodological Problems of Comparison

First of all, the concept of productivity should be made clear.

The definition once given by the Organisation of European Economics Co-operation is that productivity is a quotient which is achieved by the division of the product by one of the productive factors. It states that in this manner the measurement of productivity can be made in the form of land productivity, labour productivity and capital productivity by calculating the ratio to the output in respect of each of the productive factors such as land, labour and capital.

Again, the ILO (International Labour Organization) defines as follows: Output is what can be obtained as the result of the invested quantity coupled with the multitude of various factors, all having significance, such as equipment, resource, energy, labour, technique and management. These various factors can be divided into principal classifications as labour, capital, land and organization. The proportion to the output of each of the invested factors can be called the productivity of the respective factors in question. Now, when one actually delves into the problem of produc-

tivity, what sort of concept should be regarded as the most appropriate in different cases?

Broadly speaking, it is divided into productivity as an indicator of enterprise management and productivity as an indicator of economic welfare, and our concern is with the latter. After the War, the concept of labour productivity was looked upon as vital by every country. This labour productivity is understood in the form of physical productivity, behind which lies the general understanding that every country can enjoy economic welfare which will be brought about by the increase in labour productivity.

To understand productivity, what is to be measured and in what form? According to the above definition, there are various methods of measurements such as labour productivity, capital productivity, land productivity, collective productivity. While the first three indicate ratio to output in respect with one productivity factor, collective productivity signifies that all the productive factors are converted into one same unit and the ratio to the output in regard to the total invested quantity thus converted is arrived at.

Furthermore, by using output expressed in value, the concept of value productivity can be obtained in place of the physical productivity.

Regarding the comparison of the levels of the productivity between different sectors of the economy, labour productivity is usually employed in practice partly because of the limitation of reliable statistical data. Broadly speaking, there are two ways of sectoral comparison of labour productivity. One is a so-called macroscopic way of comparison as measured in terms of gross or net product per worker in different industries by using national income and labour force statistics. The other is, so to speak, a microscopic way of comparison in terms of the value added per worker based on surveys of individual farm management and of business results of non-agricultural enterprises. It appears that the former way is adopted more frequently than the latter in this country. In using the latter way, more-

over, a question would arise as to what size of groups of farms or enterprises should be chosen for comparison purposes.

Either way of comparison faces a common difficulty of the existing different patterns of employment between agriculture and other industries. As is well known, agricultural workers are usually not able to work constantly throughout the year because of the seasonal nature of their labour requirements. Even if they are forced to be idle in farming for a fairly long period in a year, a certain number of family workers are normally being retained on the farm holding to meet the labour requirements in the busiest season. For this reason, agriculture is destined to have relatively more workers than other industries. Therefore, it would seem, some insist, more appropriate to express in terms of manhours for a comparison instead of the number of workers. It might also be important to take account of the quality of labour in view of a marked difference in the components of labour force between agriculture and other sectors. Nevertheless, sufficiently reliable statistical data on man-hours to be usable for comparison are not available as yet, not to speak of those on the quality of labour. Another point is that the concept of productivity would intrinsically be better expressed in physical terms. The absence of reliable deflators of gross or net product by industrial origin, however, has made it difficult to arrive at a precise macroscopic comparison in real terms. It is true that use of indices of labour productivity in different sectors would enable us to compare rate of change in the respective time-series with each other, but it would be unable to show the magnitude of the gap itself in levels of productivity.

Labour Productivity & Income Disparity

Productivity Gap Between Agriculture and Industry: In 1967/68, the net product per worker computed on the basis of both net domestic product and labour force by industrial origin, amounted to Yen 317 thousand in agriculture as against Yen 823 thousand in manufacturing. In other words, the former was

as low as 39 per cent of the latter. From Table 1, however, it may safely be judged that such productivity gap, though with annual ups or downs, has on the whole tended to narrow slightly in recent years. The narrowing gap, however, has primarily resulted from a steep rise in agricultural price relative to prices of manufactured goods. Between 1960 and 1967, the index of physical labour productivity in agriculture rose by 60 per cent (or 6.9 per cent annually), the rate of increase matching that of advanced Western countries. However, the corresponding rise for the manufacturing industry was much greater, reaching 90 per cent (or 9.6 per cent per annum).

Income Comparison

Of course, the low comparative productivity of agriculture is by no means directly indicative of disparity of incomes distributed to workers between agriculture and other sectors, since profits, reserves, dividends, etc. accruing to corporations and included in the net product of nonagricultural sectors hardly ever go to their workers, whereas virtually all the realized agriculture income goes to agricultural workers in this country. The comparison between agricultural income and industrial wages shows that in 1967/68 the average agricultural income per man-day worked out for farm households

TABLE 1

Comparative Productivity of Agriculture and Related Indicators, 1960 to 1967

	Net product per worker at current prices *			Indices of labour productivity** (1960=100)		Indices of Prices * (1960/61=100)	
	Agriculture	Manufacturing	Agriculture, as per cent of Manufacturing	Agriculture %	Manufacturing %	Agricultural Prices to Producers %	Wholesale Prices of Manufactured Goods %
1960	113	406	27.9	100	100	100	100
1961	124	466	26.6	105	110	109	100
1962	145	482	30.1	113	113	120	98
1963	162	550	29.4	117	124	128	100
1964	186	599	31.0	126	139	134	99
1965	218	625	34.0	133	144	149	100
1966	255	721	35.4	143	163	160	102
1967	317	823	38.5	160	190	174	102

Source : Economic Planning Agency: *National Income Statistics*; Statistics Bureau of the Prime Minister's Office: *Labour Force Survey*; Japan Productivity Centre: *Labour Productivity Indices*; Bank of Japan: *Index Number of Wholesale Prices*; Ministry of Agriculture and Forestry: *Index Number of Agricultural Production*, and *Index Number of Prices Received by Farmers*.

* Fiscal years beginning 1st April of the years indicated.

** Calendar years.

TABLE II

Ratios of Agricultural Income* to Manufacturing Wages** on
Per Man-Day Basis, 1960/61 and 1967/68

	Agricultural income per manday in Yen	As per cent of manufacturing wages				
		5 or more regular workers	5 to 29 regular workers	30 to 99 regular workers	100 to 499 regular workers	500 and over
National average 1960/61	525	62.0	96.9	74.3	61.3	43.8
Farm household 1967/68	1,632	87.0	116.2	100.7	86.1	68.3
Farm size groups excluding Hokkaido :						
1--1.5 hectare						
1960/61	527	62.2	97.2	74.5	61.6	44.0
1967/68	1,570	83.7	111.7	96.9	82.8	65.0
1.5--2 hectares						
1960/61	616	72.7	113.7	87.1	72.0	51.4
1967/68	1,765	94.1	125.6	109.0	93.1	73.8
2 hectares and more						
1960/61	811	95.7	149.6	114.7	94.7	67.7
1967/68	2,239	119.3	159.4	138.2	118.2	93.6

Source : Ministry of Agriculture and Forestry: *Farm Household Economy Survey* and Ministry of Labour: *Monthly Labour Survey*.

*Agricultural income per manday is obtained by dividing annual agricultural income on the average farm by total mandays spent on its family farming.

**Manufacturing wages per manday is arrived at by dividing the average annual total wage earnings by the average number of days worked per year.

was equal to 87 per cent of the average daily wage in manufacturing establishments employing five and more regular workers. In recent years, rising agricultural prices and decreasing labour input have brought about a substantial increase in agricultural income per manday, leading to a diminishing disparity with industrial wages (see Table II). Naturally, the level of agricultural income or industrial wages varies according to the size of farm land or the number of regular employees. In 1967/68, the average agricultural income per man-day on the farms with 1 to 1.5 hectares of cultivated land approximated to the average daily wage of small factories employing 30 to 99 regular workers; and the corresponding income on farms with 1.5 to 2 hectares or on those with 2 hectares and over of cultivated land was still 6 to 7 per cent below the average daily wage of medium factories with 100 to 499 regular employees or of large factories with 500 or more regular employees, respectively. The wage differentials of factory workers among enterprises of diffe-

rent sizes have recently tended to dwindle, reflecting an aggravating difficulty of recruiting young labour especially in the medium and small enterprises, but are still very wide as mentioned earlier,

It should be kept in mind that, no matter how high the agricultural income per manday may be, it is rather the parity of annual total agricultural income with yearly wage earnings in other sectors that would concern agricultural workers who include many short-time workers. In fact, the estimated agricultural income per head of fictitious full-time workers into whom the aggregate mandays of agricultural labour were converted on the basis of the number of days worked (averaging 280 days a year) of regular workers in the manufacturing industry, remained only 82 per cent of the annual wage earnings of the average factory worker in 1967/68. To attain such parity of annual income, it is primarily the scale of farming that matters.

Hyderabad Firm's Bonus Scheme Linked with Productivity

The Comprehensive Bonus Plan introduced by the Vazir Sultan Tobacco Company Limited, Hyderabad, has been a success, according to the Chairman of the Company, Mr. A. M. Lal. Addressing the 39th Annual General Meeting, he traced the genesis of the plan, and in doing so, he observed: "While I have spoken of productivity before, I would like to touch upon one aspect which is unique, and that is the workers' participation in productivity. Whereas many manufacturing units work on individual incentive schemes, and determine Bonus on the profits made, we hold the view that profitability under normal conditions is under the control of management, as employees do not participate in decision-making. They are, however, responsible for productivity. This thinking led some years ago to the creation of a comprehensive Bonus Plan, which has subsequently been modified and brought up-to-date.

"This Scheme incorporates a Productivity Payment Index for different levels of production. Workmen get advances each month against the Production Index, and the final adjustment is made at the time of paying out the Annual Bonus. This year, the Bonus amounted to over five months' basic wages. Rewards directly linked with Productivity are eminently sensible, and the added benefit is that this Bonus covers not only machine-operators, but also all non-management employees in the plant and office. Apart from the monetary aspect, the Scheme gives the employees a greater sense of dignity and involvement in the Company's production plans."

Assessment of Quality Programmes In Developing Countries

By

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Quality Reliability is the theme of the Asian Productivity Year-1970. In India, as in several other countries of the Asian region, it has been a tremendous task to create an awareness, among managements, of the importance of quality. "The problem is acute by itself", say the authors, "more so for a developing country with a sellers' market sheltered by import restrictions." The three typical case studies presented here have an important moral, particularly for developing countries, and in presenting the problem the authors state that "even a mere recognition by top management that there is a real continuing need to relook into and assess objectively its quality problems, programmes, and policies from time to time is in itself a significant step forward in the direction of a breakthrough in modern Quality Management."

IN a developing country with a sellers' market sheltered by import restrictions, complacency has often prevented managements from recognising quality problems, and the need to resolve them employing modern QC methods. Only pressure of crises or similar cause has compelled the attention of some of them to review their quality problems, programmes, and policies.

A few studies, typical of the many the authors encountered in the course of their work in the companies, are presented in this paper. These studies have brought out an urgent need for arousing a positive attitude in the managements for continuous review and audit of their quality programmes and modernising them. The question in such a context is posed as to how to accelerate the pace of the QC movement without waiting for crises to develop.

Presented below are three typical case studies having an important moral to convey, particularly to developing countries.

CASE I

The Director of a factory, producing industrial and medical equipment, invited a group of Quality Control Specialists, and desired them to answer :

- (a) How effective are the activities of Quality Control in my plant?, and
- (b) Can its working be improved, and if 'yes', how?

The factory, of medium size, is producing precision industrial and medical equipments with an annual turnover of about \$ 1.33 million. Short-run jobs are characteristic of its production. The plant with overseas colla-

boration has reportedly established a reputation for the quality of its equipments.

There are 11 Sales Branches in the country which in a way form the first line customers. The branches inspect the equipment again for quality, and the defects and rectifications in them are relayed to their Director, who, in turn, transmits these to the Factory Director. The branches also provide field service and report similarly the complaints from the ultimate customers.

The Factory Director is proud that the field complaints on quality have not been many—less than one per cent of the equipment marketed. The defects and rectifications from the branches have, however, caused some concern to him from time to time.

It is against such a background that the questions were somewhat confidently posed by the Factory Director.

Steps Taken

At a meeting of all the Divisional Heads and the QC specialists convened by the Director, the Plant Manager circulated a Note, which suggested certain study areas by the specialists' team. In the discussions that followed, divergent opinions were noted both on the nature of quality problems in the plant, and the studies thereon. Strong views were, however, expressed that raw material and bought-out components accounted for many quality problems.

Arising out of these discussions, it was finally agreed to constitute a Diagnostic Study Group, including the Chief Inspector and Production Manager, and pilot an exploratory Quality Audit to identify the areas for special studies in depth.

The Audit comprised: (i) a questionnaire (Annexure 1); (ii) analysis of company data as well as fresh data collected; and (iii) discussions with the various operating Divisions which included purchasing, marketing, and costing.

Based on the above, a Check List (Annexure II) identifying the specific areas was drawn up, and depth studies were launched. The constitution of an ad hoc committee of the plant Manager, the Chief Industrial Engineer, with the team members enabled expeditious completion of the tasks of the team in about three weeks.

Outgoing Quality: About 40 per cent (major and minor defects) of some of the equipment did not meet with the requirements. Considerable differences existed from branch to branch in the standards of inspection, and also between the factory and the branches.

Final Inspection & Assembly: Hundred per cent inspection is carried out on all product characteristics. Audit, however, showed the following defects on a few key products:

Products Type	% Defective	% day-to-day variation
A	23.2	10.2 to 34.1
B	22.0	12.3 to 28.6
C	10.6	1.3 to 18.5

In-process Inspection: Most of the gauges were worn out. Patrol checks during production were carried out arbitrarily on 50 to 60 per cent of the items. Capability studies with respect to about 40 components showed that in more than 80 per cent of the cases, the machines could not meet the drawing tolerances. Concessions were frequently allowed, but not all documented. Reliable scrap assessments were rendered difficult because of unaccounted losses. Arbitrary cutting and machining allowances frequently resulted in the production of components either in excess or deficit from the anticipated targets. Reworks were not systematically recorded. The assessment of setting scrap, machine resettings, etc., was rendered difficult as there was no record.

Raw Materials: The data recording system was inadequate. Vendorwise information was not available. The sampling and acceptance

procedures employed were defective, and inefficient.

General Observations: Operator consciousness of Quality was inadequate. While inspection at the final stage was excessive, the inspection of incoming materials and components was insufficient.

Sources: Coming to the sources, it was noted that (a) no specific internal acceptance standards were available for most of the equipments produced; (b) goals were not set forth for various quality losses (scrap, defects, wastes, safety allowances, etc.); (c) the responsibility for the prevention of defects was not clearly specified as between production and inspection; and (d) no apparatus for feed-back or follow-up existed.

Management Appraisal & Actions

The results were first discussed with the factory Director, and was followed up by a meeting with all the Divisional Executives. The findings of the team, described above, which provided an answer to the first question of the Factory Director, were considered in detail, and the need to reorganise the QC system in the Plant was agreed to.

Coming to the second question, the team had prepared a list of recommended suggestions for improving the QC system which included (a) Formulation of clear-cut Quality Acceptance Standards; (b) Establishment of Quality Audit Cell; and (c) Setting up of goals for internal losses (scrap, defects, wastes etc.).

The Management accepted the recommendations, and set up Working Groups and an implementation Committee to proceed with the tasks ahead.

CASE II

There is the case of another factory producing bearings. It is a mass production plant with an annual turnover of Rs. one crore. A fifth of its products is exported, and, like the former, has overseas collaboration,

The Plant Director is happy that there are not many quality problems, as his is, unlike a Job shop, a mass production plant laid out mostly for standard bearings. Problems of machine loadings and setting, patrol checks on quality, etc., are reported to be not serious.

Inspection strength accounts for about 10 per cent of the manufacturing group. A 100 per cent check is carried out on all the bearings at final inspection. About 20 per cent to 30 per cent of intermediate products are snap checked, and at two of the machining stages a cent per cent check is instituted.

The Director, in view of an expansion project, desired to know from external QC specialists —

- (i) how effective was his existing Inspection Department, and
- (ii) to what extent the reinforcement of the Department was necessary to take up additional load.

To answer these, the QC specialists set about their task commencing with a Quality Audit in the Plant. Discussion meetings were held first with the top, and, next, with the middle management executives to seek their views on the effectiveness of current quality activities in the factory. Opinions widely varied both within and between levels on the status of Quality Activity. Arising out of these discussions, three quality audit teams were formed, including in each of them executives of Departments. A Questionnaire (Annexure 1) was also employed to compile a comprehensive picture of the QC Department's work. The audit itself lasted for about two weeks.

Here again, contrary to the beliefs of the management, the operating results showed that about 32.5 per cent of the outgoing bearings had defects (both major and minor); machine scrap widely varied from 3.9 to 18.3 per cent; almost one fifth of the products both in the standard and the special production lines was reworked (No documents were available

on reworks or concessions allowed); the machine downtime for 'Quality reasons' was almost 40 per cent; customer claims on a few types were fairly high—4 to 5 per cent of their turnover, though the overall claims settlements were assessed at 0.5 to 0.6 per cent of the sale value.

Tracing the major reasons, the teams observed: (a) The inspection was mostly pre-occupied with segregating good from bad products; (b) No clear-cut responsibilities or procedures existed for preventing defects; (c) The areas of quality losses were not clearly identified, and goals were not set forth for various quality losses (scrap, defects, wastes, etc.)

The results pointed out that (i) there was an urgent need to reorganise Inspection as a QC Department with redefined functions and appropriate structure to step up its effectiveness, and (ii) the existing strength was adequate *after reorganisation* of the department, to meet all the needs of the expansion, without any addition—an observation which caused considerable surprise to the management.

CASE III

A third example is of an Insulator Factory. Against an installed capacity of \$7 million, the present annual turnover was \$3 million or a saleable output of about 42 per cent only of the kiln output. The Director seemed concerned about this low yield; along with the Senior Executive he attributed the low yield to the raw material—clay—though ready remedies were not available.

He was, however, concerned with the stream of customer complaints on the dimensions and visual defects from the field. The situation was all the more puzzling to him, as he had a QC Department with responsibility for 100 per cent checks not only on the finished but also on the semi-finished insulators.

In this context, he invited QC Specialists and posed them the question: "What is defi-

cient in my present Quality set-up which prevents us from getting full assurance that the quality shipped is O. K.?"

The Specialists commenced their task with an evaluation of the field as well as the internal product quality status. As in the earlier cases study teams were constituted. The teams conducted comprehensive quality audits both of the products and the functions of the QC Department. The steps and the procedures employed were nearly the same as in the previous cases.

The results showed that (a) about 25 per cent of the insulators were passed under concessions particularly for dimensional deviations; (b) there were no documents either of actual dimensions or concessions granted; and (c) overchecks and feedback were almost non-existent.

It was noted that in-plant corrective action was all that was required to eliminate practically all these complaints.

While the Director's question was thus answered, the investigations concurrently brought out revealing results in respect of low yield: (a) About a tenth of the in-process losses was unaccounted; (b) Kiln Scrap—about 50 to 70% significantly varied from shift to shift, car to car and between one product type to another; (c) About 20% were retouched for repetitive defects; and (d) Operator to operator differences were significant.

The results showed that action on the above within the plant can step up the yield by another 40% (raising the yield from 40 to 80%) using the same clay—earlier believed to be the culprit for low yield.

Need for Breakthrough

These cases, as already stated, have an important moral to convey, particularly to developing countries. They are typical of many more encountered by the authors in the course of their work in companies, where the

managements had felt that all was well with quality. While the managements at least raised the questions in these cases, in most others complacency has prevented even that curiosity. Even a mere recognition by top management that there is a real continuing need to relook into and assess objectively its quality problems, programmes and policies from time to time is in itself a significant step forward in the direction of a breakthrough in modern Quality Management. How best to arouse the awareness of managements for such a positive need to have their Quality programmes and achievements audited for their own and the country's benefits still remains a formidable task. The problem is acute by itself, more so for a developing country with a sellers' market sheltered by import restrictions.

ANNEXURE I

Assessment of Quality Programmes Questionnaire Items

Company : XYZ

I. Position and structure of the QC Department—

II. Primary responsibility for:

(a) Defect prevention during production—

(b) Prevention of defective products from being purchased or accepted—

(c) Prevention of Defectives from reaching customers—

(d) Improvements of product or process quality—

(e) Reporting to management regarding product and process quality.

III. By which group* are the following functions carried out :

* 1. Inspection; 2. Quality Control; 3. Inspection and Quality Control in one group; 4. Industrial Engineering; 5. Materials Control; 6. Production Planning and Control; 7. Production; 8. Purchasing; 9. Research and Development; 10. Reliability. (Add remarks, like, received little attention, not defined, etc.).

(A) Physical Inspection of

1. Purchased material
2. Manufactured parts
3. Metallurgical, Chemical, etc. nature
4. Finished products

(B) Reporting of Quality

1. Quality Audits
2. Quality Ratings
3. Vendor rating
4. Customer complaints
5. Action reporting
6. Quality Costs
7. Basic paper work (appraisals, evaluation, follow-up)

(C) Studies using statistical techniques

1. Sampling inspection
2. Experimentation
3. Process capability studies
4. Charts

(D) Gauge Inspection & Control

(E) Taking corrective action

(F) Studies to reduce cost

(G) Reliability studies

(H) Quality assurance

(I) Vendor approval

(J) Systems & Procedures

(K) Scrap and Rework evaluations

(L) Disposal of non-confirming material

(M) Creating quality consciousness

(N) Liaison with Government and other outside inspection agencies.

IV. Relations of QC with other Departments.

V. Evaluation of results of Quality Control:

- (a) Measurement of
- (i) Routine Control charts and sampling inspection procedures;
 - (ii) Product and process improvement studies;
- (b) Do you expect the results of quality control to reflect on your Balance-Sheets?;
- (c) Cost savings from quality control programmes (Quote specific cases).

- downtime, deviations in standards, and un-accounted losses;
- (b) Evaluate the actual current situation by pilot studies on two key items;
 - (c) Conduct machine capability studies for as many components as possible;
 - (d) Explore limits and fits;
 - (e) Develop a model list for Quality checks with reference to two of the key items;

ANNEXURE II

Checklist items for QC Depth Study

Company XYZ

Time schedule: 3 weeks

1. Final Equipment:

- (a) Audit and Evaluate the Quality of outgoing equipment—cover two vital items in each of the industrial and medical equipment categories. Draw the items from the finished products stores;
- (b) Compare and analyse the branch and customer complaints;
- (c) Analyse the value and defect priorities for claims, returns, damages;
- (d) Classify the defects—assess if inspection differences exist—cover two key equipments. With reference to medical equipment, analyse measurement characteristics;
- (e) Assess the significance of standards, procedures for testing, etc., with reference to two key items.

2. Final Inspection, Assembly & Sub-Assembly and Machine Shop :

- (a) Assess the overall quality losses for the six months ended—reworks, scrap, wastes,

- (f) Scrutinise generally the quality reporting and feed-back systems and in particular with reference to one of the items;

(g) Sample and its gauges in everyday use;

(h) Analyse concessions, history and proceedings;

(i) Formulate the basis for Inspector deployment with due consideration for job precision, their quality history and machine capabilities.

3. Raw Materials and Bought Out Components :

- (a) Examine the adequacy of current recording system of inspections;
- (b) Snap audit a few bought out components and material in relation to the quality and nature of inspection;
- (c) Carry out Vendor Analysis for a few major items; and
- (d) Snap survey of the QC systems of one or two key suppliers.

4. Inspection Department : Examine the goals set-up, its place, structure, composition, strength, nature of responsibilities, budget, etc.

Reference

1. Dr. I. Oshikawa - *Vile* proceedings of the All-India Conference on Quality, 1967, ISI, Calcutta.

APY-1970

Essay Contest for Supervisors and Foremen

The National Productivity Council (NPC) invites Supervisors and Foremen to write Essays/Articles, not exceeding 3,500 words in length, in English or Hindi, on the following topic:

**WHAT I HAVE DONE TO IMPROVE PRODUCTIVITY AT MY
WORK CENTRE THROUGH ELIMINATION OF WASTES
AND INCREASING THE VALUES OF THE OUTPUT**

2. The following prizes are offered :

First Prize : (One) Rs. 300 with a Certificate

Second Prize : (Three) Rs. 100 each with a Certificate

Third Prize : (Ten) Rs. 25 each with a Certificate

3. Entrants to the contest should be employed in any industrial or other organisation in the capacity of a Supervisor or a Foreman for not less than two years.

4. Two copies of the Essays/Articles, neatly typed or written, should be submitted through their respective Heads of Departments. All articles submitted will become the property of NPC, and will not be returned.

5. The results of the contest will be announced early in January 1971. The decision of the NPC on all matters pertaining to the contest shall be final.

6. The envelope containing the Essays/Articles should be superscribed "Contest for Supervisors and Foremen," and reach the

Assistant Director (Coordination)

National Productivity Council

38, Golf Links, New Delhi-3

on or before July 31, 1970

Coordination Through the Secretary

By

KN Sapru

Chairman, National Small Industries Corpn. Ltd.

COORDINATION is a word very difficult to define and still more difficult to put into effect. Its scope is very wide, but fortunately its meaning is well understood. I should, therefore, particularly like to focus attention only on coordination as an administrative and managerial process.

To my mind, this process is best illustrated by taking the example of a machine. A machine is composed of several parts, which move in various directions and ways. Such motion, however, is regulated and synchronised, so that the parts are made to mesh with one another. It is this meshing together that leads to production and it is the meshing process that is called coordination. An industrial organisation, likewise, is composed of many departments, units and cells, all of which perform their particular roles. The task of the coordinator is to make their activities mesh into a meaningful and purposeful whole. Coordination is, therefore, the binding force tying together the various managerial functions of planning, organising, and operating. It is the synchronising of effort from the standpoint of time and sequence of execution. It is the common element in all managerial efforts. Authority arises from responsibility. Responsibility is discharged through leadership. Leadership is multiplied through delegation, and defined through delineation of functions. Coordination is the process of tying together or synchronising of all efforts of management. The Chief Executive Officer is usually the supreme coordinating authority in the enterprise. Human relationships spring from human understanding, and the beginning of all relations is then the meeting and

knowing of people. Good relations in an enterprise come from carefully planned coordination of common activities and objectives. It is only through coordination that the Chief Executive Officer—the leader—can face and overcome the effects that the external and internal influences impose on the life of the concern. The external pressures arise from a variety of factors like State policies over which he has no control. Likewise, internal pressures develop from inside the company from unforeseen occurrences, or from policies which have been established in good faith. Price competition, better quality goods, better after-sales services, more effective advertising—all of them, gives rise to pressures of various kinds. Changes in the standards of living, wage rate change of fashion may affect sales volume International occurrences, like tariff changes and currency fluctuations, may affect sales and financial soundness. The chief executive officer must so perform his intricate job of coordination as to ensure that the standards set are not too high or too low. He must mediate and decide when differences of opinion or judgement are apparent, and he must be prepared to initiate other means of reconciliation when his personal intervention is not desirable or possible. It is up to him to decide when coordination can be best secured by establishment of new objectives, policies or procedures, by the delegation of new responsibility or authority or by the withdrawal of authority and centralisation of command of the activity.

In an organisation, the scalar chain constitutes process of coordination, through which

the coordinating authority operates from the top throughout the entire organised body. The scalar process becomes effective through (i) leadership, (ii) delegation, and (iii) functional definition. The clear identification and effective integration of functions completes the cycles of coordination in organisation practice.

A communication system is a pre-requisite to effective coordination. There are three directions in which communication should flow in any human organisation: downwards, upwards, and sideways. We must not just think in terms of problems, techniques, media and information system, but must consider the people in industry who are talking, arguing, and negotiating—in other words, the communicators. The objectives are the central points of plans and operation, and must be developed and defined clearly before we set out to accomplish them or suggest the lines on which coordination is to be done.

The Committee is a common device for achieving effective coordination amongst various units, in divisionalised organisation, or in large plants. In order to solve an immediate problem, managers frequently have to deal horizontally with their peers and diagonally with people at different levels who are neither superiors nor subordinates. To follow established formal routes would be too time-consuming and costly. It is the chief executive officer's task not only to recognise these undefined relationships, but also to make them work definitely and smoothly. Once the discrepancy between organisation and technology has been recognised, steps must be taken to integrate the two by one or more of the following methods:

- (i) Change the technology to conform to the existing organisational structure;
- (ii) Change the organisation so as to define and formalise the relationships with technology; and
- (iii) Maintain both the existing organisation and existing technology, but introduce mechanisms to reduce or minimise the discrepancies between the two.

Widespread use of the highly developed and specialised techniques for rapidly processing a large amount of information, and then its application to decision-making problems reduce the coordinating activities made outside the chief executive function. It is only reasonable to expect that all such specialised analysis and techniques are coordinated before they are put into effect. The chief executive can largely accomplish coordination through use of committee meetings, personal staff, and specialised staff assistance. The Committees do help carry out the responsibilities of coordination, and generally consist of principal line and staff heads. They meet periodically to counsel, advise and coordinate objectives, programmes, organisational changes, use and expenditure of funds and other operating matters brought before it. It is an interesting point to ponder over whether or not worker representative should be invited to attend, as it may result in getting real cooperation and coordination among the entire plant group.

Role of Secretary

The secretary of any industrial or commercial enterprise is preeminently the coordinator of the organisation besides being the link-pin between the policy-making organ, viz., the Board of Directors, and those to whom it is given to carry out those policies, viz., the executive.

Much depends also on the size of the company. The larger the organisation the more specialised do managerial functions become, and the more numerous are the levels in the line of command. The more difficult, therefore, is the task of ensuring that all are working to a common policy and pulling in the same direction. This is the essence of the Secretary's task as coordinator.

Further, coordination demands not merely that all executives on the same or different levels are pulling together, but also that the right kind of specialist advice is made available to them before managerial decisions are taken. It is on the Secretary that this responsibility devolves. The Secretary has a pivotal position

in a company whether it is in the private sector or public sector. The Companies Act casts upon him responsibilities for compliance with its various provisions. Various Returns are to be filed with the Registrar of Companies and other Government Departments within the prescribed time, and the meetings of the Board of Directors or Shareholders are to be called and certain resolutions passed in a particular manner. He acts as a link between the policy-making body, i.e., the Board of Directors, and the Top Executives. The various proposals and plans needing consideration of the Board of Directors pass through his hands, and the decisions taken thereon are again conveyed by him to the Executive concerned. In this function, whether the Secretary ought to act as a Postman or he should have a soul of his own is a debatable point. The argument in the former case is that the proposals going to the Board are drawn up by Departmental Heads who are specialised in the subject, and therefore, the Secretary could not be allowed to meddle with their notes prepared for the consideration of the Board. On the other hand, the same argument is given to justify that the Secretary of a company who also acts as a Secretary to the Board must act as a conscience-keeper of the Board. He, being an officer uninvolved in any specific operation, can impart objectively to the proposals by bringing out some more vital information which either gets withheld as a deliberate action or inadvertently. Particularly in a public enterprise, the part-time Directors have no financial stake in the organisation, and have little time for detailed scrutiny, and, therefore, their decisions tend to be taken on whether information is circulated to them. According to this view, the Secretary must examine, get elucidations wherever necessary, and satisfy himself as an agent of the Board before including the proposal in the Agenda for the consideration of the Board, and in that event he must accept responsibility for factual and correct presentation of the case.

Public & Private Sectors

What I have said so far applies equally to the role of a Secretary in private and public

enterprise. There is, however, an important distinction between the two types of enterprises which the Secretary has constantly to bear in mind. This distinction lies in the difference in motivation. Both private and public enterprises serve the public by producing goods or providing services as economically and efficiently as possible. But, whereas in public enterprise service is a direct and conscious purpose, in private enterprise service is incidental to and a by-product of profit-making. There is, or should be, no conflict in a public enterprise between the social purpose set for it and the largest profits compatible with the social purpose. But in private enterprise such a conflict is not only possible, but virtually inevitable. This is because the maximisation of profit does not necessarily give rise to the maximum public benefit; the more so if the enterprise is operating in conditions devoid of competition. In the performance of his role as coordinator, the Secretary must take care to ensure that the pursuit of profit does not obscure the social purpose or militate against its achievement.

Equally the Secretary must guard against the danger of the enterprise developing into some kind of "Managerial Empire" in which officials enjoying the security of tenure, characteristic of the civil service, become apathetic about the social purpose they are supposed to be pursuing, and even become overbearing in their attitude to the public.

There is, or used to be, a popular misconception that a public enterprise should be allowed to pursue its social purpose uninhibited by the commercial constraints that characterise private enterprise. This view is not correct. In the actual running of a public enterprise, sound commercial policy has a definite meaning and place. A public enterprise, like any other enterprise, should endeavour to minimise the cost of production, and strive as far as is compatible with the social purpose to make the concern pay its way. Economic viability, however, should not be given undue emphasis. In an underdeveloped country, it may be necessary to run the enterprise at a loss, even for prolonged periods. Such losses have to be balanced against the actual or potential gain to the economy as a

whole. It is the needs of the economy, long-term and short, as conceived by the authorities responsible for the development programme, that must take priority. It will be the Secretary's task to steer a course between these opposites so as to achieve the maximum public good at minimum cost.

Internal & External Coordination

There are two types of coordination—internal and external. As regards internal matters that need to be coordinated, they are diverse, and cover a wide range. Broadly speaking, they include:

- (i) Relationship between the executive headed by the Managing Director and the Board or any other supreme body;
- (ii) Internal structural organisation;
- (iii) Procedures and supervision;
- (iv) Personnel; and
- (v) Labour relations.

It is absolutely important that the relationship between the executive and the Board, of which the Secretary is the bridge or the go-between, should at all times be harmonious and cordial. To achieve this, the Secretary should ensure that the Board restricts itself to its policy-making function, and does not interfere in matters of managerial detail. The implementation of policy lies in the hands of the chief executive, and there it should stay. The Secretary is called upon to report to the Board the performance of the executive in giving effect to its policy. In the discharge of his duty he should pay the maximum regard to factual accuracy, objectivity, and clarity. Misunderstandings can easily arise over a loose word or phrase, particularly where the subject is a controversial one.

On internal structural organisation the Secretary's role as coordinator is to see that as far as possible the same pattern of organisation is adopted through the enterprise in all its

branches, units and sales, subject only to modifications necessitated by differences in the nature of work, local conditions and circumstances. All large enterprises tend over the years to evolve a standard organisational structure best suited to their needs. As far as possible the standard pattern should prevail, since it is convenient from the administrative point of view. At the same time, organisational patterns adopted elsewhere which are considered more conducive to economy and efficiency should also be kept in view.

Under personnel fall such matters as recruitment, training, promotion, assignment and use of specialised technicians, incentives and morale, pay systems, and so on. The Secretary will be guided in all such matters by past experience and practices, and his coordinating function will be to see that departures from them are made for good and proper reason. There should, of course, be no hesitation on the part of the Secretary to put forward ideas gathered from other enterprises which occur to him and promise better results.

There are next the external matters to be coordinated by the Secretary. These may, for convenience, be considered in three groups:

- (i) Relations with Government.
- (ii) Relations with other enterprises.
- (iii) Non-Government relationships.

Of all the enterprises' relationships with the Government, the financial one is of key importance. The Financial Advisor is primarily responsible for the conduct of relationship, and the scope for coordination by the Secretary is perhaps limited. Finance from Government may take the form of an outright grant, or equity capital or loans, or a combination of these. Each form has its own merits, and its own suitability will depend on the nature of the enterprise and the prevailing policies of the Government. Whatever form finance from Government might take, it will be subject to various conditions and stipulations which must be fulfilled. For example, Governments' prior approval is necessary to the declara-

tion of dividends from the profits earned. It will be for the Secretary to ensure that such approval is obtained at the suitable stage. Similarly the matter of payment of interest and repayment of loans, the Secretary should coordinate by seeing that the prescribed time-limits are not crossed except with good reason.

Personnel Management also impinges on the enterprises' relationships with Government at various points. In India, complete freedom to hire and fire, to promote and demote, or to establish grades and pay-scales has not been conceded to the management of public enterprises. The limitations imposed by the Government are fairly stringent, and it is mainly in their observance that the Secretary's role as a coordinator is attracted. Demotion, for example, being a punishment, can be awarded only after due compliance with the established procedure and after giving the person concerned an adequate opportunity to be heard. These procedures have acquired in India almost the sanctity of law and the Secretary through whose hands all such cases pass is usually the repository of information and precedents.

A public enterprise necessarily develops a series of complex relationships with firms on the public and private sectors which function as its suppliers and customers and sometimes its competitors. The smooth functioning of such relationship can be facilitated by the Secretary in his role as coordinator by arranging for mutual consultation at suitable levels and before differences of opinion harden into irreconcilable stands.

Relations of the enterprise with the public are of vital importance for managerial and employee morale. Strictly speaking, one should distinguish between relations with the public, i.e. the general body of the citizens and relations with *its* public, i.e. those who are consumers of its products and services. The approach to each will be different, and the Secretary has ample opportunity and scope to influence the public relations effort of the enterprise in the right direction.

The Secretary's special responsibilities include compliance with the requirements of

various laws—the Companies Act, Labour laws, and fiscal enactments of all descriptions—and personal contacts with the appropriate personalities in the various Ministries enable him to keep abreast with the latest developments in the sphere of policy. Such liaison work is of immense help in order to coordinate the activities and policies of the enterprise with those of the Government. The public enterprises being financed from the public exchequer become the business of all tax-payers and their elected representatives in Parliament. The Members of Parliament and public in general get easily influenced by any adverse comment which may rightly or wrongly come to be circulated. It is, therefore, very necessary for a Company Secretary to coordinate favourable opinions for his enterprise and to change any hostile opinion. In order to do so he should be in close touch with the Administrative Ministry, and feed them with regular information so as to keep them fully informed of the day-to-day activities of the enterprise and not be caught unawares on any occasion.

Conclusion

In concluding this article, I must sum up that coordination is the very breath of efficiency of an enterprise, and plays an important role in achieving the objectives set before it.

This Could Have Been Avoided.....(I)

In the Mettur Workshop, Mettur Dam, a workman who was not fully conversant with the operation of a carpenter's revolving saw (electrically operated) worked in the machine without the knowledge of superior officers, and met with an accident by cutting two of his fingers.

This reflects the inquisitiveness of the individual to work on the machine without knowing its working details. — S. S. MANI, Papanasam Project.

Modern Management Techniques & Their Application

By

Jyotirmoy Banerjee

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In this paper, the author has drawn attention to the complex man-machine systems confronting the managers today—systems where they look for quick, precise, and effective methods to arrive at decisions in all spheres of activity. According to him, “scientific techniques contribute only partly to the needs of management. Human judgement, understanding, and volitional choice fill in the balance for an effective guidance, direction, and control of activities in achieving the desired results.” The author points out that “although management is sure to become an applied science in the near future, one should not consider the various new techniques as wonder-drugs, and be carried away by the charlatanism dressed up in mathematical parameters, unless of course these are tested and applied within the spectrum.” He adds: “Strikes and gheraos are epidemics that cannot be kept out of doors. What is required is to face the situation threadbare with a little humanity, patience, and humility, and lead the people towards the common goal of greater productivity, security, and higher standards of living.”

IN this age of steadily expanding business, the management executives have to operate on the highest order of environmental couplings with shrinking time at hand. The problems generally faced by them are so complex, intertwined, and dynamic in nature that unique solutions are hard to find, and the optimal solution is the nearest approach to the prediction of results within the domain of technical, economic and political feasibility. Guess work, rule of the thumb, and blind flying methods are gradually being replaced by modern techniques that quantify the real situations in terms of different forms of mathematical models of quick perception, effective decisions, easy evaluation, and control. No matter how complex the system is, it can be represented by a function of the form:

$$E=f(C_1, U_1) \quad \dots \quad \dots \quad \dots \quad 1.1$$

where E is the measure of the system's effectiveness or performance; C_1 are the controlla-

ble aspects of the system, and U_1 are uncontrollable aspects of the system.

Science and technology are continually evolving methods to reduce the uncontrollable aspects to set patterns for predicting the most likely solution under the evaluated risks.

Till the end of the 19th century, management was considered to be a skillful and disciplined approach to the accomplishment of objectives. F.W. Taylor first introduced the concept of scientific management, and applied successfully the analytical techniques to shop production methods. Grantt refined the techniques, and stressed the human aspect as the vital point in the man-machine systems. Mathematical, psychological and sociological techniques were developed independently, but their impact on industry was felt most in World War II, when the systems concept was developed and an interdisciplinary approach to the deci-

sion-making process was considered inevitable. A host of sophisticated techniques are now successfully applied to real life problems in the different spheres of management activity under the broad heading of Operations Research.

The techniques are either classified according to the problems of sub-optimisation (allocation, programming, sequencing, inventory, emplacement, competition, and others) or according to the areas of activity (finance, procurement, physical distribution, facilities planning, manufacturing, project scheduling, marketing, personnel, transportation, research and development, and others). A more general classification would be as follows:

1. Isomorphic model techniques;
2. Mathematical Programming;
3. Statistical;
4. Electronic Data Processing;
5. Simulation; and
6. Quasi-mechanistic.

ISOMORPHIC MODEL TECHNIQUES:

These are the deterministic models to depict the real life situations on numerical or schematic notations for gaining insight, discovering significant variables, devising means of improvement, and for control. Since the classical work of Lanchester³, several iconic, analogue, or symbolic models have been developed. Physical scale models are utilised in Facilities Planning. Schematic models are used for Production Planning and Control. Graphic charts indicate business trends. Standards, formulae, and monographs are used in work measurement, accounting, and cost control. The basic tool utilised is either analogy or simple mathematical computation.

MATHEMATICAL PROGRAMMING

TECHNIQUES : Mathematical programming techniques are generally applied to production processes where the various scarce resources are allocated to obtain some given or alternative outputs. These techniques are further classified as: (a) Linear Programming; (b) Geometric Programming and (c) Dynamic Programming.

(a) *Linear Programming* (T.C. Koopmans⁴ & G. Dantzing⁵): This methodology is used where

some objective function is to be minimised or maximised, while at the same time satisfying the various restrictions (equalities or inequalities) placed on the potential solutions. Problems of mixing, job assignment, capacity allocation, production scheduling, transportation, and purchasing are the common areas of its application. Simplex method is applied where slack variables, real or artificial, are found to exist. For extensive problems, computers are used to reduce steps.

(b) *Geometric Programming* (C Zenner⁶): This technique is utilised for problems in which constraints are non-linear. It is based on a generalisation of arithmetic-geometric mean inequality. It has great potentialities in engineering design and systems analysis.

(c) *Dynamic Programming* (R. Bellman⁷): It is used in multi-stage decision processes where a sequence of choice has to be made, and each choice, made from among two or more possibility either maximises or minimises some predefined objective function or criterion function. Here, time is introduced in the statement of a problem. Problems on replacement, optimum inventory location and control, production smoothing, and long-range policies are handled by this technique. Because of manipulation of a large amount of information, an electronic computer becomes more or less indispensable for solving such problems.

STATISTICAL TECHNIQUES (W.A. Shewhart⁸): Such techniques are based on the laws of probability and applied to stochastic processes where management is interested in knowing the maximum likelihood of a decision being correct and the risks involved (because of random variation of quantity, quality, and cost of output) within some kind of limits. A few of them are noted below:

(a) *Sampling Techniques* (H.F. Dodge⁹): In many industrial problems, where chance variables show a definite pattern, it is possible to draw inferences about the output based on less than complete information. Such information is tapped from time to time to arrive at a defi-

nite conclusion about the output economically. The procedure may be random, random-stratified, or systematic. The technique is universally employed in controlling the quality, or process. Other fields of application are the determination of production cost, accident rate, labour turnover, absenteeism, machine breakdown, and the reliability of a product. The Work Sampling technique is used for the determination of idle time and labour strength.

(b) *Industrial Design* (R.A. Fisher¹⁰): The technique is used to pinpoint quantitatively and at a minimum expense the significant causes of variation resulting in out-of-control process by randomising one and deliberately varying others. By permutation, it is possible to isolate those factors which contribute to the observed variation in other than random fashion. Also, tests can be performed to detect any inter-action between the factors. The two powerful tools are the statistical inference and analysis of variance. Such techniques are used in the establishment of production standards, quality of incoming materials, and in cases where decisions are to be taken from limited data.

(c) *Queueing Theory* (A.K. Erlang¹¹): It is used where several incidents line up randomly, and await clearance in some specific way, as in communication systems; and in the flow of information, product, work and people in a plant. Its use has also been extended to more complex cases like customer priority or machine interference¹². The technique basically works on the assumption that the waits increase indefinitely as the utilisation of service channels increases towards unity; and the probability that there are various sizes of waiting lines, tends to become a reality.

(d) *Game Theory* (J. von Neumann¹³): It deals with strategies in repeated competition where end results are more or less predictable, such as in bidding tenders, or in Market Research. The pay off matrix is decided first, and the choice is optimised by the minimax criterion.

(e) *Search Theory* (B.O. Koopmans¹⁴): This technique is of recent origin. It is used for

directing efforts to areas where indications show that results would be fruitful. Its principles are found useful in advertising, sales, and marketing.

ELECTRONIC DATA PROCESSING (A. Ottinger¹⁵): With the help of an electronic computer, the technique offers a standard disciplined approach to the recording of a massive amount of factual data arising out of the day-to-day problems, and provides the management executive with a meaningful information, through sifting, for effective decision-making. The steps involved are: collection of data; processing (sorting, collating, calculating and summarising); and comparison with expected values, past performance, and provision of guidelines for decisions which may serve as inputs to subsequent cycles. Symbolic Logic¹⁶ is used to deal with the information flow to computers, and to manipulate logical formulae for clearer thinking in a host of alternative combinations. More powerful, complex, and expensive equipments are being developed to ensure savings through decreased processing costs, and pay off at situations when timely information is needed for a course of action. Burrough's 'Datatron', Ferranti's 'Pegasus', IBM 65, 701, 1420, Sperry Rand 'Univac', and other types of machines are now available for computer programming and solution by techniques discussed earlier.¹⁷

SIMULATION TECHNIQUES (F.M. Recciadi¹⁸): This methodology is to set up first a stochastic model of a real situation, and then perform sampling experiments upon the model to obtain the essence, without operating upon raw data. Basically five different techniques have been developed: (a) Monte Carlo; (b) Systems Simulation; (c) Operational Gaming; (d) Industrial Dynamics, and (e) Net-work Analysis.

(a) *Monte Carlo Technique* (G.E. Forsythe¹⁹): This technique is used in problems that involve uncertainty, where the variables cannot be represented by standard probability distribution curves, or where they involve interactions of a number of probable events. The sample values are developed through the use of some random-number generator, and used to represent

observations in the real world. Such a technique allows more flexibility in the analysis than is permissible by other rigorous mathematical computations. It is particularly helpful in job allocation and sequencing problems. Integer Linear Programming (Gemory²⁰) is a special algorithm generated out of this technique.

(b) *Systems Simulation* (J.Moss²⁰): It utilises a computer of the type Univac 1103 A, and aims at a total-system simulation for designing better systems, understanding the workings of the operative systems, and studying the decision making process itself, in man-machine operations. Such a technique has been found helpful in complex inventory control and distribution problems on broad-scale projects.

(c) *Operational Gaming* (C.J.Thomas²¹): This is different from the theory of Games in the sense that the end results are unpredictable. It is generally utilised in complex operational environments, or in competitive situations of several companies seeking the same or similar goals. The market picture in such cases is based partly on the combined action of the companies in the industry. Such problems arise in the distribution of the finished goods or in optimal routing of salesmen. The executives take independent decisions simultaneously to meet the strategy, and on a common place reveal their choices and transfer score from one to the other on the basis of some mutually agreed upon pay off function.

(d) *Industrial Dynamics* (J.W. Forrester²²): It utilises mathematical models for analysing the stability and fluctuation of an industrial system. It has closed loop information feedback characteristics, and it incorporates linear, non-linear, or random decision functions to convert them to actions, which, in turn, are fed back into the system for improved analysis. The notation of a 'black box' operator is basic to the development of the system. The concept has been utilised in replacement and maintenance problems.

(e) *Network Analysis Techniques*: Network techniques are used in the design, co-ordination and/or control of engineering projects, where

scheduling is involved. These assist the analyst in recognising and identifying the relationships existing amongst the components of the system, and in evaluating them at any stage of progress for corrective action.

The Critical Path Method (Ford Fulkerson²³) is one such technique. It is used for planning, scheduling, estimating, and controlling projects. The prerequisite in the use of such a system is that the estimates of time are established before the project is undertaken. The entire system is depicted in the form of a network diagram with all information incorporated in it. The path followed through critical jobs in the project diagram determines the total project time.

In Research and Development, and in other facets where there is no established system for doing the task, Programme Evaluation and Review Technique (Navy²⁴) is used. This is based on the concept that, within the time allowed for any programme, the resources and performance specifications may vary within definitely known limits. All pertinent activities are sequentially indicated in the network diagram, and the time forecast made for each activity leading to an event. The estimate may be either most likely, or optimistic, or pessimistic, depending upon situations. The flow network with its coded events are fed to an electronic computer for programming and computing slackness. Resources can then be reallocated from the slack areas to evolve a critical path for meeting the end objectives in time. Alternatively, the maximum probability of achieving the task within the scheduled data can be determined.

QUASI-MECHANISTIC TECHNIQUES: These are used where human beings are deemed as operating elements or components of the system, whose behaviours are by and large unpredictable. Such elements become vital spots of attention for internal and external co-ordination, in order to stabilise business on a dynamic footing. Its aims and objectives are to understand the behavioural pattern of the people, and minimise losses due to error or

differene of opinion. Biomechanics, Human Engineering (Chapnis²⁵), and psychometric methods (L.L. Thurstone) have been developed to guide the management in the design of man-machine systems, selection and fitting of personnel, and in the measurement and control of human error. Gaming techniques are also utilised to a limited extent in the making of a prudent choice for an optimum pay off in a dilemma.

Achievements

Continuous efforts are being made in practically every field of management activity to translate physical problems into ones that follow systematic logic for design, coordination, and control. In the control system, multi-characteristic Q-charts have been developed to monitor a number of continuous quality characteristics upon one control chart²⁶. Selective sampling is now used either to reduce the simulation effort for a given level of accuracy of decision-making or to increase its accuracy with a greater confidence for a required amount a simulation effort²⁷. Regenerative stochastic methods have been used in inventory control problems where random opportunities are available for replenishments in case of irregular demands²⁸. Markov chain model has been developed to control the output quality of complex productivity processes having many quality levels or aging type of failure, and to recommend periodic plants to minimise the corrective action costs²⁹. For continuous production processes, the multilevel continuous sampling plans like H 106 or MLP-RS have been devised for more effective controls.³⁰

In the field of Industrial Engineering, non-parametric Statistics like Kolomogorov-Smirnov and Krushal-Wallis techniques have been applied in the work measurement of activities having unknown distribution functions³¹. In the work measurement of indirect labour, where a number of variables interest, the multiple linear regression analysis³² has been found useful. The work sampling technique has been considered to be a powerful tool in handling manpower requirements. In cases where job variables cannot be measured on a continuous

scale, the LP-MR techniques have been used.³³

In production planning and allocation problems, different programming methods have streamlined the decision process. Linear programming is used in the allocation of production of varying qualities to meet orders demanding certain performance levels³⁴. Integer linear programme has been used to solve problems on capital budgeting, travelling salesmen, multiple choice, and machine interference³⁵. Geometric programming has simplified the problems of non-linear systems, for instance, in finding out the optimal component proportions that are completely independent of fluctuating prices and unit charges³⁶. The dynamic programming approach has been followed in obtaining optimal production schedules of job processes under the manufacturing progress function³⁷. Further, this technique has been employed in finding out the minimum travel distance between a set of demands and facilities for a new equipment to be located.³⁸

Computers have renovated the management decisions in the different facets of business. Computer systems like Huges, Fairfield, Texas Instruments, and Western Electric have been developed to provide dynamic information flow to discrete part production scheduling³⁹. Similarly, plant layout⁴⁰, maintenance system⁴¹ and forecasting replacements⁴¹ requirement⁴² and myriads of other problems are now handled by computers⁴³.

The balancing of assembly line with variable work elemental times have been solved by the Heuristic Method⁴⁴ or the Ranked Positional Weight Technique⁴⁵, with certain reservations. Precedence diagrams assist in visual interpretation⁴⁶. The computer has eased out the interpretations where the learning curve continually shift the balance problem to different points⁴⁷. Network flow algorithms have been used in machine-loading problems⁴⁸, project costs⁴⁹, flexible cost optimisation routines⁵⁰, and in handling systems⁵¹. Decision models can now be developed in computer language⁵².

Techniques are now in progress to deve error proof reporting procedures.⁵³ Q

programmes are now being developed to determine attitudes and reasons for differences in attitudes between groups.⁵⁴

Conclusion

Although management is sure to become an applied science in the near future, one should not consider these new techniques as wonder drugs and be carried away by the charlatanism dressed up in mathematical parameters, unless of course these are tested and applied within the spectrum. Continuous vigilance is required, and adjustments have to be made to suit the dynamic situations. Further, one has to tap judiciously the resources, and apply these techniques to the complexities of real life situations, in order to avoid the pitfalls inherent in mathematical models.

The successful executive today is in a better position to distinguish the real from the casual differences, the substantive from the illusory resemblances. He is more exact in the analysis and synthesis of systems, and more practical in execution.

The challenging task in the form of quantifying and monitoring human factors in systems still remains. These, sometimes, prove disastrous and mar the very existence of the organisation. Strikes and *gheraos* are epidemics that cannot be kept out of doors. What is required is to face the situation headbare with a little humanity, patience, and humility, and lead the people towards the common goal of greater productivity, security, and higher standards of living.

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Vikram Sarabhai on

Ways to Fulfil Expectations Aroused by Green Revolution

... Unless planning, management and organisation are put on a sound basis, there is little hope of our fulfilling expectations aroused by the green revolution. A physicist studying the properties of matter has to understand what happens when he attempts to produce a deformation or a change by applying force. He knows the difference between elastic deformation and inelastic changes. In the first, as soon as the force is released, the body returns to its original state. But in the second, when the limit of elastic deformation is exceeded, a permanent change is produced, which maintains itself even when the applied force is no longer present. It is important to assess the minimum critical effort required to produce a permanent change, for it is not as if with small effort we can produce a small change. When we have, as in this country, many desirable things to accomplish, and large areas to be covered with limited resources, one is apt to regard that spreading effort widely, even though thinly, is the most sensible thing to do, since it appears to satisfy a social objective. In fact, what we generally do, through such a process, is to stall completely the take-off, so that historical and unorganised rather than consciously planned factors determine the unfolding of events.—Dr. Vikram Sarabhai in "GSFC News".

Workers' Participation in Israel

By

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In developing countries, the need to stimulate workers to a sense of participation in the continually changing set-up of modern industry is a vital part of industrial relations. This paper discusses the various forms of workers' participation at the plant, union, and national levels in Israel, and emphasises the importance of extensive preparatory work before introducing any form of participation. The author points out that it is difficult to speak of any one formula of participation, and says it should be based on constructive participation in the production process. He concludes that the "Israeli experience is particularly relevant as it does reflect a situation of a rising standard of life and increasing technical development, where participation has been effectively maintained. With all the questions that arise out of the involvement of the labour movement in economic development, both at the national and enterprise level, there is no doubt that the importance of this participation cannot be exaggerated."

THE use of the term "workers' participation" in this paper encompasses all forms of motivation that give the worker a sense of belonging and identification with the decision-making process. It is not limited to any particular technique or formal framework. On the other hand, it is impossible to cover the subject comprehensively and analyse it in depth within the limitations of a single paper. It is only possible to review some of the forms of participation existing in Israel, and to try to draw some lessons and conclusions from these experiences.

With the development of industrial enterprises during the last decades, there has been a parallel growth in appreciation of the worker and his role in economic development. The earlier concepts of "Economic Man" have given way to a greater understanding of the drives and motivations of men at work. Research in the behavioural sciences has contributed to a deeper understanding of the motives of the individual

and has led to the evolution of modern organizational theory. The complexity of human motives has been studied and we have gained insight into the comparative importance to the individual of different material, social and intellectual drives. The former dominant concept that the basic motive for the man at work was economic gain has had to be re-evaluated.

Major Factors

The sense of participation by the worker in the entire production process, his need to communicate and to be motivated by leadership, rather than by merely responding to orders, are now considered as major factors in the study of organizational behaviour.

The changing appreciation of the worker and his needs has been paralleled by increasing social awareness on the part of both management and the State. Social welfare has become

a basic item of political policy and the ideals of democracy find forms of expression in the industrial scene.

In the present period of rapid technological progress the worker's response to change has often been determined by fears of a loss of income and security and by changing job conditions which implied a loss of traditional skills and a decline in social standing. The pressures that developed have led to the concept of workers' participation as a means of moderating the adverse effects of technological change and of reducing the consequent tensions. The concept involves the bringing of the worker into an active participative role in the production process and does not refer to a purely formal statement of co-operation, in a general sense. Workers' participation has become a valid subject for social research, and agreement is being reached regarding the basic factors operating. Emphasis has been laid on identifying the motives for such participation, and these may be grouped as being:

- (a) social values, emphasizing cooperation as a component of social and political ideology.
- (b) economic motives where the worker has an interest in the benefits of increased productivity and a rising standard of living.
- (c) technological motivations arising out of complex and inter-dependent technical processes which require the use of know-how taken from different areas.

Participation at Macro-Economic Level

In Israel, we may observe a whole gamut of forms of participation. The origin of some was motivated by social and political values, others were initiated through economic or technological motivations. Although the country is small, analysis of local experience is valuable since participation exists at different levels and in different forms.

The role of the Trade Union Movement, on the national level, has been determined by

the unique circumstances that led to the establishment of the State of Israel.

In most countries the Trade Unions' major concern is in protecting the workers' interests and in making demands for an increased share of the benefits of industrial production.

The emphasis of the trade union in Israel took somewhat a different form as there was no employer "class", and, in fact, few actual opportunities for employment. The trade unions—The Histadruth—while being a component of the National Movement, evolved a distinct social and political ideology. Accepting a role of responsibility in building the country, the Histadruth established industrial plants and farming communities so as to create employment, and to build a viable social structure. With social values dominant, emphasis was placed on maintaining acceptable work relations, job conditions and salary rates in these plants. Vocational training would be available to prepare the worker for his restraint on salary differentials between differing skill levels in industry.

This type of motivation, in expanding development, did not always meet the objective and economically rational criteria of evaluation, but was made possible by protective measures taken at that time.

These economic activities of the Histadruth have given the trade union movement a relatively strong position in Israel, but with continued growth, different elements and social values have appeared in Israeli society and considerations of economic rationality are being given their due weight. These changing circumstances have created areas of tension, and the Histadruth has had to re-evaluate certain basic concepts. Because of its relative power position the Histadruth has found itself without any countervailing balance. Dominating, as it does, entire sectors of the economy, the Histadruth has had to exert self-discipline in retraining its demands on the economy as a whole.

The position of the Histadruth, and the nature of its dominant social orientation, had

*For reports of research in this field, see especially Bellecombe & Walker "Workers' Participation in Management", Bulletin No. 2, February 1967, and No. 5, November 1969, (I. I. L. S. Geneva).

led it to be a direct partner in other areas of the national economy. It is represented at various levels of economic planning, and, in particular, participates in the sectoral committees which include representatives of management, employers, Government, workers and professional specialists.

These committees have the responsibility of evaluating Industrial Branches with the aid of future trends in product development, competitive capacity with respect to imports, manpower development, and investment policies. This implies, of course, participation by workers, through their representative bodies, in the most critical aspects of economic growth.

In addition, the Histadruth is concerned in meeting the vocational requirements of a developing economy and maintains extensive training facilities.

The development of Israeli industry and the growing complexity of the economic system has created a realization on the part of the Histadruth that it must become a partner in stimulating technological development. This attitude is evident in many instances, the most notable being its partnership in the Productivity Institute, promoting advanced production methods and techniques. Another example of this approach can be seen in the activities of the "Automation Committee" established by the Histadruth, with the objective of studying the social and economic implications of the subject so as to make the transition less difficult.

This central position of the trade union movement at the national level and the acceptance of the social responsibility that this involves has created a dilemma for the unions. Histadruth leadership has more than once found itself in conflict with the rank and file over such questions as wage stability, labour mobility, and manpower requirements.

This duality of interest may find expression in many instances. Although in favour of labour mobility at the national level, the

Histadruth finds itself supporting such principles as security of tenure which restricts the transfer of redundant personnel while protecting the less efficient worker. A further case may be when union leadership emphasizes the need for rational work measurement and finds itself opposed by workers at plant level interested in maintaining the advantages of the *status quo*.

This dilemma becomes even more acute, considering the political structure of the trade union institutions. The high degree of centralization in the trade unions does not make the problem less difficult. This situation tends to hamper the maintenance of trust and communication between the rank and file members and union leaders, and has led to "wildcat" strikes.

In spite of these conflicts, the Histadruth's participation at the macro-economic level contributed significantly to industrial progress and the acceleration of technological change. The Israeli worker has increased his productivity by some 5% to 6% each year for more than a decade now. Although there are some instances of maintaining redundant labour, in no case was there opposition to the introduction of new equipment or processes.

Future technological developments, the need for greater specialization, and acceleration of the pace of change will require more extensive and effective communication between the leadership and rank and file of the trade unions. The existing conflict between the responsible long-range economic outlook and the immediate demands of workers at the enterprise level might become more acute. To alleviate this difficulty, the unions will have to extend training and develop more extensive programmes designed to discuss with the workers the implications of the economic scene.

Participation at Enterprise Level

The social values and ideological motives mentioned above influenced, to a great degree, forms of participation of workers at the level

of the individual enterprise. We shall attempt to describe some of these forms.

For the purpose of this discussion, we shall distinguish between different types according to the degree of participation which exists. We shall use the following categories :

1. **Direct ownership, where the workers own jointly and directly the means of production.**
2. **Indirect, non-remunerative ownership, when the enterprise is owned by the trade unions.**
3. **Participation in management, where the workers participate formally in the management of the enterprise.**
4. **Consultative participation, where workers are involved, through their representatives, in consultative capacities in the decision-making process.**
5. **Participation through the sharing of financial rewards which can take a form in combination with any of the above.**

Direct ownership can be found, especially in the cooperative movement, both in the agrarian and industrial sectors.

Cooperation in Agrarian Sector

Perhaps the most extensive pattern of cooperation is to be found in the agricultural settlements—*moshavim* and *kibbutzim*. While varying in structure and social ideology, they give expression to the national ideals of productive labour, development, and social equality.

Motivated basically through ideological considerations, and demanding high levels of personnel involvement in these ideals, Israel's cooperative farms have achieved a synthesis of social and economic development that is unique.

In the case of the *kibbutz*, industrialisation has also developed in recent years. Numerous *kibbutzim* have established industrial plants while retaining their cooperative nature. These plants are run by managerial staff, appointed by the settlement membership, and responsible to it—the other members serving as rank and file workers.

While there are great differences in the quality of leadership in these cooperatives, there are many which are distinguished by a high level of managerial skill and readiness to accept innovations. Rationalisation of work procedures, techniques such as linear programming, participation in managerial training programmes—all find their place in this sector of the economy.

Recent Studies

Recent studies of the subject indicate that these settlements remain the most receptive and dynamic enterprises in the economy with respect to introducing new technologies in both agriculture and industry. The increase in productivity of this sector is higher than any other in Israel, but the motivations operating are not only those related to their social ideology. These settlements, unable easily to mobilise manpower which meets the requirements of their unique communal life style, have been forced to turn to greater mechanisation and technical efficiency so as to make progress.

A closer examination of this form of cooperation shows that a complex of problems does exist. We shall enumerate several of these:

The first problem faced by these enterprises is that of limitation of size. The capacity for growth of the cooperative venture is mainly determined by the availability of members. If the problem is overcome by the use of hired labour, this produces a strong ideological conflict. Some industrial ventures within the *kibbutzim* have tried to overcome this problem through having the hired labour participate in the ownership of the enterprises. Experience is too limited to draw any conclusions.

Another problem is that of professional manpower within the cooperative structure. Where the cooperative principle of periodically electing management is strictly adhered to, the professional quality of the operation is impaired. On the other hand, the present

tendency is to re-elect competent management, and thus a managerial class is evolving.

One further problem is that with the passage of time the ideological commitment weakens, and questions of placement and human relations arise.

Yet, in spite of these problems, the agrarian cooperative movement, based on ideological values, has proven its viability. In future, it will find it necessary to develop attitudes and techniques which will bridge the demands of advanced technology and competitive economy with the values of the cooperative system.

Cooperatives in Urban Sector

In addition to the agrarian sector, there is a wide network of the type of cooperation in production, distribution, and consumption that is found in other countries.

Many of these cooperatives have been in existence for several decades, and are to be found in all areas of the economy. These cooperatives cover such fields as public transport, industrial production, marketing and credit financing.

Some of the problems facing this type of cooperative are similar to those evolving in the agrarian cooperative movement, namely those of professional management and of limitation of size and capital.

Many of these cooperatives were established without the ideological commitment of their members. In these cases, friction and operating problems led to the dissolution of the cooperative. Statistical surveys over the past twelve years indicate that the number of new cooperatives was only slightly higher than the number which went out of existence during this period.

Where these cooperatives were established under ideological stimulus, problems have usually been overcome. The strong commitment to the social values underlying the cooperative movement provided the motivation to adjust to the needs of professional

managerial techniques and technological change, without abandoning valued principles. However, with the passage of time, there is some weakening of ideological and social cohesion.

With technological development demanding high levels of managerial and technical skill, the existing cooperative structure will come under increasing pressure to maintain a dynamic and feasible response to these demands. Whether such a response will be made remains to be examined.

A further form of participation, at the enterprise level, is that of indirect ownership. The trade union movement itself is the owner of a wide range of economic enterprises, and membership of the movement implies a share in ownership of these plants. While workers in Histadruth concerns like the Koor and Solel Boneh complexes do have a formal right of ownership, this, in fact, remains abstract for most of them. Studies of the subject indicate that workers in these plants do not strongly identify with them. Their expectations are primarily focused on improved economic conditions, and are not concerned with questions of ownership or management.

Ad Hoc Agreements

These Histadruth plants have succeeded in fulfilling certain critical social and economic roles—especially in making available employment, and in maintaining acceptable job conditions. However, problems at the managerial level have developed, particularly since the commitment to ideas of social welfare and political ideology has restricted the operation of economically rational criteria of performance. The need to avoid overt conflict between management and men, in these plants, has produced compromises and *ad hoc* agreements which are not always in the best economic interests of the enterprise. In certain cases, the political loyalties of management in the enterprises was of higher importance than economic performance. This situation has not been conducive to the development of managerial cadres. Only in recent years has the

trend been to introduce professional management, and to emphasize the profit motive in these plants.

Experience thus indicates that purely formal patterns of enterprise ownership do not give the workers a sense of participation. Break-downs in communication between men and management occur, and identification with the plant and its problems remains low. The trade union movement recognises this problem and is now in quest of other forms of participation so as to strengthen the sense of identification of the workers with these enterprises. One of the steps taken is that of bringing workers' representatives on to Boards of Directors.

Participation in Management

It is perhaps surprising to note that in a country such as Israel, with a strong labour movement and traditions of social participation, there are few cases of workers' representatives being seconded to managerial functions. Participation in management as a concept has often been held abroad to be the most effective technique that might be adopted.

This is not the case here, and it will be difficult to describe all the reasons for the failure to make wider use of this technique. The fact that the labour movement does have such a relatively powerful position in society has made management extremely reluctant to introduce direct workers' representation at the managerial level. The technique has been introduced into certain Government and Histadruth plants, but with limited success.

The question has been recently subject to research by Prof. J Tabb of the Israel Institute of Technology (see *Workers' Participation in Movement*, Haifa 1968). We shall refer to two examples in this study so as to indicate the complexity of the situation. The first is the case of the Israel Electricity Corporation. This corporation, old established and one of the country's largest employers, is a government-owned public utility.

Although launched as a new orientation in labour relations, management participation was introduced in this corporation in 1957, without full clarification of its objectives. This lack of clear definition was evident in conflicts of interpretation of rights and responsibilities that arose between Government, the workers, and the Histadruth. However, the Electricity Corporation was able to supply power to a rapidly expanding industrial and urban complex.

Organisational Changes

Immediately following the introduction of participation of workers' representatives in management, some significant organisational changes were made. During the period of participation, which commenced in 1957, new power stations were built, lines extended and productive capacity rose by some 27%. The corporation encountered significant difficulties in the effectiveness of its management, and in its labour relations.

Some of these difficulties are attributed to the method of introducing participation, having workers' representatives appointed to executive positions. Other causes are attributed to political power conflicts. The awareness of the problem encountered during this experiment has made management reluctant to make wide application of this type of participation.

The second case is drawn from the Histadruth-owned sector of the economy. The principle of workers' participation has been subject to continuous debate in the labour movement, and the official ideological stand taken is that this participation is necessary as an expression of the movement's values and of the sense of partnership.

One of the Histadruth's oldest plants—Phoenecia Glass—was selected for the first attempt to fully implement this principle. There was opposition by both workers and management. The workers suspected the step as an attempt at manipulative control, and management feared the loss of decision-making authority to inexperienced personnel.

The absence of clearly defined objectives and organisational structure, the lack of preparatory activities and communication breakdowns all led to limited results in this particular attempt.

It is difficult to draw any conclusions, especially as experience is still limited, but it is clear that merely bringing workers' representatives into managerial functions does not increase participation. Communication gaps arose and the lack of careful preparation produced adverse results rather than those expected.

Consultative Participation

Institutional consultative participation at the enterprise level takes two distinct forms. We shall not deal with the workers' shop committee which is an accepted element of consultation in all matters pertaining to planned changes in labour conditions. Other forms of consultative participations vary, and are generally well known. Such participation operates at different levels and includes both informal procedures, such as encouraging suggestion schemes, and the setting up of formal institutional bodies such as the Joint Productivity Councils. These councils are a feature of Israel's industrial relations system and have their origin in the early fifties. At that period of stringent economic conditions, prices were calculated and controlled on a cost-plus basis. Wages were frozen. So as to permit increased workers' income without upsetting wage agreements and stability, the Histadruth was instrumental in introducing productivity agreements. Joint Productivity Councils, with both management and men represented, were set up in numerous plants, with the task of increasing productivity and of introducing work measurement and incentive pay systems. It is interesting to note that employers, who were operating under the protective conditions of a cost-plus pricing system, expressed less interest in the scheme than did the workers who saw an opportunity of increasing their take-home pay.

Studies of the consultative mechanisms

indicate that where they have been introduced, subsequent increases in productivity have been considerable. The Joint Productivity Councils affected both workers and management, and stimulated the latter to introduce improved production techniques, better planning methods, and to increase machine utilization.

Although the original impetus has declined in recent years, and the Councils now generally restrict themselves to questions of incentive pay, the consultative methods that evolved did serve to facilitate technological change, to increase productivity, and to reduce friction.

In general, this experience has proven to be advantageous and should be positively evaluated as a tool for improving communication between workers and management, in the process of introducing technological change.

Sharing Financial Rewards

Bonus payment systems are used extensively in Israel, but there are few cases of share distribution or group bonus payments. This type of financial participation has lagged behind in Israel, since the setting of precedents in this sphere may upset the national wage structure. Wages are set at the national level and policy-making is a delicate and complex operation. Differentiation in the wage structure between individual plants is not encouraged at present. There is some pressure to change this attitude and certain enterprises have developed their own remuneration schemes. At least one experience of participation in sharing operational savings indicates that these methods require a strong management with extensive knowledge of the cost, thoroughly prepared so that they understand the change in orientation and accept the methods and communication mechanism which has to be developed and maintained to facilitate the functioning of such a system.

Conclusion

The need to stimulate the worker to a sense of participation in the continually chang-

ing set up of modern industry is a vital element of industrial relations. The economic and technological necessity for constant change on the one hand, and the instinctive resistance to change and the fear of the unknown on the other, require the development of open communications and trust between workers and management.

It is impossible to speak of any one formula of workers' participation. It should be based on constructive participation in the production process, and not lead to confusion over managerial functions.

Israeli experience in this field emphasizes the importance of extensive preparatory activity before introducing any form of participation. The need to develop supportive relationships, open communication and trust through inspired leadership is of paramount importance.

The increasing complexity of industrial processes will lead to greater managerial specialisation and the lack of appropriate skills will make the question of participation by workers often more difficult. In this sense the developed countries may find it particularly complicated to introduce participation while those whose economies are less advanced may find the situation easier. We feel that the Israeli experience is particularly relevant as it does reflect a situation of a rising standard of life and increasing technical development,

where participation has been effectively maintained. With all the questions that arise out of the involvement of the labour movement in economic development, both at the national and enterprise level, there is no doubt that the importance of this participation cannot be exaggerated.

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This Could Have Been Avoided (2)

While working in a 40-ton power press in the Mettur Workshops, Mettur Dam, the operator inadvertently pressed the foot pedal before taking out his hand after setting from the bottom die. As a result, the operating ram holding the top die came down, and his fingers were jammed in between the top and bottom dies.

This could have been avoided had interlocks been provided whereby the machine could not be started until the guard was fixed in position, or until the machine was safe to be operated.—S.S. Mani, Papanasam Project

In Lighter Vein:

My Fair Employee

By

T Pushpa Sampath

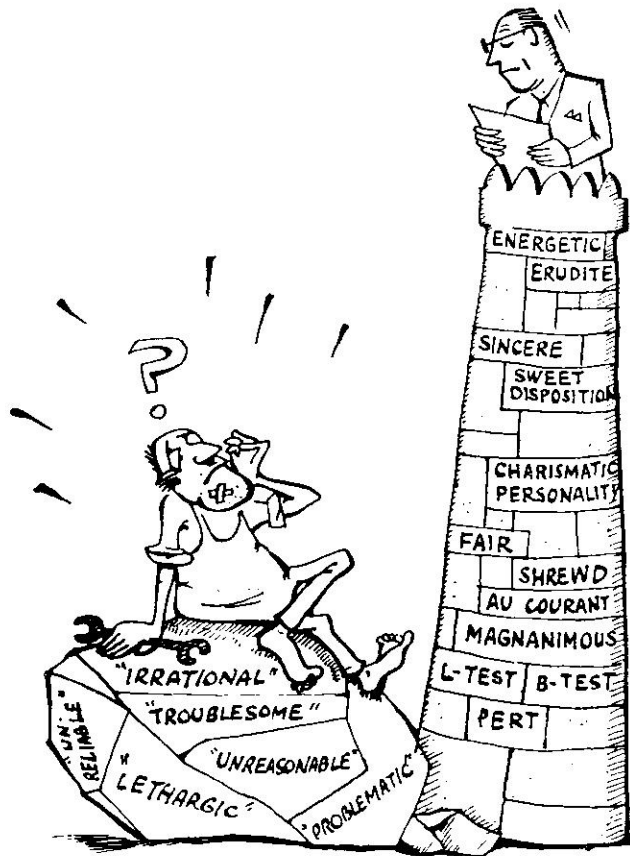
(With apologies, if need be, to Loewe and Lerner)

(If Mr Higgins, Professor of Phonetics, was a manager, and had occasion to observe the present-day employee-indiscipline, would he react? Certainly he would, rhetorically for sure.)

HIGGINS: I say, Pickering! Why can't an employee be more like us?

(Pickering looks at him startled)

Yes, why can't an employee be more like us?



...Why Can't an Employee be More Like Us?...

Employees are irrational, and just not facile.
 They're unreliable, unreasonable, and enigmatic.
 If anything, they're troublesome, lethargic, and problematic.
 Instead, Pickering ! why can't they be like us?
 We are energetic, erudite, and known for sincerity,
 And're endowed with sweet disposition and charismatic personality.
 Yes, we are fair, shrewd, *au courant*, and magnanimous.
 Rowan's plan, Halsey's scheme are on our fingertips.
 a test, β Test, L.P. & D.P., PERT & PART run in our veins,
 MAP, COPAC & CPM, OR & RAMPS we practise without a strain.
 Mosley's Needs and McGregor's Theory are the beats of our pulses.

(With abrupt rage)

It's a pity our employees are not productive;
 It's not, I am sure, for want of incentive.
 It's true they lack proper perspective.
 Isn't it despicable that they're ignorant of our objective?
 Oh! worse still, they don't have the spirit of innovation.
 Ask them of it, and the answer is, no recognition!
 And a vehement declaration that there's no motivation.
 Isn't it appalling that they're blissfully unaware of imagination,
 And totally ignorant of good communication.

(With subdued tone)

Pickering! Are you hurt if your boss does not adore your work?

PICKERING: Of course, not. I'm paid for it—I mean, for work.

HIGGINS: Do you fall sick or let others in your house, when your boss needs you most?

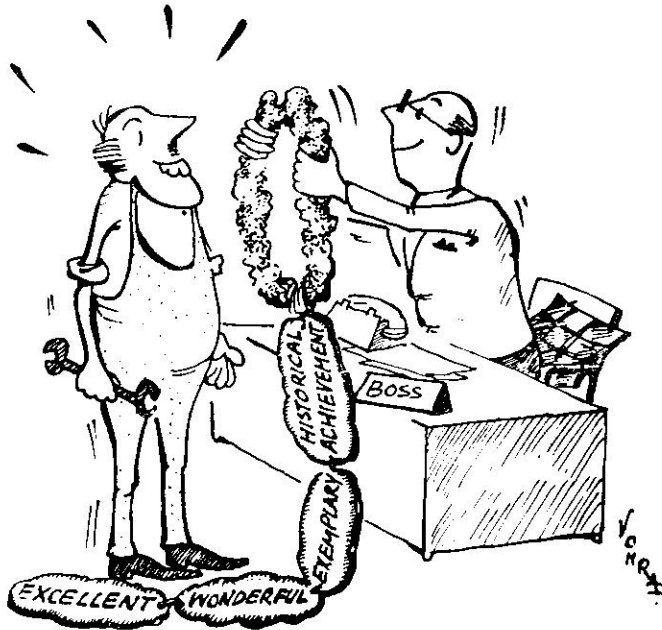
PICKERING: No, Never. How can I let him down?

HIGGINS: Do you resort to "Sit-in-Strike" or "Tool-down-Strike"?
 For any or every fatuous reason you can strike?

PICKERING: Of course, not; of course, not.

HIGGINS: And strike without giving due notice?

PICKERING: How can I? That would be illegal.



**“...Are you hurt if your Boss does not adore your Work?”
 “Of course, not. I’m paid for it — I mean Work”**

HIGGINS:

(Violently) Then why can’t an employee be like you?

(Gently) One employer in a million may shout a bit.

Now and then there is one who ‘slave drives’ or ‘flits’;

Or one, whose temper is short, may bully you a bit.

One, perhaps, may not be blessed with managerial acumen.

But, by and large, we belong to a marvellously affable circle.

Why can’t an employee behave like us?

We are so cooperative, good-natured, and kind;

A better boss and guide they never will find!

(Demanding) Pickering, if I give you a job to do,

Would you pass that buck to your underling to do?

PICKERING: Of course, not; of course, not.

HIGGINS: And not feel accountable for his errors by the score?



“Do you resort to “Sit-in-Strike” or Tool-Down strike for any or every fatuous reason?”

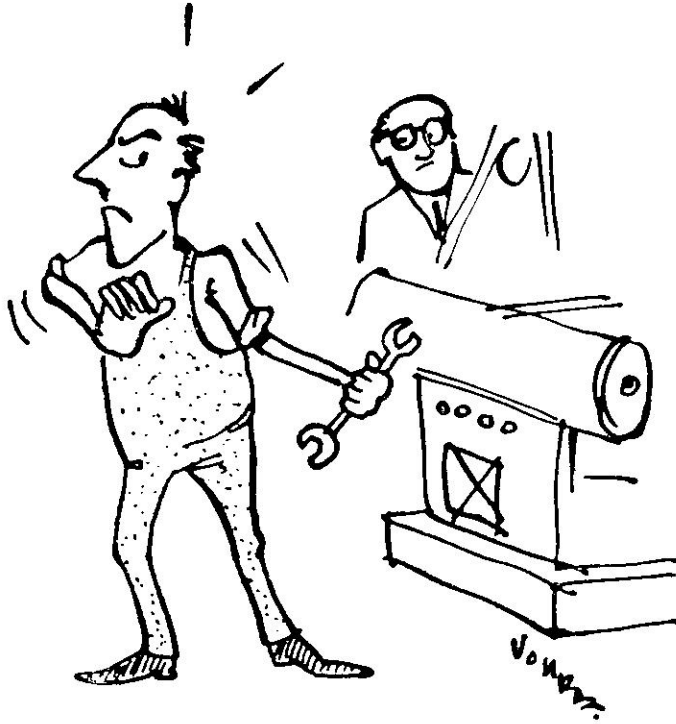
PICKERING: Nonsense. I ought to reap what I sow.

HIGGINS: Would you resent if I keep track of your progress?

PICKERING: Of course not, the pleasure would be mine. It’s my progress!

HIGGINS:

(Thundering) Why can’t an employee be more like you?
 He brands it ‘supervision’, and forgets the fact that I have
 ‘super vision’.
 Yes, he covets authority!
 Shirks commensurate responsibility!
 Invariably evades accountability!
 What’s more, he boasts of his indispensability.
 Pickering, are you perennially after promotion,
 With or without the requisite qualification?



**“He covets Authority,
Shirks commensurate Responsibility...”**

PICKERING: No, it would be shameful!

HIGGINS: Why can't an employee realise his limitation,
Instead of becoming the victim of frustration?

(Sweetly) I have *elan*, *esprit de corps*, and determination,
Zeal and the will to win that are necessary for high production.
I am capable of making on anybody a favourable impression.
Whether I write or talk I have good expression.

(Bellows) Why can't he be like me?
(and walks out hastily)

PICKERING: *(Nods thoughtfully)* How can it be possible? Isn't it
Like asking “Why can't a woman be like a man”?

APY-1970

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(B) Students of Science, Technology, or Engineering Subjects :

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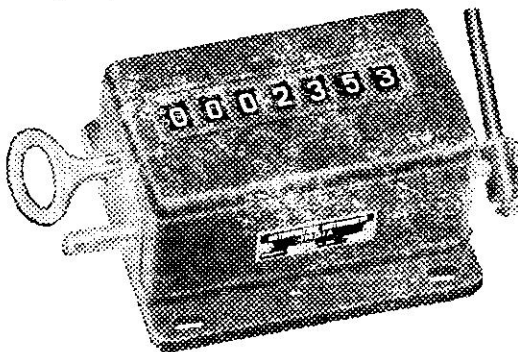
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MPS: Proponent & Agent of Change

By

George Catell

Director, Manpower & Productivity Service, U.K.

The British Government has adopted a new approach to increasing productivity and efficiency in industry, commerce, and the public service by setting up the Manpower and Productivity Service as a part of its Department of Employment and Productivity. In this paper, Mr. Catell considers the origins of the services, its organisation and operations, and its future prospects. The main task of MPS is to diagnose what is standing in the way of better performance, and then to prescribe a programme of reform. "It does not offer standardised solutions to preconceived problems; it does not proclaim universal doctrines; it does not peddle panaceas. . . .," he says, and adds that in its first year, MPS followed up 40 diagnostic surveys, though only in respect of four sufficient time had elapsed for the assessment of results. The reports in the four cases were particularly encouraging and, according to him, MPS has shown itself to be a proponent and agent of change.

THE Manpower and Productivity Service (MPS) of the Department of Employment and Productivity is a new approach by the British Government to the introduction of higher productivity and greater efficiency in industry, commerce, and the public service. It seeks to locate and remove obstacles to the more effective use of industrial resources, and to encourage the development of modern management techniques. Its main task is to diagnose what is standing in the way of better performance, and then to prescribe a programme of reform or reconstruction. Its services are available free of charge to all who wish to make use of them. It acts confidentially at the invitation of an industry, company, trade union or Government department, and in consultation with trade unions in appropriate cases.

When I was appointed to develop this new service, the department was already operating an industrial relations service through seven re-

gional offices and offices in Wales and Scotland. This enabled me to build on a well-established foundation. I was able to bring in, on short term engagements, managers from industry and officials from trade unions with a wide range of skills and experience to enlarge the staff of regional and national offices, and to establish a consultancy unit at headquarters. The service began operations in September 1968. Further staff has since been recruited during the year, and recruitment is continuing to cope with the growing demand for the service.

Five Main Branches

The MPS has now organised five main branches—a central consultancy unit, a central information service, a special industries branch and an administrative branch, all located at headquarters in London, and officers in the regions and in Scotland and Wales. In the out-stationed offices the Senior Manpower Adviser and his team of manpower advisers

numbering more than 100 in all, spend most of their time on advisory and diagnostic work. The 20 or so consultants at headquarters are available to support the regional staff, and to undertake long-term assignments of national character.

The central information service provides information for the other branches, and following the recommendation by the National Board for Prices and Incomes in a report on payment by results systems is collecting information on wages systems and productivity measurements. It is hoped that in the future this information can be made available to companies, trade unions, and other bodies. The special industries branch continuously follows up reports of committees of inquiry into specific industries, such as the Devlin report on the docks, the Cameron report on the printing industry, and the Phelps Brown report on the construction industry; and, with the aid of manpower advisers and consultants, overseas particular projects are carried out in these industries. The administrative branch supports the MPS officials outside, and is able to make available to them the wide range of services within DEP.

Joint Consultation

Requests for the services of MPS consultants and advisers come from a variety of bodies—from companies, employers' associations, trade unions, cooperative societies, nationalised corporations, Government departments, and local authorities—and may originate directly from these bodies or indirectly from NBPI recommendations, from incomes policy cases, from conciliation work, from employment exchange managers, from the Commission on Industrial Relations, and from the everyday contacts of manpower advisers with local firms. In some industries which have experienced particular difficulties, MPS has taken the initiative in bringing employers and trade unions together. In the jute industry, for example, it has helped to establish a voluntary negotiating structure which has made the continuation of the statutory Jute Wage Council unnecessary.

Working methods are flexible. A visit of

less than one day to a firm may be sufficient to help managers, or managers and shop stewards, to overcome an immediate problem. The need may be met by a manpower adviser drawing on his experience, or on the sources of information available to him, but there may be a need for a specific and detailed diagnostic survey. There were more than 3500 advisory visits of less than one day in the first eleven months of 1969. An analysis by size of firm is given in Table 1, and the subjects on which advice was given in Table 2.

TABLE 1
Advisory Visits of less than one day
by Size of firm
(1st Jan. 1969 to 30th Nov. 1969)

Firms Employing	Number of Visits	Percentage of Total
1 to 99 persons	632	18
100 to 499 persons	1,457	41
500 to 1,499 persons	837	24
1,500 persons and over	592	17
Total	3,518	100

TABLE 2
Subjects of Advisory Visits
(1st Jan. 1969 to 30th Nov. 1969)

Subjects	No. of Firms
Productivity bargaining, productivity, job evaluation and Work Study	727
Wage rates, wage structures, wage systems	762
Labour turnover, absenteeism, time-keeping, recruitment and selection	575
Industrial relations	522
Management and personnel policies and organisation	432
Training	206
Redundancy, grievance, and dismissal procedures; and other subjects	192

A straightforward diagnostic survey in a small company may require two or three mandays, while some of the larger assignments may require 20 to 30 mandays. In the first eleven months of 1969, 128 diagnostic surveys were completed and at the end of that period a further 119 were in hand (see Tables 3 and 4). The division of effort between less-than-one day advisory work and diagnostic work has been in the proportion three to two, but the trend is towards an increasing volume of diagnostic work, particularly for the larger firms and public bodies.

TABLE 3

Diagnostic Surveys Completed from 1st January 1969 to 30th November 1969, and in hand as on 30th November 1969, by Size of Firm

Firms Employing	Surveys Completed	Percentage of Total	Surveys in Hand	Percentage of Total
1 to 99 persons	13	10	13	11
100 to 499 "	54	42	42	36
500 to 1,499 "	34	27	30	25
1,500 " & over	27	21	34	28
Total	128	100	119	100

TABLE 4

Subjects of Diagnostic Surveys in Hand (as on 30th November 1969)

Pay and productivity issues	76
Management structure and control systems	12
Labour turnover and absenteeism	12
Job evaluation	9
Manpower planning and others	10

Consultants and advisers have undertaken assignments in firms in each of the 24 industry groups in the Standard Industrial Classification and have done work in industries as diverse as steel, chemicals, paper and board-making, saw-milling, quarrying, rubber, banking, insurance, aircraft and engineering. Assignments have been undertaken for clients employing from 40 to 20,000 people in the location studied. Most have been concerned directly with pay and productivity, and in several firms manpower advisers have presided at joint productivity committees. Some have tackled specific problems, but in many cases investigation has shown that the apparent problem is not the real one, and recommendations have been made to remedy a deeper malaise. It may be found, for instance, that employee dissatisfaction is caused by an inadequate wages structure which has failed because of inadequate management controls, and this failure may, in turn, be caused by defects in management structure and management policy.

Variety of Work

The following random list gives some idea of the variety of work the service has undertaken:

- Seasonal fluctuations in employment in a food-canning firm;
- Supervisors' salary structure in a food processing firm;
- production control procedures in a printing firm;
- operation of the personnel department of a plastics firm;
- establishing a management-services unit for a local authority;
- resolving a deadlock in a strike in a nationalised industry;
- optimum scheduling of buses for a local authority;
- re-structuring incentive schemes in a rubber firm;
- reviewing the effectiveness of the work-study department of a vehicle component manufacturer;
- analysing the profitability of an electronics firm.

How Service Operates

One assignment from among many may be picked out to show how the service works with

managers, trade union officials, and shop stewards. A plastics manufacturing firm in the south of England was taken over by a much larger company. The employees reacted by joining trade unions, and hopes of improving productivity were at hazard. In November of 1968 the company contacted the Regional Senior Manpower Adviser, who carried out a diagnostic survey. Following the recommendations made in the survey, managers, officials, and shop stewards began negotiations, and MPS gave continuous advice to all parties. After several months of negotiations agreements were reached which formally recognised the trade union, introduced a comprehensive negotiating and consultative procedure, established a new wage structure and converted the existing three-shift system into continuous working. Overtime was reduced, production increased, and wages rose. In a joint statement, the parties said: "We believe that with the help of MPS we have established a sound basis for raising productivity and equally sharing the results of increased output."

Generally, the cost-effective use of the taxpayers' money dictates that the service should limit its work to studying problems, recommending reforms, advising on the resources required to achieve the reforms and making follow-up visits from time to time. The service does not seek to install, monitor, and maintain specific systems, and, in this respect, its work differs from that of many commercial consultants. A diagnostic survey may recommend that commercial consultants should be engaged, and may suggest terms of reference for the engagement. Sometimes, however, it may be a worthwhile use of the service's resources to supervise or assist with a programme of reform over a given period and there are some firms, especially those in immediate financial difficulties, to whom it can offer help when a commercial consultant could not see a profit for his organisation.

Long-Term Project

One example of a long-term project is the evaluation of the jobs of university technicians. A joint steering committee under the chairmanship of an MPS consultant has directed 150

field-workers in the interviewing of a sample of 3,000 technicians in 14 universities. Another example is the work which has been done with a stevedoring firm in one of our largest ports to establish for the first time reliable measures of labour utilisation that could form part of the information for a comprehensive manpower forecast. For the Ministry of Public Buildings and Works MPS has surveyed possible improvements in the productivity of the directly employed labour force and helped to formulate and quantify a proposed productivity agreement and is carrying out similar assignments in the Royal Naval Dockyard, other defence establishments, HM Stationery Office, and the Department of Health and Social Security.

Since its formation one rather different function has been given to MPS. The Donovan Commission recommended that organisations should be encouraged to review their industrial relations procedures and register information with DEP. More than 300 companies, nationalised corporations and large local authorities, employing in all more than 6,000,000 people, have now been invited to register their agreements. The response has been good, and the information received is being analysed. The process is already helping to identify organisations in which there appear to be weaknesses in negotiating, consultative and grievance structures, and in which MPS and the Commission for Industrial Relations with whom the service is working closely, may be able to offer help towards making improvements.

One characteristic of its approach to its work is that MPS prefers to get on with the job in a positive way rather than talk about it, although 500 talks and lectures have been given. It does not offer standardised solutions to preconceived problems. It does not proclaim universal doctrines. It does not peddle pnaaceas. In background, training, experience, temperament and outlook its staff are so various that they could not subscribe to anything that might be called a philosophy, but they hold certain beliefs in common:

—there is a need to improve our industrial performance;

- while each industrial situation is unique, some operating principles and techniques can be discerned to be more generally appropriate than others and can be modified to fit differing situations;
- while industrial situations make intuitive judgment on intangible issues necessary, inevitable and economic, there is growing scope for the systematic study and quantification of operations;
- changing social forces and the balance of power in industry compel managers to recognise that they manage by the consent of their employees;
- while conflict cannot be totally eliminated, its social and economic consequences can be lessened by comprehensive agreements which licence the authority of managers and define rights, rewards and means of remedying dissatisfactions.

Encouraging Reports

The blunt question is, how effective the work of MPS has been in its first year. The easy,

but nevertheless accurate answer is that it is too soon to tell. It is for the customer to judge. Forty diagnostic surveys have been followed up, but in only four cases has sufficient time elapsed for results to be assessed. The reports in these four cases are particularly encouraging. In other cases, employers and trade unions have repeatedly expressed their satisfaction with the help given to them. Certainly there is a continuing and increasing demand for MPS services.

MPS enters its second year with a full workload. During the year MPS may find its work changed, expanded or contracted, linked or merged with that of other bodies, to give industry and commerce a better service and the taxpayer better value for money. But in its one year of life MPS has shown itself to be a proponent and agent of change.

65 per cent of Indian Soils Deficient in Potash

The emphasis on fertiliser use in all agricultural development programmes in India as well as in many fertiliser experiments has too often been mainly on nitrogen use, due to its quick and spectacular effect in increasing crop yields. The use of phosphate and potash to increase crop yields has received comparatively less attention in the agricultural development programmes. As a result, there has been hardly any improvement in the relative proportions of phosphate and potash consumed to the nitrogen consumed annually during the past 10 years.

In 1962, nearly 50 per cent of Indian soils were thought to be deficient in phosphate, while potash deficiency was believed to be confined to the soils of Kerala State only. In 1968, more than 65 per cent of our soils were found to be deficient in phosphate, and potash deficiency was found to be widespread in the soils of Kerala, Orissa, Gujarat, parts of Maharashtra, Andhra Pradesh, Tamil Nadu, Assam, Tripura and Punjab. This situation is likely to have been further aggravated by continuous intensive cropping with high-yielding varieties which remove large quantities of plant nutrients, particularly potash. Firm indications to this effect are observed in the recent experiments conducted at the Central Rice Research Institute, Cuttack, with high-yielding varieties of rice. They reveal that two crops of rice in one year remove 2 to 2.5 times more nitrogen and phosphorus, and as much as 4 to 4.5 times more potassium than the respective quantities of nutrients removed by the local improved varieties. Cash crops like sugarcane, tobacco, potato, cotton, jute, etc., are also heavy consumers of phosphate and potash. Balanced fertilisation of crops with nitrogen, phosphate and potash, as well as with secondary and micro-nutrients, wherever necessary, is absolutely essential if we are to arrest depletion in soil fertility, improve soil productivity, and increase yields on a sustained level. The experience gained in the agriculturally advanced countries like Japan, Taiwan, Israel, Holland, Germany, etc., where NPK Consumption ratios vary from 1:1:1 to 1:1:2, should serve as a guideline to us in highlighting the importance of balanced fertilisation.—From Fertiliser News



BOOK REVIEWS

TRADE UNIONISM IN INDIAN PORTS: Michael V.D. Bogaert, Shri Ram Centre for Industrial Relations, New Delhi, 1970, Pages 196+xx, Rs. 25.

The Sri Ram Centre for Industrial Relations is an independent, non-profit, research organisation which has been undertaking studies facing management, labour and society in general. The present publication dealing with the problems of trade unions in the Indian ports is the third in the series put out by the centre.

The book is the result of a study conducted by Father Bogaert in part fulfilment of the requirements for a Master's Degree in the University of Wisconsin. It has grown out of the interest the University has displayed in the study of labour movements within the country and abroad. A distinctive feature of the study is the fact that it has not relied too much on Government documents and reports, but is based on a grass-root study conducted by the author, both at Bombay and Calcutta.

The aim is to ascertain why particular trade unions have become successful and others not, so as to derive some of the factors that seem to be associated with healthy trade unionism in developing countries. Although the attempt was initially concentrated in the Calcutta region, it was later extended to cover similar movement in the Bombay docks. It was felt that such a comparative approach will have a meaning only if the study was confined to the same industry under somewhat similar conditions, so that the factors responsible for successful trade unionism could be derived.

Attention in the study has been largely focussed on the success of two

Trade Unions—the Calcutta Port Sha Union (CPSU) and the Transport and Dock Workers Union, Bombay (TDWUB), as the most successful of the Trade Unions operating in the two ports. The success of Trade Unions was evaluated by means of criteria: (a) institutional growth and survival; (b) ability to maintain members' loyalty; (c) promoting members' interest; (d) on the negative side, an ability to ward off competitors.

The importance of labour productivity the success of any industrial enterprise is well recognised; it is also felt that for increase in such productivity, a successful trade union could perhaps bring it about much more easily than otherwise. It is in this context, then, that trade unionism has a significant impact on the productivity movement in the country and the volume under review has a meaning in the year which marks the As Productivity Year.

The book gives a detailed account of administrative and social pattern of the trade unions of Calcutta and Bombay, and the growth of trade unions with special reference to the role of politics as a factor for building up the trade union movement. There is a descriptive chapter on the organisation of the Unions, another on the leadership of the Unions, which according to the author, gives a good clue as to why certain unions have been successful. The history of industrial relations in the two ports is outlined in one chapter, while the last deals with the perspectives of the entire process. A comprehensive bibliography at the end lists important documents and publications which interested readers could refer to.

It has been stated that the study is without any specific hypothesis

Perhaps, it was not intended to formulate such hypothesis. However, a few important points emerge from this study. Perhaps the most interesting is the fact that the leadership pattern of a Union is important to the ultimate success of the trade union movement, and that contrary impressions in some circles, it is professional leadership that has generally been successful in union work more as a social service or as an extension of party work. It seems necessary for the trade unions to generate the leadership within rather than rely on outside political forces to fight their battles.

This, however, does not imply that trade unions can afford to stay away from politics. In fact, the author is quite clear that while there has been a tendency among the unions towards political disengagement, there is a positive use also in this association as providing an ideological orientation which would help labour to be more committed and to identify the movement with initial leadership. Perhaps, this viewpoint is well-expressed by John Kennedy, whom the author quotes as saying that "in a developing society trade unions are inevitably political, but not necessarily dominated by parties". The degree to which unions can be free from political tutelage depends on the organisational strength and character of the leadership of the union.

Although references have been made in the book to productivity, there is no detailed discussion of the impact of unions on increased productivity. Perhaps, this is due to the fact that the author's interest lay elsewhere. There are indications, however, that productivity in the initial stages may now show an appreciable increase due to the growth of the trade union movement, although it will ultimately have the desired impact by making labour more committed to industrial growth.

The book is useful to all industrial managers, who have to deal with problems of labour in providing a broad perspective of the factors that will enable a healthy trade union movement to be developed. There is, however, a self-imposed limitation that the book is

confined to one specific type of activity, namely, those of ports in the Bombay and Calcutta areas. A wider application of the conclusions reached in the study would naturally have to take into account the difference due to the nature of the industry and the regional variations that occur from place to place. In spite of these limitations, however, this publication of the Sri Ram Centre for Industrial Relations forms a useful addition to the literature on the growth of the trade union movement in India.—
Ram K. Vepa

Small Industries

PRODUCTIVITY IN SMALL INDUSTRIES: SOME LESSONS FROM JAPAN—Ram K Vepa, Asian Productivity Organisation, Tokyo, 1969 : Dollars 1.50 (USA)

In the developing countries of Asia, the small industries sector has during the last two decades received a lot of encouragement as promotion of small industries is considered essential to push up the economic growth of these countries. This concept has received the strongest support in India which has to face three main problems, viz., unemployment, scarcity of capital and skill, and unequal distribution of wealth. The small sector has an important role to play as it has certain advantages over the medium and large-scale ones. In the first place it is labour-intensive, and hence has the scope to widen the employment opportunities. It helps in mobilising resources of capital and skill in the rural areas, and further provides a more equitable distribution of national income. The Government's Industrial Policy Resolution (1956) stated: "They provide immediate large-scale employment; they offer a method of ensuring a more equitable distribution of the national income, and they facilitate an effective mobilisation of resources of capital and skill which might otherwise remain unutilised. Some of the problems that unplanned urbanisation tends to create will be avoided by the establishment of small centres of industrial production all over the country".

The growth of small industries in our country has been phenomenal indeed. The support of Governments, Central and State, and the work of organisations like the National Productivity Council, the All-India Federation of Small Industries Associations, the Small Industries Services Institute, and its Extension Centres, etc., have led to the development of this sector on fairly proper lines. Till the mid-'fifties the small industry sector consisted largely of unit servicing and processing traditional agricultural crops. In the last 15 years, the stress has changed, and the small industry sector is now turning out a large variety of modern products—including bicycles and bicycle parts, automobile parts and components, plant production equipment, steel furniture, paints and varnishes, etc. We have also numerous Government industrial estates... And with the growth of the public sector, the importance of the small sector has also increased: it has enormous opportunities now to go higher up on the ladder of technical competence. There is no longer the question of the non-availability of technical know-how, and easier credit is available, too, with the nationalisation of a large number of banks. The small sector is now in a position to fabricate precision parts and components, and to function as ancillary to large-scale units. The experience of HMT in setting up an ancillary industrial estate in its neighbourhood has been rewarding.

In this publication, Dr. Ram K. Vepa, formerly the Managing Director of the Andhra Pradesh Industrial Development Corporation, and now attached to the Union Ministry of Industrial Development, has examined the position of small industries in Japan *vis-a-vis* the developing countries of Asia and Africa. So far as Japan is concerned she occupies a position of leadership amongst the advanced countries. "In ship-building, she is the undisputed leader in the world; in steel she is No. 3; and in automobile, with a production of more than 4 million vehicles in 1968, she is ranked second next only to the USA. In electronics and optical goods, Japan has come to the top and her products have found markets all over the world. She is second only

to the USA in the manufacture of synthetic fibres. There is little doubt that today may well be ranked amongst the world's three or four largest producing countries. The author says that "small industry sends more than 99 per cent of the total number of industrial establishments in and that it offers employment to 24 representing nearly 50 per cent of all those employed in Japan. During 1965-66, enterprises contributed 49 per cent of sales, and are particularly prominent in such fields as wholesale and retail trades, agriculture, forests, fisheries, and food processing industry".

Keen observers of Japan's growth have attributed her amazing growth in the last three decades to the pivotal role which small industries have played in that country. Vepa went there in 1966 as a participant in one of the projects (Small Industries Development and Administrators' Course) sponsored by the Asian Productivity Organisation, thus had the opportunity to make a study of the development of small industries in Japan. What struck him particularly was the complementary manner in which both the large and small industries operated in Japan with mutual benefit.

There are nine chapters in all: in Chapter 1 he gives us the background of the problems of small industry in most Asian countries; in Chapter 2 he stresses how Japan, despite acute scarcity of natural resources, has been able to develop in a miraculous manner; then, in the following chapters, he proceeds to analyse some of the problems and policies of small enterprise, cooperative business associations, finance and credit, wage differentials, sub-contracting, and research and consultancy services. In the concluding chapter, he recapitulates the outstanding features of small enterprises in Japan, and mentions the ways where the benefit of Japanese experience would be valuable to other developing Asian countries. He points out that Japanese experience has shown that through the concerted effort of government and industry, universities and profit organisations, labour and management

significant change in the productivity of small enterprises could be brought about in a short time.

In his Foreword, the APO Secretary-General, Mr Ichiro Oshikawa, has paid compliments to the author, and remarks that his study, though from an administrator's point of view, offers "a very stimulating food for thought for all those engaged in the development of small industries."

The author wields a facile pen, and his treatment of the subject is objective.—L.K.B.

Career Building

LETTER WRITING FOR CAREER BUILDING: G. P. Shah, Shilguni Prakashan, Baroda-3, Rs. 12.50.

Letter-writing as an art had its hey-day in the past. In the eighteenth century, England could boast of a number of first-rate essayists and letter-writers, and some of their writings are even today read with great profundity of interest by students of literature the world over. With the arrival of modern media of communication—the newspapers, radio, etc.—the art of letter-writing began to decline.

Today, with mass production, there is the man with wants and the man with goods. Effective communication is necessary to build up business, and a problem confronting managers is how to express themselves clearly and effectively in correspondence. In this book, Mr G.P. Shah has made an effort to show how far effective letter-writing could lead to improvement of business, and the desired responses in the reader. In Chapter 1, he deals with the various facets of a letter. How to create an effective letter forms the theme of Chapter 2. By far the most important part of the book is Chapter 3, which deals with the human side of a business letter. He points out that unless sufficient attention is paid to human psycho-

logy, other techniques cannot bring optimum results. "Cordial human relations", he says, "act as lubricants in human systems to minimise friction, i.e., resistance". The principles for effective presentation of the contents of a letter are dealt with in Chapter 4. The following chapters deal with the structure of sentences, the development of skills to evaluate a letter, and integrated evaluation of a letter as a whole.

The various principles enunciated by the author are supported by a number of examples drawn from operating business conditions, and this is a welcome feature of the book. Altogether a useful publication.—L.K.B.

A New Journal

INDIAN BEHAVIOURAL SCIENCES ABSTRACTS—Vol. 1, No. 1, January 1970, Published by the Behavioural Sciences Centre, Delhi-6. Annual Subscription Rs. 75.

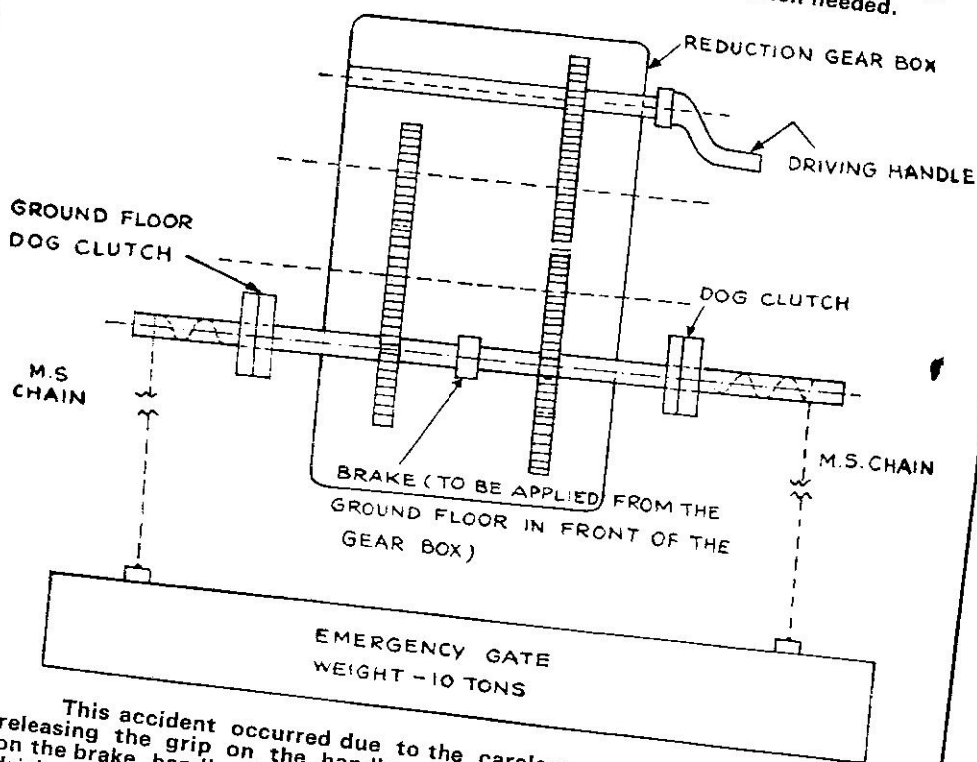
We welcome this useful quarterly journal. The inaugural issue, a copy of which we have received, contains abstracts of behavioural science literature published in India, and also of such literature published abroad, but dealing with India. Psychology, Sociology, Social Anthropology, Economics, Management, Human Geography are among the subjects coming within the ambit of coverage. The information is classified under a number of heads, and the material provided is useful to professional and research workers and others as it endeavours to keep them abreast of developments in the different subjects. To facilitate the use of the material, the Journal also gives for each extract such details as date of research, area, details of sample, methodology, and the results obtained.

If conducted on right lines, this journal has a bright future, and we wish it all success, though we do feel that the annual subscription is very much on the high side so far as individual research workers are concerned.—L. K. B.

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This accident occurred due to the carelessness of the two men by releasing the grip on the handle without coordinating with the man on the brake handle, i.e., they should have released their grip on the driving handle only after the brake was applied by the man on the brake handle.—S.S. MANI, Papanasam Project

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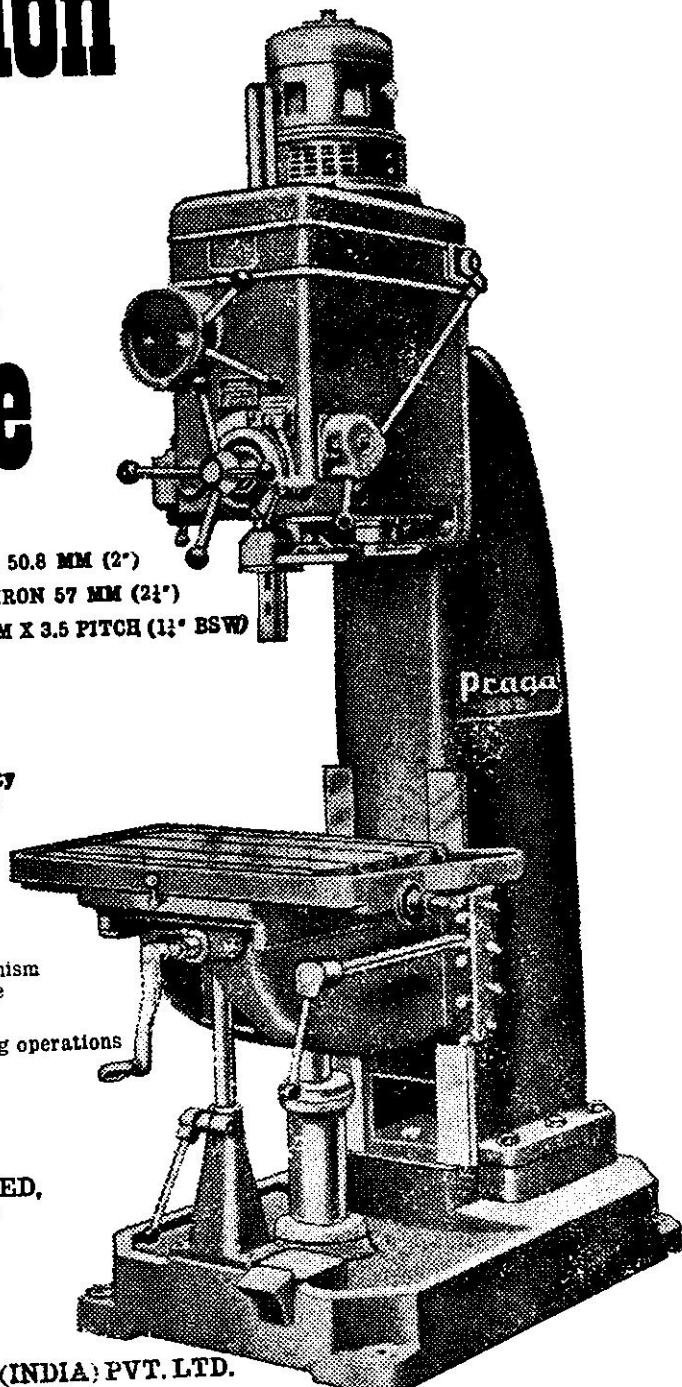
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