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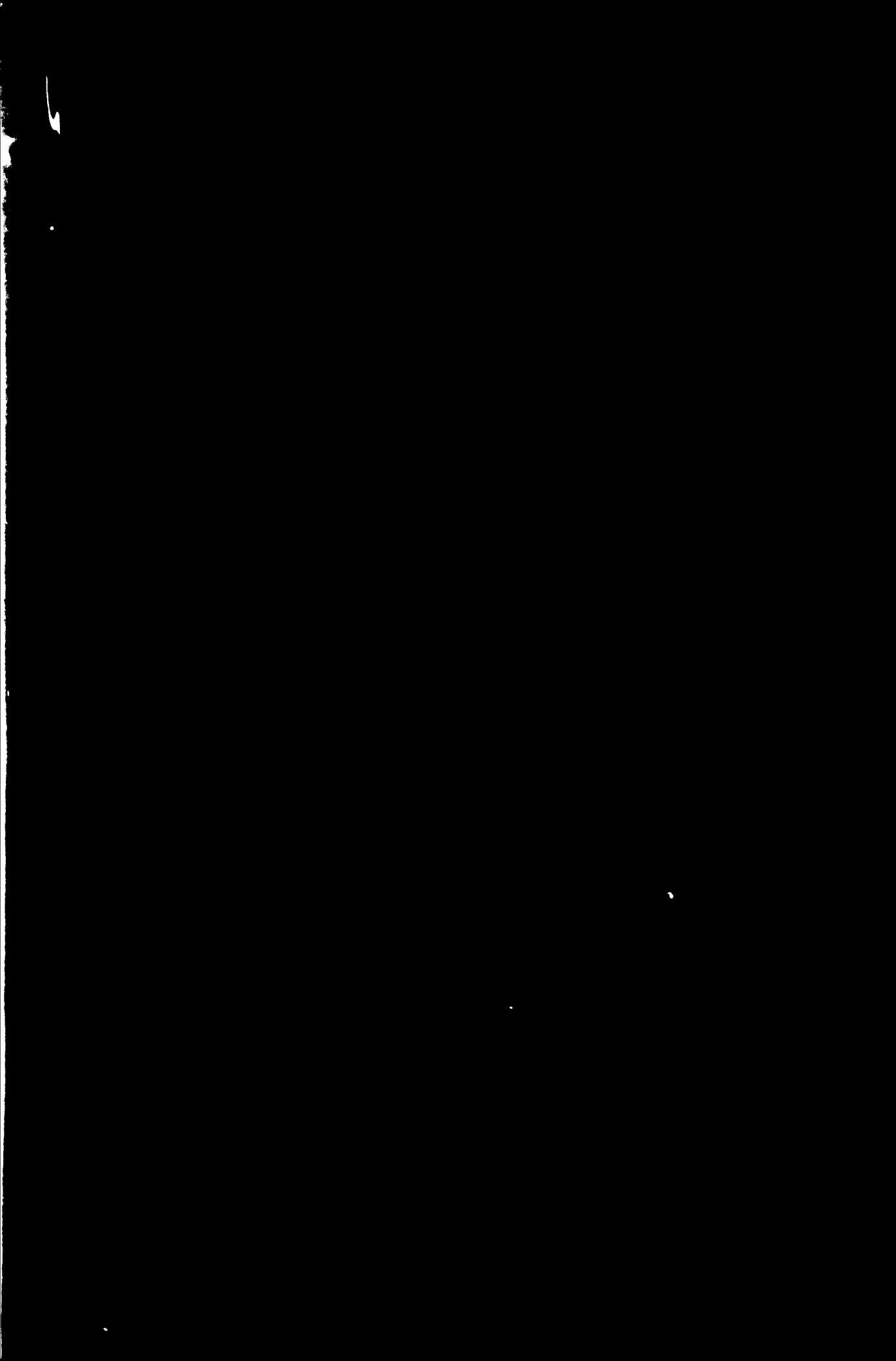
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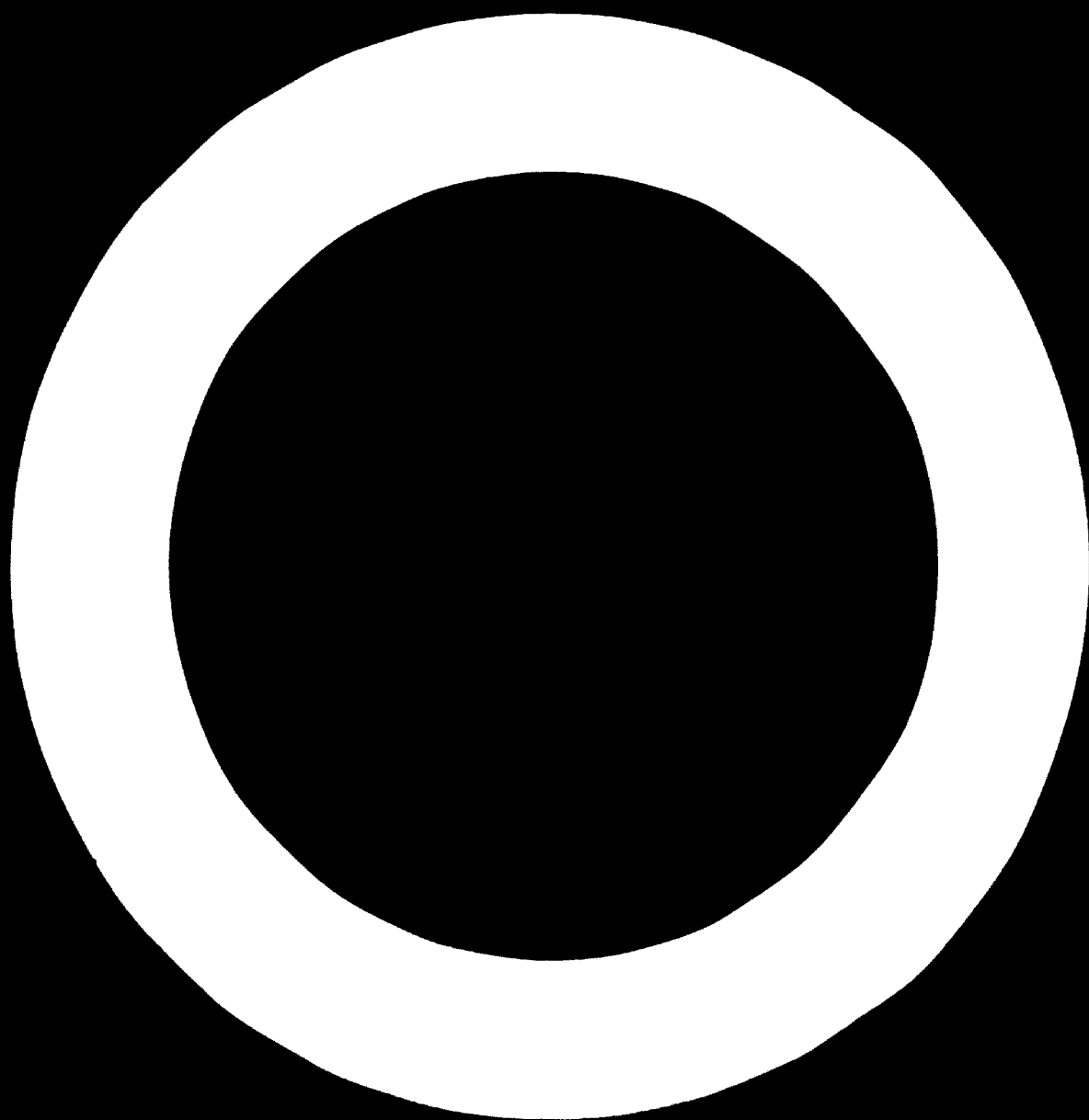
MANAGEMENT AND THE TRANSFER OF TECHNOLOGY^{1/}

by

C.R. Wynne-Roberts
UNIDO Consultant

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PRE-FACE

This study was initiated by the Industrial Management and Consultant Services Section of the United Nations Industrial Development Organisation, financed under the Work Programme Special Activity No. 31.3.02-4/31.3.01-1 Biennium Budget 1976-77. It was carried out by Mr. C.R. Wynne-Roberts, Consultant, during the period 8 - 30 May, 1975. The firms providing the subject of the main discussion and of the cases in the Appendix were visited during this period. Additional material has been included in the text from the Dominican Republic and Pakistan, where this has appeared relevant. No cases from these countries are included.

Many people contributed to the accomplishment of this mission, including officials and the industrialists who gave freely of their time and information. Special mention should be made of those whose contributions, one way or another, were vital to the success of the work. They include Mr. M. Jurihandano, President, Jakarta Industrial Estate, Pulogadung, Mr. G. Kastengren, Senior Industrial Development Field Adviser, UNIDO, Jakarta, Professor D.V. Galati and Mr. John Whittaker, ILO Adviser, National Institute for Training in Industrial Engineering, Powai, Bombay, Dr. K.C. Sen, Industrial Planning Adviser, UNIDO and Mr. Philip Pooks, ILO Project Manager, Kabul.

1. THE PURPOSE AND LIMITATIONS OF THIS STUDY

In the last 25 years industrialisation has spread rapidly throughout the world and there are few countries today where some effort is not being made to create industries. The extent of industrialisation in terms of total numbers employed or percentage of the economically active population varies greatly from country to country. The objectives are generally similar - employment promotion, import replacement and the provision of consumer and capital goods required to raise the standards of living of the peoples concerned.

In a very few countries a wide range of modern industries has been established for several decades - India was considered by the International Labour Organisation a "major industrial country" before the Second World War. In many others, manufacturing industry is being introduced on a substantial scale for the first time. In yet others it is only just beginning. With few exceptions the plant and equipment needed for industrial production or operation, especially the more advanced processes, have to be imported from the industrialised countries.

In spite of an ever increasing number of institutions, programmes and individuals involved in providing technical assistance to the developing world, the results are often not commensurate with the magnitude of the inputs - especially of material resources - plant, equipment and raw materials. In some cases, it might even seem that the external aid has been counter-productive in relation to the objectives. Development planners are often preoccupied with the transfer of technologies and technical know-how and tend to overlook problems of imbedding the technologies introduced into their new environments.

The critical factor in industrial development would appear to be the effective integration of industrial planning with the actual implementation of such plans at the level of the enterprise. In many

countries the breakdown of planning and effective control at the enterprise level has actually impeded the transfer of technology and, in turn, the process of industrialization. Put simply, the problem is managerial in both origin and execution.

The operation of any technology, however simple, must be accompanied by appropriate management structure and management practices if satisfactory results are to be obtained. Furthermore, as simple, often labour intensive technologies are replaced by more advanced, usually more capital intensive ones, fundamental changes in management structures, practices and techniques are almost always necessary. A brief, theoretical discussion of this question is given in Section III below.

Experience of the staff and consultants of the United Nations Industrial Development Organization suggests that in many cases modern production plant and equipment, including "turnkey" factories, have been introduced into industrially developing countries without any parallel introduction of the appropriate management practices or modification of previous management structures.

The purpose of this study, which must be regarded as preliminary, and which it is hoped will lead to more specific and detailed research, is to determine

- (1) what steps have been taken in selected firms in both public and private sectors in three Asian countries to match management practices to the requirements of the technologies employed;
- (2) how far owners and top managers are aware of the need to match management with technological practice and what steps they have taken or envisage taking to ensure that this need is met;

- (3) what assistance may be needed to enable them to understand this problem better and meet it;
- (4) what steps UNIDO can take to provide technical cooperation, whether in the short term - workshop and management clinics - or in the longer term through the setting up of facilities for techno-managerial consultancy and training.

The emphasis throughout is on the technologies of production rather than of the product since few developing countries have yet reached the stage of doing much original product research, design or development and tend to manufacture goods already well developed and known in industrialised countries.

The limitations of the study and thus the validity of its findings are evident in its short duration, due to the limited availability of finance. This made it necessary to limit plant visits to a small geographical area in each country where a sufficient concentration of industry could be found from which a reasonable representation could be made. This certainly excluded a number of firms which might have provided further evidence and somewhat modified the findings. But, by avoiding travelling, ensured a maximum of productive work in the time available. The areas selected were Kabul, Afghanistan; Punjab District, India; Jakarta, Indonesia. The findings can therefore only be considered as indicative but tend to be confirmed by observations made in the two supplementary countries, the Dominican Republic and Pakistan in the course of previous, unrelated projects.

II. METHODOLOGY

In selecting India, Indonesia and Afghanistan as the countries in which the sample studies should be made, the aims were

- (1) to have three countries at three distinct levels of industrial development:
- (2) in view of the limited funds and time available, to choose countries which were on a more or less straight air route and whose industry was to be found in the cities with airports on the route:
- (3) to choose countries where UNIDO field staff or others associated with UNIDO could make preparations in advance of the arrival of the consultant.

In the modern industrial sector, India may be considered sophisticated both technologically and managerially. Modern industry in India is not confined to any one sector or any size group. Indonesia may be considered to represent an intermediate state. Apart from a few major industries in the State sector and the oil companies, most Indonesian industrial development has taken place since 1968 and is composed of medium and small industries. Afghanistan is at the very beginning of industrialization. Virtually all Afghan industry has been set up with foreign aid, but the firms visited are all now operating with Afghan managements and in one or two cases, strictly limited foreign technical advice.

Altogether 16 firms were visited during the 18 days actually spent in the countries concerned. Duration of the visits varied from one hour to about five hours. In most cases discussions were with chief executives or senior managers having wide knowledge of the firms' operations. In only one case did it prove impossible to visit the manufacturing plant. Firms visited varied in numbers employed from 10,000 down to 10.

Apart from the plant visits, discussions were held with a number of knowledgeable people, both national and international, who were able to provide a great deal of useful background information. A particularly useful meeting was arranged with some members of the Bombay Management Association, managers and consultants, with a wide experience of Indian industry.

Before leaving Europe a form of questionnaire had been prepared, intended primarily as an aid to the consultant himself. In the event, it was used with discretion. As far as possible, the points to be discussed were memorised. In some cases it proved difficult to obtain information on many of the points by direct questioning. In general, after noting characteristics of the firms such as their main products, numbers employed, ownership, and so on, discussion was allowed to flow from subject to subject under the control of a general plan. Once confidence was established, the interviewer took brief notes of salient points but, in general, every effort was made to keep discussions conversational. Notes were written up and expanded soon after the meetings, usually within two or three hours.

In the terms of reference laid down for the study, its primary objective was said to be

"to study in selected countries, industry sectors and enterprises, the management problems associated with technological change at different levels of technology and industrialisation."

The term "technological change" had to be interpreted liberally and the study made to cover not only firms in which there had been technological upgrading as between a former, relatively simple, labour intensive technology and a newly installed, technologically more complex and capital intensive process, but also firms which had been newly established or branched out into manufacturing industry with processes imported from abroad, generally with some technical aid from the suppliers. It was also made to embrace firms which had been operating

given processes for some time, to find out whether in fact their management practices were such as to enable the maximum exploitation of those processes to be achieved.

A further reason for allowing the greatest possible flexibility both in the interviews and in the ground to be covered was the difficulty of ensuring, except in the case of managers with advanced management education or training, that terms used would be fully understood and that both interviewer and interviewee were talking about the same thing. Allowance also had to be made for differing standards when considering the application of a management technique. It was clearly impossible to examine in depth the application of each management technique discussed and a good deal had to be deduced from answers given and from observation. The consultant was sometimes able to make helpful suggestions on problems discussed and this had the further effect of turning what might have been a question-and-answer session into a dialogue and making the executive interviewed feel that their time had not been lost.

The additional information gathered in the Dominican Republic and Pakistan was collected while carrying out missions with other objectives, but is none the less valid. The Dominican Republic represents a stage of industrial development comparable with Indonesia. Major firms in the extractive industries and agro-based industries are mainly foreign owned and managed. Most of the nationally owned industry is small to medium sized and in the hands of individual owners or families. In Pakistan most of the basic industries are now State owned. Some are highly sophisticated. Others are still being modernised after being taken over from the private sector.

Before discussing the various national environments and the operation of industry within them, it is proposed to present in the next Section a theoretical basis of the study against which the findings can be assessed.

III. TECHNOLOGY AS A DETERMINANT OF MANAGEMENT

Thanks to the spread of business education and management development throughout the world in the course of the last twenty years, most industrialising countries now have managers with a substantial knowledge of modern management practices and techniques. In industrially more advanced countries such as India and to some degree, Pakistan, the numbers who have received substantial management education or post experience training are now very large.

They appear to divide into two fairly distinct groups, depending on whether

- (1) they have attended post-graduate schools of business administration in the United States or institutions in their own countries modelled on U.S. business schools, or
- (2) they have received post-experience training at one of the institutions set up by governments deriving its philosophy from the "productivity movement" of the fifties and early sixties.

Business schools in the United States and, in general, schools set up abroad with their aid, tend to concentrate more on problems of general management, marketing and finance than on those of the management of technology. This orientation reflects the primary preoccupation of most U.S. businesses, which is rather the profitable disposal of the products of the production processes than with the techniques of their management.

The large numbers of younger managers, including the sons and other relatives of the founders of industries, who have obtained masters' and sometimes doctors' degrees from major American business schools, represent the elite groups in most countries and tend, perhaps, to downgrade the products of the "productivity oriented" centres. Thus, more and more of these latter are beginning to move away from

their original roles and to concentrate more and more on the non-production aspects of management. It is worth looking for a moment at the background to the development of modern management theory and practice.

"Scientific" management started on the shop floor in the United States and for about four decades, (1890 to 1930), comparatively little attention was given to other areas of management, a notable exception being Henri Fayol. It was during this period that the basic techniques of production management were developed by Taylor, Gantt, Emerson, the Gilbreths, Henry Ford, Bedaux and others. Since then there have been many refinements: there is a better understanding of control systems, via cybernetics; computers have speeded up the process of analysing and supplying information; and, above all, an understanding of the interdependence of the various sectors of activity of the enterprise, including the production activity, which did not exist 40 years ago. However, production management remains basically what it has been for decades, the optimization of the use of the productive resources by means of the application of fundamentally simple systems of obtaining correct information and using it to plan, direct and control. Included in these systems must be those which aim to optimize human effectiveness through the reduction of effort, the establishment of performance standards and the motivation of the individual and the group.

The fact is that in the United States today, the management of production does not pose any real problems. Note that this applies only to the management; the introduction of new technologies may pose great problems in the development stages and even later. The management techniques are well-known and there are large numbers of specialists available to apply them, which does not mean that they are everywhere applied as they should be. This is emphatically not true in most of the developing countries, where there is generally a very serious shortage of properly trained specialists in production management techniques and where neither the top management nor the plant management always understand fully their nature or their use.

• Operational research and related mathematical techniques have improved the optimization of physical inputs, especially in highly capital intensive industries.

Taking the emphasis away from production management towards marketing and other aspects of management seems to be premature in many cases. In most developing countries the basic industries at least seem unable to meet the demands of the markets, and in some cases where there is excess capacity, it is due to serious miscalculations of the size of market and the available purchasing power, which may be limited to a small percentage of the total population. The real problem in most industrializing countries lies first in making as accurate and realistic assessments as possible of the type of technology to be employed and the capacity needed to meet present and projected market demands over a defined period and then of ensuring that all the resources, equipment, especially that imported from abroad at a cost of foreign currency, labour and raw materials are used as productively as possible. In the case of labour, it is often a question of using scarce skilled manpower by providing lavishly the auxiliary services of plentiful and low-priced unskilled labour. This demands at times the most sophisticated application of management techniques to the organization and management of production (or operation, in the case of service industries such as transportation).

This study, it is hoped, will not only do something to redress the balance and emphasize the importance which the management of production technology has in developing countries, but also examine the problem of management in general by starting from the production process and moving outward and upward rather than starting at the top and working downward. In this section of the study it is proposed

- (1) to examine the characteristics of production processes in the archetypical categories of labour and capital intensive technologies;
- (2) to deduce from these characteristics the production management techniques which should receive the greatest emphasis in each case;

- (3) to relate the two categories of process to the other areas of management via the production management techniques and other techniques capable of influencing directly its efficiency.

This examination necessarily demands some over-simplification for the sake of clarity and brevity.

The Process on Point of Enquiry

Until the late 1930s, the bulk of management consultancy, at least in Europe, started on the shop floor, diagnosing production problems and introducing techniques such as work study, process planning, production programming and scheduling and quality control, designed to solve them. There was a great deal of emphasis - some would say over-emphasis - on the use of direct incentive systems to increase worker productivity, many deriving from the well-known Bedaux system.

Good consultants did not usually stop their investigations at the shop floor level because so many production problems have their origins elsewhere, in product design, purchasing and especially marketing policies and practices.

A simple example will illustrate what is meant by this.⁶ In a factory making aluminium kitchenware - saucepans, frying pans, food containers and similar products - the firm found itself in financial difficulties. The management blamed the unions and the labour force for demanding piecework prices that were uneconomically high. The workers complained that they were unable to earn much money.

A consultant called in found that in the shops the machines, mainly presses, were only working 50 per cent of the time because of the very short batches being processed. Checking the catalogue, he found that there were 50 different products, some of them in as many

⁶ This example has been summarized, with permission, from ILO: The International and Factory situation in Germany, Geneva, 1943, pages 77-78.

as eight sizes, making nearly 600 variations. He went on to examine the sales records which indicated that some varieties were hardly selling at all and that even among those products which sold, some sizes were in very low demand. Checking the production cost of each product, he found that the management were losing money on some items on which it thought it was making a profit and making money on some which it thought were making losses.

There was clearly no control on marketing policy. The salesman had been allowed to demand variations in standard products because "if we had this or that variation we could sell it".

Once the basic cause of the problem had been uncovered it was a fairly simple matter to induce the management to eliminate from their planning all products which were not selling, thus greatly decreasing at one stroke the range of products and the sizes to be manufactured. Longer runs became available for machines and workers and the latter started to earn bonus, thus reducing previous labour unrest.

It then became possible to concentrate on improving the manufacturing methods of the remaining lines, which included rationalising the designs to reduce component variety and allow more economic manufacture. The result was a 90 per cent machine utilisation and 100 per cent increase in the money value of the turnover.

It can be seen from the above that, starting with what appeared to be primarily a labour problem, the consultant was able to demonstrate that the problems were principally in marketing and design. It may seem elementary when pointed out, but something like this is happening all the time in firms all over the world.

Labour intensive and Capital intensive Processes

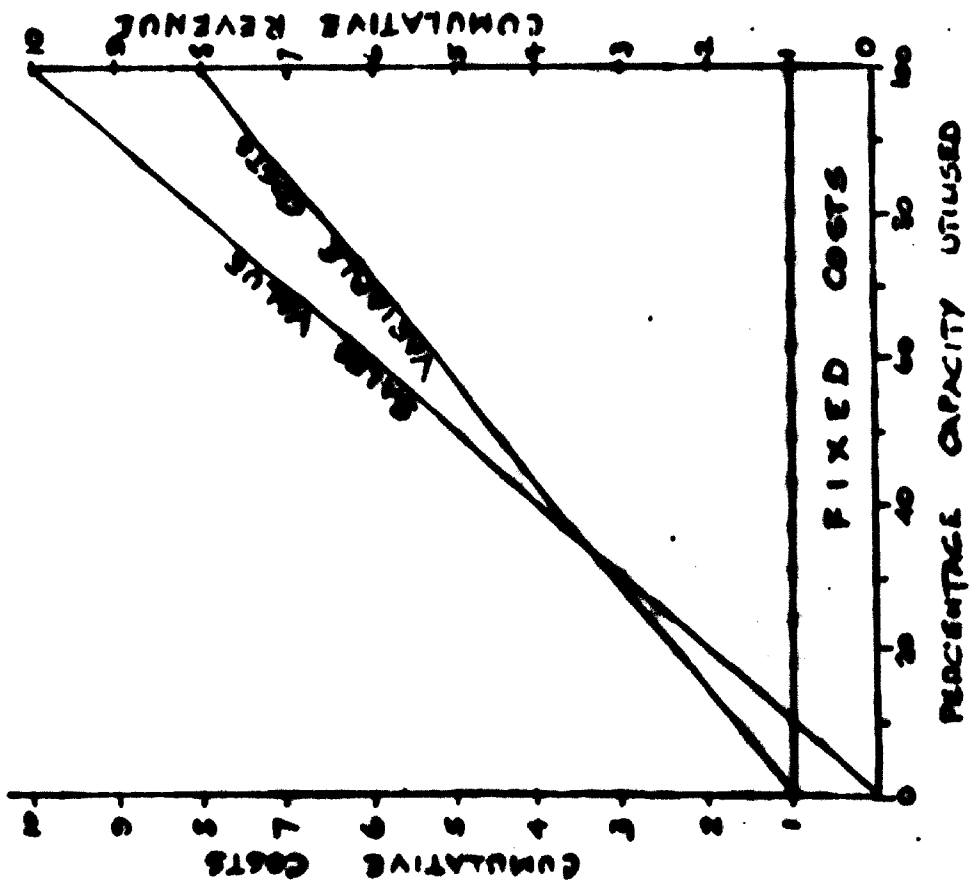
It is now time to examine the management implications of the two categories of processes representing the extremes of the spectrum. These extremes do not often occur in the same industry. In the engineering and other assembly industries, high capital intensity in some departments may be offset by higher labour intensity in others. Nevertheless, the principle of what is said below holds.

Industries which offer wide variations in labour and capital intensity include the engineering industry, which has metalworking processes ranging from very simple lathes and other machine tools to very complex multi-spindle automatics, numerically controlled machine tools and processes linked by transfer machines. Fitting and assembly may be very labour intensive, as in the automobile industry.

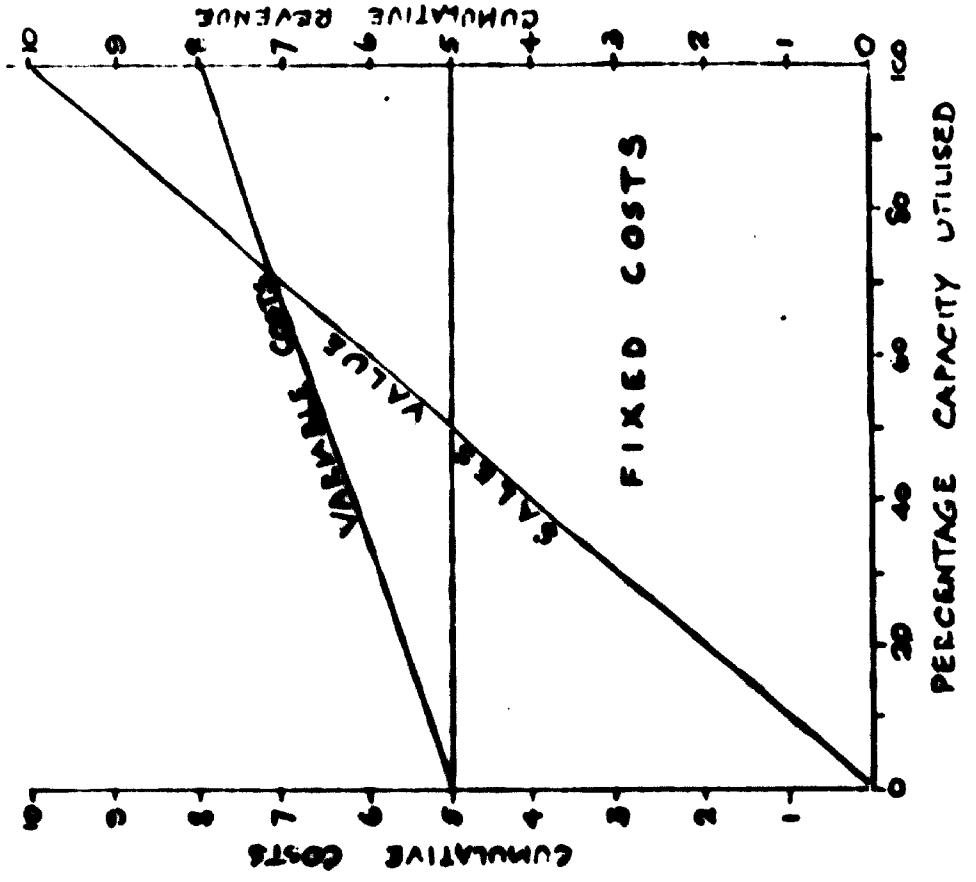
The textile industry also offers a wide range of machinery, especially in weaving, all the way from the simple hand or treadle loom on the labour intensive end to the very expensive, high-production shuttleless loom at the capital intensive end. The ceramic industry offers a third example of an industry with a wide selection of plant. The foot operated potter's wheel is still used industrially in conjunction with simple, intermittently fired ovens while at the other end of the scale is fully automated equipment for plate-making or tile-pressing capable of producing large quantities in association with continuous gas or electrically fired kilns. These latter are tyrannical in their demands to be kept filled day and night or face drastically rising unit firing costs and percentages of spoiled ware. Within any one of the three branches of industry mentioned above the per capita investment may average from around \$ 1,000 to more than \$ 20,000 and much more in the case of individual machines. The generally most capital intensive industries are the process industries, heavy chemicals, oil refinery and petro-chemicals, where the investment per worker may reach \$ 100,000. and even more.

FIGURE 1

A. BREAK-EVEN CHART FOR LABOR-INTENSIVE PROCESS



B. BREAK-EVEN CHART FOR CAPITAL-INTENSIVE PROCESS



The best way of illustrating simply the basic characteristics of labour and capital intensive industries respectively is the break-even chart. Figure IA shows a simple chart for a labour intensive process, while Figure IB shows a relatively capital intensive process with fixed costs five times as high as those in the first case. Percentage capacity utilisation is shown on the horizontal axis. The value of sales has the same slope in each case.

The immediately significant difference between the two charts is that the break-even point in the labour intensive chart is around 30 per cent of capacity, while in the capital intensive chart it is nearly 70 per cent. However, the increase in profits after the break-even point is much more rapid in the second case. The lesson to be derived from this example is that in the case of labour intensive operations, everything possible has to be done to reduce the variable costs per unit of output, while in the case of capital intensive operations, the emphasis has to be on reducing the unit cost due to the fixed cost. This may appear elementary but, in practice, as the field study has shown, it is by no means always practised.

Reversing the argument from its very fundamental beginnings, before discussing management techniques, the key characteristics of labour and capital intensive operations may be compared. These are juxtaposed in Table I, A and B. From them the key production management techniques can be derived in each case. The list is necessarily incomplete but sufficient to provide the basis for the development of the discussion.

TABLE 1

Basic Characteristics of Labour Intensive and Capital Intensive Operations

A. Labour Intensive

B. Capital Intensive

1. Productivity and unit cost depend upon the output of the individual worker, whether working independently or as a member of a group.
 2. In given conditions, total output will vary more or less directly as the number of workers employed.
 3. Workers operating directly on raw materials by hand or hand-controlled machines can usually, within defined limits, deal with variations in quality or specifications of materials or conditions of tools or machines.
 4. Labour intensive operations by definition demand relatively little capital investment and hence impose lesser burdens in terms of interest and repayment of loans or tying up capital.
 5. In general, labour intensive operations offer greater possibilities of meeting rapidly changes in demand or special orders.
 6. The planning, control and coordination of the work of large numbers of workers demands a high degree of organisation, which tends to be of a "military" type.
1. Productivity and unit cost depend primarily upon the optimum utilisation of plant which may or may not be directly related to the physical effort of the workers. It is more likely to be directly proportional to knowledge and organisational skills.
 2. Total output will be limited by the technical qualities and capacities of plant and machines and not necessarily related to the numbers of workers employed. Beyond the limit of capacity of existing plant, increased output may only be obtained by substantial further investment.
 3. Machines and other plant are often less able to deal with variations in the quality of raw materials and other variable factors.
 4. Capital intensive operations demand heavy investments with interest payable and loan repayments. Risks of financial failure may be increased.
 5. Capital intensive processes usually demand long runs of the same product and thus the assurance that neither demand nor design will change over long periods.
 6. The planning and control of capital intensive operations tends to demand organisation of a "functional" type.

A. Labour intensive Operations

The principal characteristic of labour intensive operations is that they are flexible. The "productive unit" - the individual worker - is small. The larger the firm, the more each individual productive unit tends to be incremental. The worker as productive unit is flexible as to numbers and as to hours worked. Even allowing for the fact that in many countries it is difficult, if not impossible, to lay off workers when there are recessions in demand, there are usually possibilities of reducing working hours, (or increasing overtime when demand picks up), taking on temporary staff and so on.

The manual worker may also be flexible in that, within limits, he may be able to do more than one job in the factory and can thus be moved from department to department should demand vary between different products. How far flexibility is available in this respect may depend on union acceptance; this may well be obtained where the alternative is redundancy.

The third flexibility in some industries, (clay industries, some branches of engineering, woodworking), is that the worker can deal with irregularities in material and can improvise where, for one reason or another, tools and equipment are not wholly adequate for the job in hand.

The fourth flexibility is that labour intensive processes may be used to produce work in small batches, individual items to customers' orders, experimental work and the like. The proviso must be added that this must be part of the policy of the firm and not ad hoc.

Labour intensive operations, by their very definition, demand relatively little capital in relation to numbers employed and output. This means fewer financial commitments in the way of loans and other long term finance and a lesser burden of interest and capital repayment.

On the other hand, except in plants where large numbers are employed carrying out virtually identical operations or groups of operations, (garment manufacture, for example), large numbers of workers may demand more complex organization structures at factory level and higher quality supervision and leadership. There may also be greater problems in union-management relations.

B. Capital intensive Operations

Capital intensive operations tend to offer exactly the opposite characteristics. Capital intensive operations tend to be inflexible. In this category should be included energy intensive operations such as tunnel ovens and furnaces, many metallurgical and chemical processes which for technical reasons must run continuously and with high demands for fuel and power.

In the first place, as noted in Table IB, output may not be directly related either to the efforts or the numbers of production workers. The productive unit, if under-utilized, sends unit costs rocketing upwards, whereas an increase in demand beyond the designed capacity - or at least over a certain margin - can only be met by the addition of another "chunk" of plant involving important additional capital expenditure, which may well be in excess of the marginal increase in sales and thus prove costly to operate until the sales can be built up to an economic level.

In general, automatic processes, including many chemical processes, have no ability to adapt or discriminate. Raw materials which are not to standard specifications may be rejected or simply turn out rejects. The control of capital intensive plant tends to be a matter more of mental than of manual skills, often requiring high technical qualifications. The manual skills move from direct to indirect operations, notably maintenance, which may be critically important, especially in process industries.

Although there are exceptions, capital intensive plant in general is quite uneconomic in dealing with short batches or frequent changes of product, since any downtime has to carry depreciation and other overheads without corresponding returns from products produced and sold.

The financial burden of capital intensive plant may be very heavy; interest rates at present, (1975), are very high, and may absorb a large part of a firm's profits, even in favourable conditions, while in a recession they and the repayment of capital may prove an intolerable burden seriously restricting the management's financial freedom to manoeuvre.

The organization and management of the men and women who make up an industrial workforce are of key importance in all types of industry, since the success or failure of the firm ultimately depends on them. In industries whose operating efficiency is dependent on costly and complex plant in the hands of a relatively small number of people, these are areas which may be especially sensitive.

In the first place, the percentage of technically qualified and highly skilled workers, (including professional staff), in the total workforce is likely to be higher than in labour intensive operations. Secondly, discipline in the matter of observing operating instructions and regulations may be critically important to performance and safety. Thirdly, the absence of even one or two key workers in a specialized labour force may have serious consequences whereas in labour intensive operations a few production workers absent might merely mean a small reduction in output, possibly to be made good by some overtime on the part of those at work.

Optimum Utilization of Resources

Before going on to examine the management implications of labour and capital intensive processes, at least one other category of industry may be mentioned, although it will not be dealt with in detail. This is the category of industry in which the raw material

is by far the most expensive factor in the unit cost of the product, so demanding special measures to conserve materials and minimize their wastage and, as in the textile industry in Europe, for example, the most careful judgment in purchasing cotton, since a wrong decision can result in very severe losses. These industries may be termed material intensive. They reach extreme cases where diamonds, other precious stones and precious metals are involved. Economic production centres round the exploitation and conservation of the raw material.

The characteristics of labour intensive and capital intensive processes outlined in the foregoing section lead logically to certain conclusions. First, to achieve maximum productivity and minimum unit cost of the product in labour intensive operations, the focal point for action is the direct operative. Everything must therefore be done to optimise the use of his skills and working capacity, actual and potential. His task must be facilitated as much as possible by reducing effort and lost time and providing working conditions, physical and psychological, which will enable and encourage him to give his best. In this connection, the economists' concept of labour productivity as a measure of efficiency can not always be followed blindly. In many cases, it may be more effective to provide the skilled worker with substantial unskilled assistance to ensure that he works only on those parts of the job which demand his special knowledge and abilities.

In the case of capital intensive operations, high efficiency can only be achieved by focussing efforts on the management of the process or plant. Theoretically, optimum working and minimum unit cost of production will be achieved if the plant works 24 hours a day 365 days every year at peak technical capacity, quantitative and qualitative. Since this is virtually impossible to do, then the plant must stop only when the management plans that it shall stop, whether for maintenance or any other purpose. Furthermore, any planned stoppage must be as short as possible, which means in the case of process industries in particular, the most meticulous planning and preparation of maintenance or other work to be carried out in the downtime. In effect, the reduction in effort and in ineffective time, (time in which work is stopped

or wasted in making rejects, for example), which in labour intensive operations is directed towards the direct operations is here applied to the indirect operations. This will be illustrated graphically later in this section of the study.

Tables 2 and 3 set out in simple fashion the principal requirements for high utilization of human and capital resources respectively and some of the production management techniques available to enable this to be done at workshop or operating level, that is, those which impinge directly on the operations and the operators. They are largely self explanatory and may be summarised briefly as follows. In labour intensive operations the operative himself, (or herself), must be rendered as competent as possible to do the work allotted to him and conditions, physical, psychological and motivational must be established so that he is able and willing to do his job free of constraints. Secondly, the work content, that is, the amount of effort which he has to furnish to achieve a given output at a defined level of quality, has to be reduced to a minimum, first by product design eliminating all superfluous elements, then by sound working methods and the provision of proper tools and support. Thirdly, all ineffective time, (time when he is not working at all due to machine breakdowns, lack of raw materials or partly finished work from previous operations and other causes of stoppage, other than permitted rest periods), must be eliminated. Finally, the operatives, whether engaged on manual or mental tasks, must be organized so that their contributions to the total task integrate with those of their colleagues doing related or complementary work.

This study is very much concerned with presenting the subject in fundamental terms, shorn of jargon, because the management world is constantly being caught up in "fashionable" techniques, which for the most part represent only variations or extensions of basic management practices known and followed by good managers for many decades. Thus, it is possible to say that the capital intensive plant has basically the same sort of needs as the human operator or group of human operators.

TABLE 2.

Optimum Utilization of Resources
(Labour intensive industries)

Requirement

Key Techniques

- | | |
|--|---|
| <p>1. To ensure that every operative is trained and competent to do his job to the standards laid down.</p> <p>2. To ensure that physical and psychological conditions are such that workers can give their best efforts without undue fatigue or strain.</p> <p>3. To ensure fullest possible motivation through proper incentives combined with firm but fair discipline.</p> <p>4. To ensure that the design of the product, working methods and ancillary operations are as economic as possible in effort and time, and that the worker has the correct tools for his job.</p> <p>5. To ensure that the worker is given standards for both output and quality and that they are enforced.</p> <p>6. To ensure that the worker is not interrupted through shortages of raw materials, tools or components.</p> <p>7. To ensure that the worker is not stopped by breakdowns or malfunction of machines or other equipment or caused to make rejects due to malfunctioning.</p> <p>8. To ensure that the material provided is of the correct quality so that time is not wasted making rejects.</p> <p>9. To ensure that the organization structure is such that optimum relations can be maintained, delegation achieved and all line and staff members are adequately trained for their jobs.</p> | <p><u>Vocational and technical training on the job instruction.</u></p> <p><u>General conditions of employment, working conditions, safety and hygiene.</u></p> <p><u>Job analysis and evaluation, wage structure and administration, incentive and merit rating schemes, management and supervisory training.</u></p> <p><u>Value analysis, product development, method study (work simplification), plant layout and materials handling, system planning, tool design.</u></p> <p><u>Work measurement providing time standards and labour cost control; quality standards and quality control.</u></p> <p><u>Production planning and control, dispatching, inventory and stores control.</u></p> <p><u>Planned preventive maintenance, tool maintenance.</u></p> <p><u>Purchasing quality control.</u></p> <p><u>Organization theory, management development, technical upgrading, specialist training.</u></p> |
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TABLE 1

Optimum Utilization of Resources
(Capital intensive industries)

Requirement

Key Techniques

To ensure that every operative, supervisor, technician and engineer is fully trained and competent to do his job.

Vocational, technical and supervisory training and upgrading.

To ensure that workers, direct and indirect, supervisory and technical staff are adequately disciplined and motivated so as to obtain meticulous observance of routines of operation and maintenance.

General conditions of employment, wage and salary structure and administration; job analysis; incentive and merit rating schemes; management development and supervisory training.

To ensure that the product and product range are as designed and/or specified that they enable the process to operate under optimum conditions.

Product design and development; scrap reduction.

To ensure that plant is designed or purchased so as to be optimally suited to the conditions of market, factor costs, skills, materials etc., in which it will operate and has controls, visual and physical, to facilitate the work of the operatives and technical staff.

Plant specification (based on economic and market studies), plant design and process development, ergonomics, plant layout.

To ensure that the plant operates at optimum technical performance.

Process development, process control, Operational Research.

To ensure that the plant does not stop operating because of raw materials of unsuitable quality.

Inspection, quality control.

To ensure that the plant will not stop operating because of lack of raw materials, fuel etc.

Procurement, production planning and control, inventory control.

To ensure that the plant will not stop operating for lack of orders.

Marketing.

To ensure that the plant will not stop operating because of absenteeism, labour shortage, accidents etc.

Manpower planning, discipline, incentives, safety and hygiene.

To ensure that the plant will not stop operating due to breakdown, malfunctioning or lack of spares to reduce any planned stoppage to a minimum.

Planned preventive maintenance; plant safety and performance standards; spares procurement and inventory control.

To ensure that financial resources are continuously adequate to maintain production

Long range financial planning, financial control, process accounting, cost accounting.

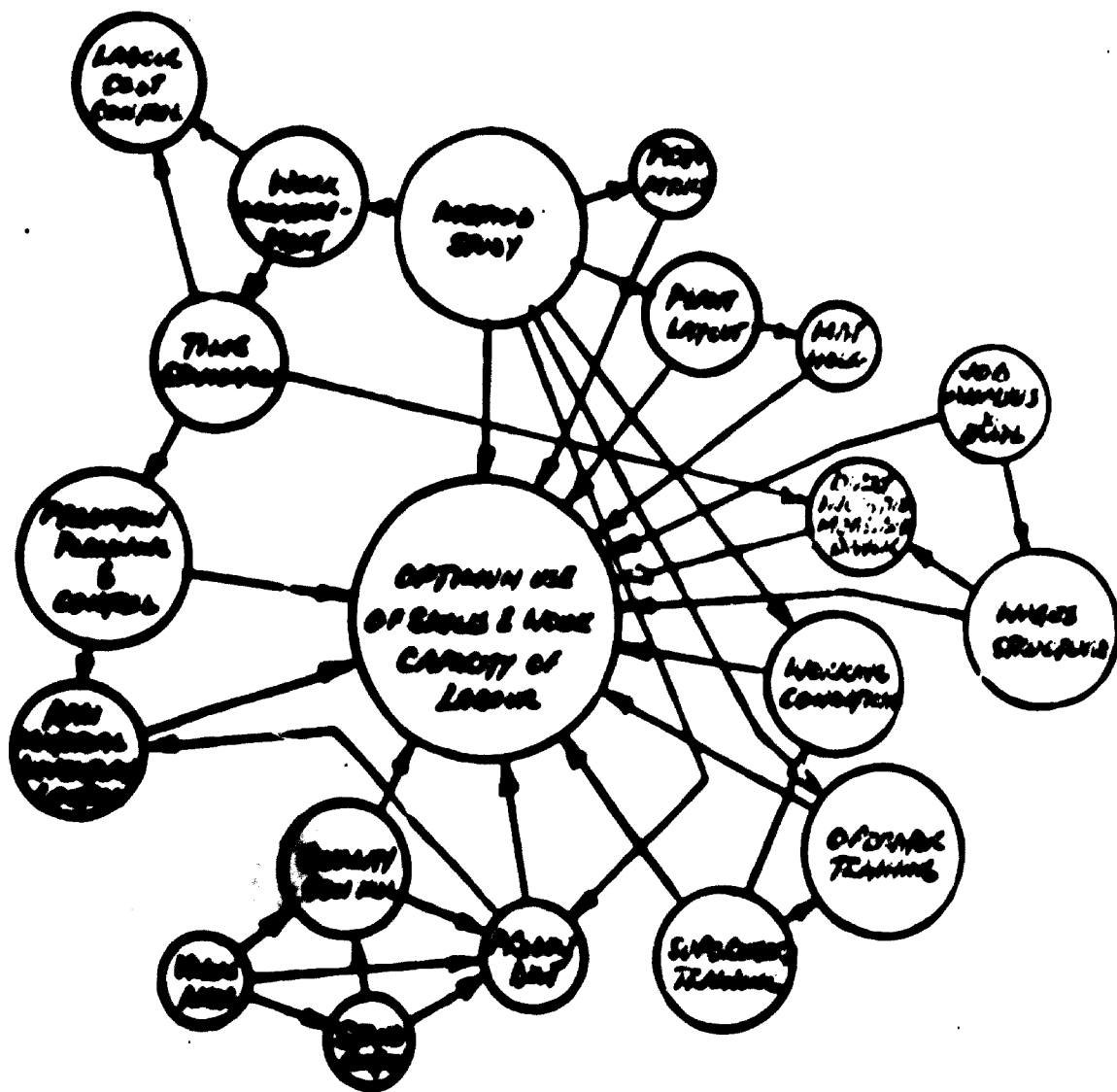
The input of energy required to produce a given output must be reduced to a minimum, (work content represented in this case by fuel consumption and the consumption of other indirect materials), and the ineffective time eliminated as far as humanly possible. The work content is large within the process itself and will be determined by technological considerations, particularly of plant design and skill of process control rather than by management techniques acting to decrease it. However, elimination of ineffective time will be achieved by the same management techniques of planning and control as in the case of the labour intensive operations except that, as already mentioned, they may sometimes be applied to indirect operations, such as servicing and maintenance.

Production Management Techniques directly influencing Labour Intensive Processes

Figure 2 shows what has been discussed above graphically as a pattern of production management techniques having direct impact upon the productivity and cost of labour intensive operations. The relative size of the circles is intended to indicate the relative importance of the contribution of each technique for improving productivity. Such a representation is, of course, arbitrary and can only be considered as broadly indicative for any one industry. The techniques directed primarily at the worker, method study, work measurement, operative and supervisory training and labour cost control may be expected to be key techniques in these conditions. Anything relating to wages and working conditions must be considered as important. On the other hand, planned maintenance and in most cases material handling, are likely to be of lesser importance, since in labour intensive processes there is usually little plant to be maintained, (what there is must be properly serviced), and raw materials and products are generally not so heavy as to demand such heavy handling equipment. Again, there may be exceptions such as assembly operations of heavy machinery.

FIGURE 8

MANAGEMENT TECHNIQUES DIRECTLY INFLUENCING CHARACTERISTICS OF LABOR'S INTEREST PRACTICES



It will be noted that the techniques tend to form "galaxies" within the total system. The first galaxy has as its centre method study, including especially work simplification, since this is the prime technique for reducing work content of manual operations at minimal cost. The second galaxy is composed of personnel management techniques with operator training and wage and salary structure and administration as the keys. The third galaxy is formed by the techniques of production planning and control and inventory control, the former being associated with time standards. These techniques ensure that the supplies of materials or work to the operatives do not run out and cause ineffective time. The ultimate application of these is to be found in the high labour intensive operations of aircraft assembly.

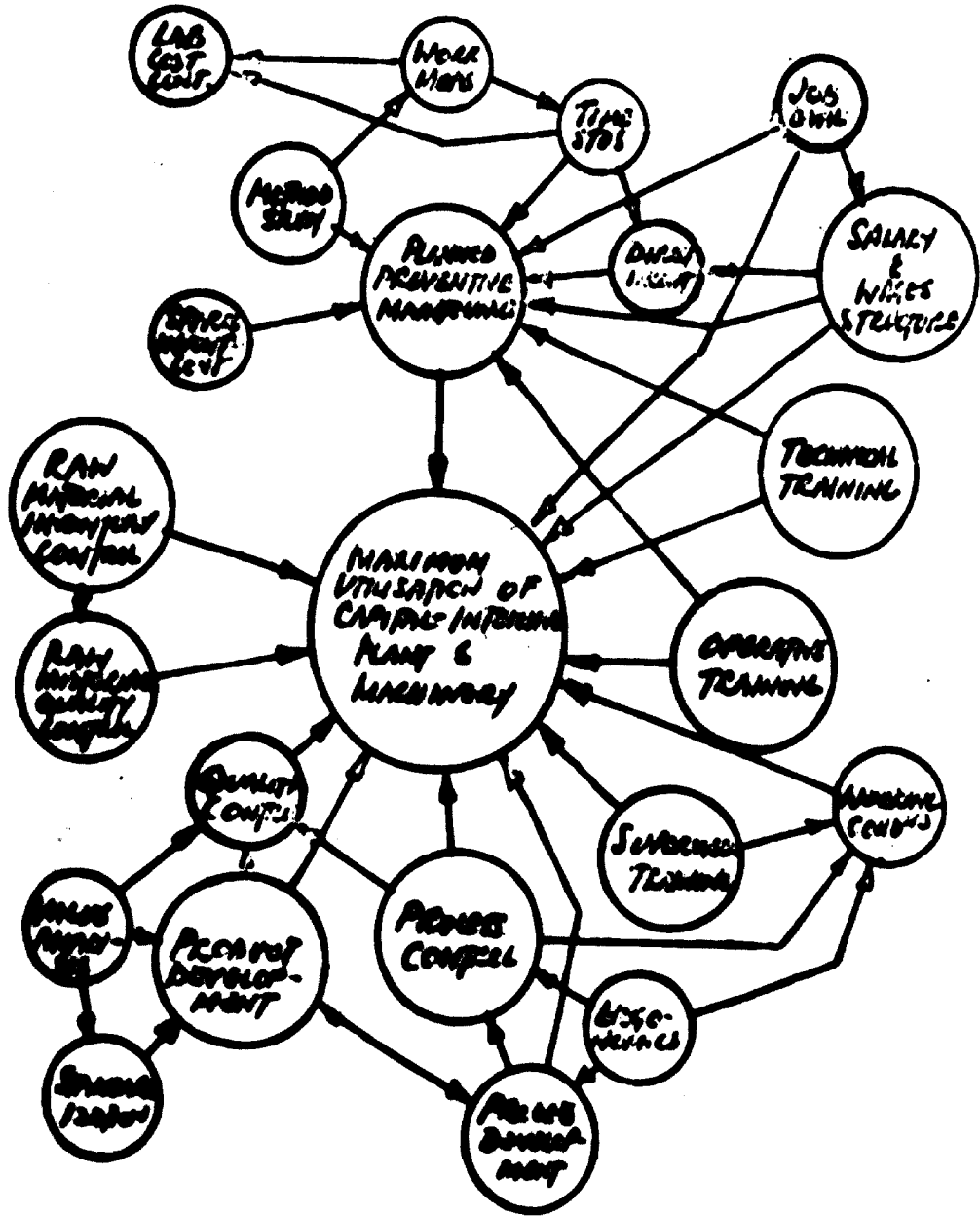
Finally, there is the galaxy representing the product sub-system in which work content, (and raw material costs), is reduced through the application of value analysis, standardisation, product development and realistic quality standards.

Production Management Techniques directly influencing capital intensive processes

Figure 3 shows a similar presentation of the techniques applicable to heavily capital intensive processes, for example, a chemical plant. These patterns would broadly apply to a highly automated engineering factory.

The first feature to strike the eye is the changed order of importance of the techniques in influencing productivity or efficiency. The centre of the production management galaxy is now planned maintenance with method study directed to reducing the work content of the maintenance operations rather than that of the production processes, because the maintenance operations may well be the most labour intensive in the plant. Time standards and direct incentives now apply to the indirect operations. The appearance of "spares inventory control" in the maintenance galaxy may also be noted. Problems of spares may become serious in developing countries where all plant has been supplied from abroad and delivery may take months.

FIGURE 3 MANAGEMENT TECHNIQUES DIRECTLY INFLUENCING CAPITAL INTENSIVE PROCESSES.



The personnel management galaxy continues to be critically important because, even if there are fewer people, they may be more highly qualified and maintaining their performance, involving greatly increased financial and technical responsibilities, and may be at least as important as in the case of a direct labour force. Note that "technical training" has been given a key place.

The galaxy composed of production planning and inventory control in the case of labour intensive operations has given place to raw material inventory control with enhanced importance and raw material quality control. This latter becomes important where the machines or plant cannot utilise or "digest" materials not conforming to specification. A case was seen in the course of the study where limestone supplied to an alkali plant had to be within certain limits of block size, (approximately five inches sides by two inches thick), otherwise the flames in the calcining kilns would not completely penetrate the stone and there would be a high level of waste.

Finally, the product galaxy has assumed much greater importance and become closely linked with a "process" galaxy. Whether in the engineering or chemical industries, product development is likely to become much more important in capital intensive than in labour intensive processes because high production plant and machinery cannot be stopped and heavy investment in tools or dies or process equipment lost because a product proves difficult to produce or inefficient in operation after sale, and variety reduction in both end product and components becomes of key importance. In the process industries, the process development may be even more important than the product development and process control, based on operating criteria resulting from process development, becomes critical to economic operation.

If the patterns in Figures 2 and 3 are compared, it can be seen that, with the partial exception of the personnel galaxy, they are very different.

The Influence of Technology on other Fields of Management

It has just been shown that the choice of technology - labour or capital intensive - influences the choice of management techniques used directly to obtain maximum productivity from the plant, equipment and workers employed. Furthermore, the emphasis to be placed on individual techniques may differ considerably, depending on the degree of labour or capital intensity.

Once consideration of the effects of technology on the management of an enterprise moves outside the direct management of the productive processes and the direct labour force, the differences in emphasis become even more marked. Figures 4 and 5 show the influence of the technology on product, production, personnel, purchasing, financial and marketing management for labour and capital intensive processes respectively.⁶⁶ It can be seen that the differences in the patterns are even greater than in the case of the management techniques directly related to production.

Characteristically, the operational inflexibility of capital intensive processes imposes much greater emphasis on all managerial activities concerned with long term policy making and planning and in all areas accurate forecasting - of demand, financial needs, raw material supplies, technological developments and staffing requirements - becomes of key importance.

⁶⁶ It has proved impossible to show diagrammatically the policy making, directive and coordinating roles of general management without making the diagrams intolerably complicated. The inclusion of the general management function must be assumed in both cases.

In general, as the field of activity moves away from those directly influenceable by the nature of the production process, the number of variables increases and it becomes less and less possible to be dogmatic.

Looking first at Figure 4 and starting with production management, there is little to be added. In a labour intensive process the options of production policy are mainly limited to those which can improve the efficiency of the manual operations, which have already been discussed. In the personnel field, outside those techniques bearing directly on labour productivity, personnel services - the provision of housing, welfare, health, educational and recreational facilities to workers and their families - are likely to be of greater importance than in capital intensive industries, particularly in developing countries. This may be partly due to the greater numbers involved but also because, in general, workers in labour intensive industries tend to earn less individually than those in capital intensive industries, (in some countries automobile assembly and dock workers are exceptions), and are thus more dependent on facilities provided by the firm. It is common experience that the more people earn and the more options they have in their discretionary spending, the less they are dependent on such facilities. Recruitment policies and practices may be relatively unimportant where technical requirements are low, but both recruitment and development of executives may have to place special emphasis on skills in human relations rather than technical expertise.

It is difficult to be categorical about the marketing policy and related management techniques in the case of labour intensive industries. In developing countries many consumer products - shoes, processed foods, consumer durables - may be made economically by labour intensive methods which in industrialized countries with high wage levels would be mainly capital intensive. The flexibility offered by labour intensive methods makes it generally easier to switch products to meet changes in demand

or special requirements of customers. There is likely to be less pressure to "sell what we make".

In some industries the small capital investment needed to start operations may make it easy for a skilled craftsman with a little capital and the necessary initiative to enter manufacturing. For the large firm, which tends to have heavier overhead expenses, competition, particularly in local markets, may become intense. Economies of scale are not so marked in labour intensive as in capital intensive industries, and the marketing effort may have to involve the establishment of a brand image accompanied by strong selling and merchandising. Market forecasting may not have to be as long range as in capital intensive industries but an effective distribution network offering rapid delivery able to counter local short delivery times may be critical.

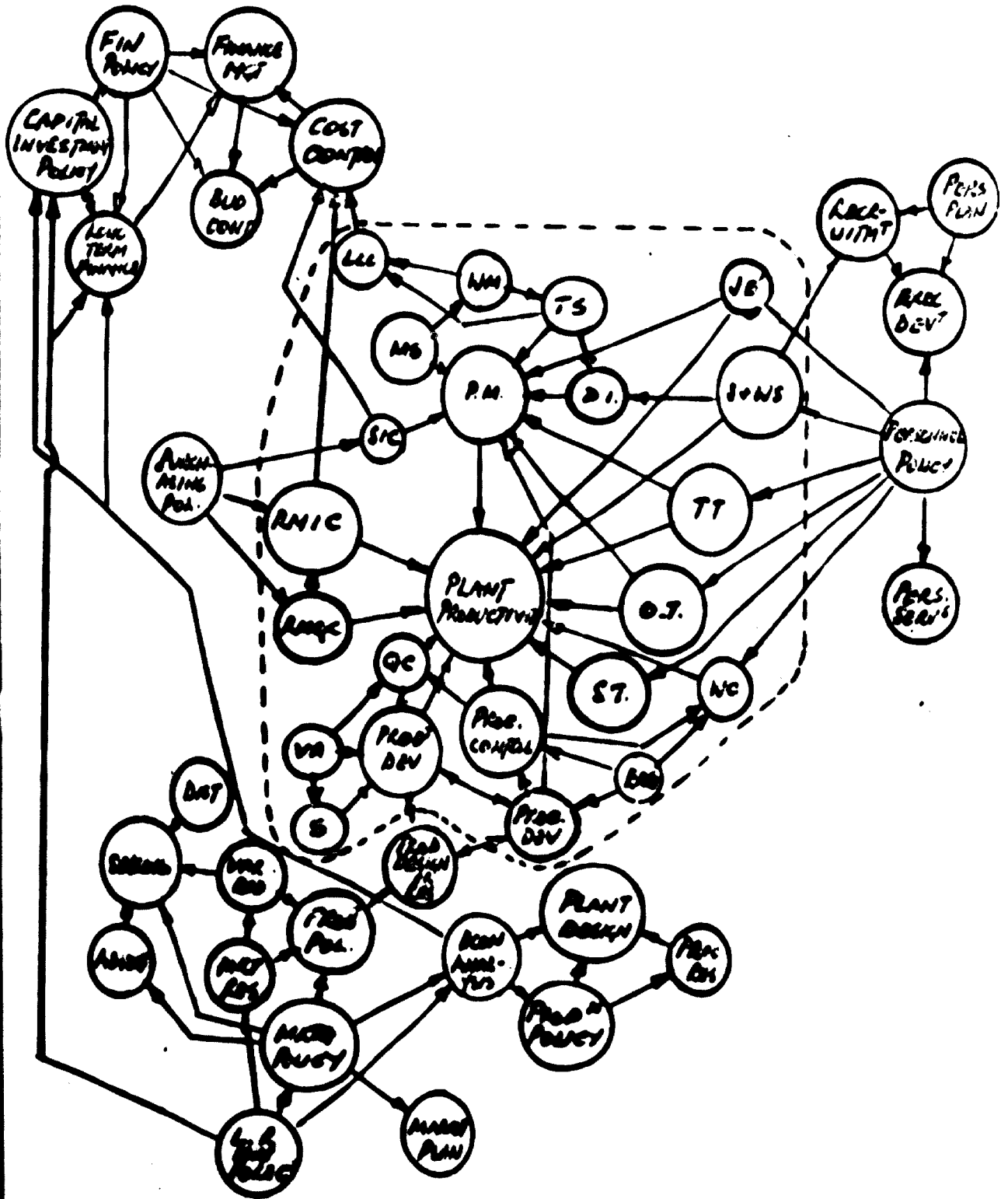
Where capital investment is comparatively light and likely to remain so, sound financial management backed by good costing methods and cost control is likely to provide the support necessary to the continuing success of the firm. On the other hand, the purchasing policy and degree of importance to be placed on the purchasing practices must depend on the relative importance of the raw materials in the cost structure of the finished product. Where material cost is a very high proportion of final cost or where the raw material selection may be critical to marketing success, as in some branches of the fashion industry, the purchasing function may be very important.

Figure 5 shows the much more complex pattern of management for capital intensive industries.

The personnel management galaxy has, inevitably, much the same pattern as in the case of labour intensive industries, but much greater emphasis is placed on personnel planning because of the greater density of professional and technical skills likely to be involved. The usually greater percentage of highly qualified staff also imposes a more highly

FIGURE 5

CHARACTERISTIC PATTERN OF INFLUENCE OF CAPITAL INTENSIVE PROCESS ON NON-PRODUCTION MANAGEMENT FUNCTIONS.



developed recruitment policy. It may well be necessary to prepare long range plans for recruitment of managerial, scientific and technical staff and to maintain close contact with universities and business schools. It must be borne in mind that, by definition, each individual is responsible for the performance of a much larger amount of capital investment, (possibly also of energy utilisation), and of material consumption than in the case of labour intensive industry. Errors or poor performance on the part of the individual are thus liable to have much more serious consequences. The constant evolution of technologies may also place emphasis on continuous technical upgrading.

It can be seen that in the product, process and marketing galaxy, the components of which are heavily interdependent, the pattern is very complex. Outside the techniques impinging directly on the production processes, which were discussed in connection with Figure 3, the focal points of the galaxy (which profoundly influences the production directed techniques) are the marketing policy, product policy and production policy. Except in rare cases where the nature of specialised products demands very expensive items of plant,* the costs being passed on directly to the customer, capital intensive plant normally demands a highly standardised product and a very limited product variety, with the assurance of very long runs. In the highly capital intensive oil refining sector and some branches of the chemical industry, the same products may be expected to run for many years with improvements in quality deriving from product research and process research and development. Long range forecasting coupled with extensive market research becomes imperative where investment runs into many millions. This may have to take into consideration macro-economic and demographic evolution. Some years ago, when a major oil company decided to set up a new refinery in India to produce oil for lamps and cooking stoves, extensive

* See Appendix, Case C.

studies were made of population trends, the rate of creation of new family units and progress of rural electrification before deciding on the capacity of the proposed plant. Process industries, whose plants are essentially limited to one or two products, are especially vulnerable to errors in the assessment of demand. Highly capital intensive plants whose operation is indivisible (that is, no part of the production can be shut down) and which often consume very large quantities of energy, have such high break-even points that sales have to be maintained by massive promotional campaigns as witness petrol and detergent producers.

The need for very large amounts of money both for capital investment and as working capital imposes very sophisticated financial management. Large sums may have to be raised and interest paid for years before production can start and make any return on the investment. The capital investment policy and policy for financing become the focal points of the finance galaxy. They may involve very complex decisions on how far funds should be drawn from the firm's own reserves, and how far outside sources should be tapped. Policy decisions may have to be taken on placing issues of stock on the open market. This can be painful to the entrepreneur or family which has hitherto had undivided control of the business. Financial control systems and, indeed, the whole system of management information and control must be at a high state of efficiency and generally much more highly responsive than for labour intensive operations.

The purchasing policy is also more likely to be highly sophisticated. Many capital intensive processes consume large quantities of raw materials 24 hours a day throughout the year. Huge reserves may have to be maintained tying up large amounts of capital. Quality and consistency may be critical. In general, the more capital intensive a technology, the more the whole management of the firm has to interlock and behave as a single, integrated system.

Finally, it must be repeated that the patterns in Figures 2, 3, 4 and 5 are characteristic of labour or capital intensive operations in general. In any one industry the emphases on individual techniques may be greater or less than shown. The reader may care to apply the method of visual presentation used here to any industry or firm with which he is thoroughly familiar.

IV. OBSERVATIONS ON THE INDUSTRIAL ENVIRONMENT AND PERFORMANCE

Before going on to discuss managerial performance in relation to technology employed in the countries visited, it is relevant briefly to examine the environment in which industry operates. The purpose of this is primarily to enable the reader to fit the firms studied into their places in the overall industrial structure and thus understand that the observations apply to conditions in specific groups of industry but not necessarily (for lack of evidence from this study) apply to other groups.⁶

Industrial Environment and Structure

1. India

India represents the most advanced and complex level of industrialization among the three principal countries studied, so that a truly "representative" picture of Indian management performance and practice would be impossible to obtain without spending much longer and taking a much wider sample. Broadly speaking, manufacturing industry divides itself into five groups, omitting very small industries and handicrafts.

- (1) A very important public sector, well established and composed mainly of large units, most of which have technical and licensing agreements with leading foreign firms.

⁶ Extensive experience of U.S. and other agencies in technical co-operation with industry in developing countries suggests that some of the findings may have very wide application.

- (2) An important and in some cases very advanced private sector, in several cases composed of large conglomerates which have grown up over the last thirty years and sometimes more. Most are now public joint stock companies, but the management is still mainly in the hands of the original families. There is an increasing tendency to use professional managers and to promote them on to the boards of directors.
- (3) A number of important affiliates of major foreign firms and joint-ventures, the latter often associated with the major private conglomerates, whose top management is now almost entirely Indian. Management practices tend to follow closely those of the foreign parent companies or partners.
- (4) A very large sector of family owned and managed firms of medium size whose levels of management performance cover the whole spectrum but in general tend to be less efficient than the levels in the first three groups.
- (5) A small but growing number of companies in the light industries founded by young men who have studied technology and management abroad, usually in the U.S.A. and which show a high degree of entrepreneurship. They are often associated with foreign companies for technical know-how in forms of agreement including what amounts to franchise.

The firms visited in this study fall into Group 2, with one exception, a new small plant in Group 3. The sample was further biased by being confined to the Bombay area. On the other hand, quite a lot of data on other groups was obtained in the course of discussions with knowledgeable persons, supplemented by the consultant's own previous experience.

In the last twenty years India has had very large numbers of technologists and executives trained and educated in the United States and other leading industrialized countries. There are a growing number of institutions of high quality offering higher degree in business administration as well as post experience training. As a result the country possesses many well-trained and by now experienced cadres. However, the study revealed problems in the application of management practices where the top management is still in the hands of the original entrepreneurs, even where the younger generation has been well trained. There is still an acute shortage of specialists in the application of management techniques at the middle level.

In my discussion of industry and management in India, it has to be remembered that among developing countries it is so large that even if only five per cent of the population have substantial discretionary spending power, this is already an important market.

2. Indonesia

The limited study made in Indonesian industry suggests that it is roughly where India was about twenty five years ago, although the country still lacks the great Indian industrialists who already had "rajah" empires at this time, nor are there the same number of large affiliates of foreign firms.

Important areas of Indonesian industry, such as oil, textiles and steel are in Government hands or subject to close Government control. With some few exceptions the modern private sector has only begun to develop substantially since the political changes in the nineteen sixties. Up to this point there was very little accumulation of capital in Indonesian hands other than those of Chinese extraction.

In the private sector, with which this study is primarily concerned, firms tend to divide into three main groups.

- A. Purely Indonesian owned firms, often owned and managed by Indonesians of Chinese origin with extensive commercial experience and connections abroad. Cooperation from abroad, especially from Taiwan, is common, but joint ventures are not usual. The managements are skilled in finance and costings; administrative overheads tend to be minimal. Owners and their families take a very active part in all aspects of management. Distribution tends to be through networks of associates.
- B. Indonesian firms which may or may not be joint ventures. If they are, the foreign partner is kept in the background. Technical and production management may be in the hands of foreigners, either directly employed or supplied by the foreign partners.
- C. Joint ventures in which the foreign partner is dominant. In some cases the firm may have the name of the foreign firm. Capital most nominally be 51 per cent Indonesian, but in practice, much of this may be made up of long term loans. Senior management initially comes from the foreign partner which also supplies plant, equipment and know-how.

The public sector has made extensive use of foreign aid, both in the form of managers and technical staff and through the use of U.S. and other consultants. The only public sector enterprise visited by the consultant in this study had had UNIDO experts advising it for several years. Out of seven firms studied, two were in each of the groups cited above and one was in the public sector. Size ranges was between 700 and 16 employees.

* This categorization is owed to Mr. H. Srihantomo who, in his position as President of a major industrial estate, has had wide opportunities to study Indonesian industry.

Indonesia has suffered from many problems since independence including a very severe shortage of qualified technical and managerial personnel. A productivity movement started towards the end of the 1950s and the Indonesian Productivity Centre did some very good work. Management development was carried out at Bandung and there is a Business Administration Institute at the University of Indonesia. Many Indonesians have studied in Holland, the United States and other industrialized countries. The political unrest of the sixties slowed down both industrial development and management education and training. Industry is now beginning to develop again very fast. There is a serious lack of specialized personnel in all fields of management, although there are a number of Indonesian firms of management consultants.

3. Afghanistan

Afghanistan is still in the very early stages of industrialization. There are few manufacturing firms; a large proportion are in the public sector. There have been foreign firms in the country which appear to have been more concerned with exploiting the markets and repatriating their profits than with contributing seriously to the Afghan economy and industrial development. Some senior executives have studied abroad but there is an almost total lack of management specialists and there are at present no facilities for management development.

The country suffers very seriously from its geographical position in terms of obtaining raw materials and other supplies. Goods coming from the East most normally come through the port of Karachi unless they are flown in. Access by road through Iran and the Soviet Union is good, but goods tend to be expensive by the time they reach the country.

The firms visited, all in the public sector, ranged in size from 2,000 to 20 employees.

The above represents a résumé of the background to industrial management in the three countries visited as the official part of this study. It was noted above that the consultant was able to supplement and confirm some of the data by information obtained in other unrelated missions in 1975, one to the Dominican Republic and one to Pakistan.

The Dominican Republic and Pakistan

Some four weeks were spent in the Dominican Republic in the month of March, 1975, in the course of which some 30 firms were visited, all with one exception in the private sector. They ranged in size from 800 down to 7 workers and covered quite a wide range of industries, mainly consumer goods, both durable and consumable.

Manufacturing industry in the Dominican Republic started to develop seriously only a few years ago and is growing very fast. Many younger Dominicans have studied in the United States and there is a strong U.S. influence both in the choice of goods and their design. The U.S.A. supplies much - though by no means all - of the machinery and equipment. There seems to be a tendency to purchase "turnkey factories."

Most of the entrepreneurs have little or no formal training in management but many show imagination and initiative. There have been until recently no facilities for post experience management training, although there have been some institutions providing supervisory and middle management programmes. The Instituto Tecnológico de Santo Domingo, (INTEC) has been set up very recently to provide consultancy services to industry and to carry out training programmes. It is receiving aid from UNIDO.

Since 1972 the industrial scene in Pakistan has undergone a major change. Until then, industrial development had been to a large degree in the hands of the private industrialists, several of whom had built up very substantial organizations, including major banks. All banks and certain key industries such as engineering, the oil industry and a major part of the chemical industry have now been taken over and grouped in corporations under the authority of a Board of Industrial Management. Very large investment in steel, fertilizers, oil and other key industries are planned in the next few years.

A large number of top and senior managers have studied abroad, notably in the United States. There is one major institution for post experience management training and some voluntary professional associations, as well as two post graduate business schools. On the other hand, facilities for training specialists in management techniques are seriously lacking, above all in the production management field.

The country is at present suffering from a very serious emigration of qualified engineers, accountants and skilled workers to the Arab States. In addition, many qualified Pakistanis who studied abroad and remain in the countries where they made their studies, notably the U.S.A. The return of a substantial proportion of these would greatly help in providing much needed management skills for the industrial expansion.

Managerial Performance.

It is now possible to make a summary review of the managerial performances observed in the course of the study within the context of the main theme. The limitations and reservations have already been stated.

Of sixteen firms visited or where discussions were held with top executives in the three countries primarily studied, five are judged to have been applying management techniques appropriate to the technologies used in a manner calculated to exploit these technologies efficiently and economically. One of these was a joint venture.

Four firms were well managed but these could have been better application of management techniques in some areas. One of these had extensive technical aid in the production field.

Two firms were doing well without very much conscious management by virtue of the energy and close attention applied by the owner managers, but one of these was showing signs of running into serious trouble in the near future. There was little evidence of any awareness of the need to relate management to the technologies employed.

Three firms visited, one of them only in the starting up stage, showed very serious deficiencies in management. One was a state enterprise and two were private. The largest of these had newly appointed top management fighting traditional management.

The remaining two firms are difficult to classify; one was a joint venture only just starting up whose management came from the foreign partner and appeared competent; the other, a state enterprise, was so inefficient as to be unclassifiable.

Of the companies, state or private, visited in the supplementary countries as a cross check on the main study, in one country half of those visited appeared to be in the first category. In the other country only about 20 per cent could be said to be applying management techniques in a manner calculated to utilize their technologies effectively.

No one country had the monopoly of well or badly run firms. Of four textile companies visited, three were very well run and one was well run. The last-named was suffering from the fact that it was being reactivated after the original foreign owners had closed it and left the country; the machinery was in poor condition, having been worked hard for ten years and spares were difficult to obtain. The present management understood what needed to be done. Two of the above companies, one in India and one in Afghanistan, were outstandingly well run for different reasons. The first was a private company, part of a major group, the second, state owned. (Cases A and B).

In the engineering field, one large and very well run company was visited in which it was clear that the management understood thoroughly the management of capital intensive plant, although it was admitted that mistakes had been made in the past. However, they had learned by experience. Two others, one very large and capital intensive, were operating badly, the smaller of the two being in a condition which indicated that virtually no management techniques were being applied. (Cases C, D and E).

One engineering plant employing 60 people manufactured replacement pistons for imported cars. A good deal of capital had been invested but

the operations also employed a lot of labour, mostly female. The owner-manager had been importing and distributing pistons and decided to go into manufacturing. He imported machinery and technical personnel. Without much conscious application of management he showed acumen in analysing his sales and selecting only those makes of piston which covered major makes of imported cars. He intended to expand the scope of his manufacture. This was a classical case of energetic entrepreneurship which can succeed in small and medium industry by the sheer input of attention from the entrepreneur himself. (Case F).

On the other hand, a long established firm producing steel rod for reinforced concrete changed over from an old process to a modern continuous and capital intensive process without, apparently, making any adaptation of the management and in spite of a consultant's report. (Case G).

A small firm set up in association with U.S. partners was founded by a former graduate of a major U.S. school of business administration. It was fairly labour intensive. He showed real entrepreneurship in selecting a product and finding the right partner, but admitted to being weak in the production field. (Case H).

The case brought to the attention of the consultant illustrates vividly, not the adaptation of management practices to technology, but how not to set about acquiring a new technology.

A businessman in the building trade decided to set up a ceramic plant to supply tiles to the building industry. He went to the country supplying such plants and through an "expert" intermediary, purchased his equipment. He seems to have failed to ensure that his contract was properly drawn up, with the result that the machines and other equipment were delivered and installed and the supplier's technicians left stating that this was as far as the contract went. As a result he was forced, after much delay, to engage other technicians to start the plant running, by which time he had used up all his bank loan and had no working capital. Further, he appeared to have made no effort to find out the problems peculiar to ceramic manufacture and seemed likely to run into further trouble once manufacturing started.

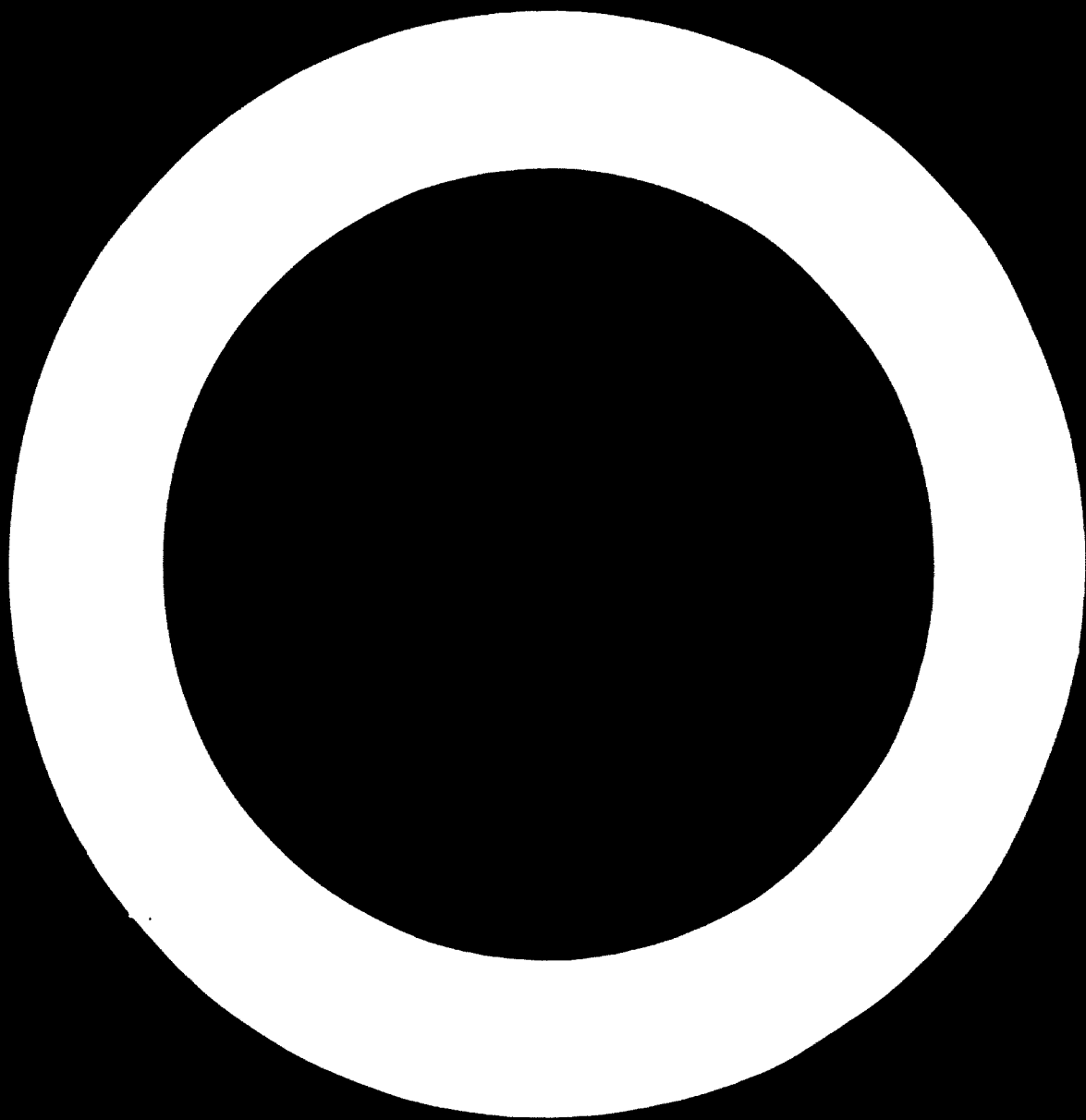
The eight cases selected for presentation in the Appendix have been chosen as representing a varied range of problems and practices in both labour and capital intensive operations and of high and low efficiency in dealing with them. One or two firms showed a good overall management with surprising deficiencies in certain key sectors. For example, one large and well-established engineering group producing a wide range of products including machine tools and only a very loose quality control system in the hands of individual department managers, some of whom proved more quality conscious than others. Only recently had it been proposed to bring in a quality manager, reporting to the managing director, who would coordinate quality standards and conformance. Clearly the concept of a quality policy appropriate to each product had not previously been part of the management thinking.

Probably the most widespread single weakness, noted not only in the formal studies but in most firms in the two other countries mentioned, was a lack of proper costing and cost control. Even in some important engineering works there was a lack of accurate time standards making costing as well as programming and scheduling difficult and inaccurate.

Of the two supplementary countries, the Dominican Republic showed in many cases an almost total lack of market studies and sales analysis and a very low rate of plant utilization. Plant selection was in some cases weak and automatic machines were seen idle because they were unable to use local raw materials. Most of the manufacturers seemed to be "playing it by ear" because they lacked the cost and financial data which would have provided them with the proper performance guidelines.

Poland is currently undergoing a period of transition in which major sectors of industry have been taken over by the state. Some very competent and very knowledgeable top managers are struggling to

make good deficiencies in organization structures and management systems taken over from the private sector and provide much more effective utilization of plant and labour. The problems encountered and practices seem confirm to a large degree the findings of the main study. However, the problem is compounded by the emigration of very large numbers of experienced managerial, technical and operative personnel overseas which has already been noted.



FINDINGS AND RECOMMENDATIONS

V. FINDINGS

Is it possible to generalize on the basis of the limited data acquired? The answer is probably in the affirmative and it is believed that further and deeper research would tend to confirm the initial impressions, although, no doubt, there would be modifications in detail. The indications obtained in this study may be summed up in the following manner.

1. In the three countries studied, even though at different levels of industrial development, there are firms in both public and private sectors which are most competently managed and in which the managements are fully aware of the management implications of the technologies employed.
2. These firms in each case represent a minority, sometimes a small minority, even among well-established firms. Many entrepreneurs do not understand the role played by modern management techniques in the full and efficient exploitation of the process and, indeed, in many cases, are not even aware of these techniques. They regard the use of specialists in staff functions as an unnecessary expense and do not see the need to use consultants.
3. This may be in part due to the fact that in some sectors, especially in newly industrializing countries, there is no competition and demand has yet to be saturated. Profit margins are considered to be high. The "unlimited demand" and high profit margins are certainly in some cases illusory. It has been noted that a lack of proper costing systems is general; more accurate costing might reveal much lower profits than generally supposed.
4. Apart from widespread lack of knowledge of technologically related management, there are general indications that much more aid is needed by managements in developing countries in the selection of appropriate technologies and of plant and equipment in general. Very large sums in foreign exchange could unquestionably be saved every year if such services were available and managements could be induced to use them.

5. The problem of applying correctly the range of management techniques demanded by various types of technology, even where the top management understands the need, is the lack of qualified middle managers and specialists to apply them. The general shortage of such people in relation to the demand and need is such that the competent ones usually achieve rapid promotion to higher management positions or move on to more highly paid jobs in other firms. This is also true of the staffs of the management training centres, who often do not stay long enough to train their replacements adequately. Thus the capacity of these centres to train new staff for industry is progressively diminishing.
6. In two of the three main countries studied there are virtually no facilities for the training of management specialists. In the third, India, they are very inadequate. However, where they do exist they are still only used by a minority of firms. Like the use of management consultants, the problem is essentially one of the education of the top management.
7. In countries where feasibility studies are required to obtain major financing by governments or banks, the consultants are usually paid by the would-be borrowers and these reports often tend to be over-optimistic. In one country the UNIDO consultant was advised that of 140 companies with major loans for equipment, 140 were in trouble and the banks were seriously concerned. The banks themselves do not, it appears, have personnel qualified to assess the value of the consultants' reports, especially in matters relating to technologies proposed or the management structures and practices to be associated with them.

6. As long as the conditions prevail in which management, particularly in the private sector, feel that they can make good profits without adopting the full range of necessary management techniques, they will not do so. It is in the interest of the financial institutions to ensure that the loans which they make are used as effectively as possible and thus, up to them to relate these loans to some conditions to this effect. This they cannot do without having the necessary information and capacity to assess management efficiency.

VI. RECOMMENDATIONS

1. Much greater emphasis than hitherto must be placed on the relation between technology and management. A major programme should be developed and implemented to ensure that the subject is everywhere properly understood, especially by top management.
2. This programme should incorporate in-depth studies, including sectoral studies and research into the effects of economic and social environment. It should also include research projects designed to relate management practices to differing levels of technology in important industries, thus providing clear cut guide-lines to managements on the structures and practices needed to achieve optimum utilization of their resources.
3. Special attention should be given to the development and propagation of costing systems appropriate to the main industries and technologies.
4. Much more aid is required by both state and private industrialists in developing countries in the selection of technologies most appropriate to their operating conditions and economic environment. Many millions of dollars would be saved annually in foreign exchange and in internal loans if selection was made more accurately. There is an urgent need for a service which would provide practical and impartial advice in this field. It would appear to be clearly within the terms of reference of UNIDO to provide such a service.
5. Greater facilities are needed in many countries for the training of managers at all levels and especially for the large numbers of middle managers and specialists demanded by modern technologies. It is essential that each country should set up facilities for this, but they are of little use if the top managements do not take advantage of them. They will only do so when the need is clearly felt and understood.

6. Action should be taken to provide banks, finance corporations and other bodies offering long term financial facilities for industrial investment with the necessary knowledge of modern management and of criteria for the proper selection of technologies in relation to local operating conditions. Experiences of technology related management organizations should be set up nationally and/or regionally to provide these institutions and national governments with the necessary knowledge and criteria for making the right decisions in this field. If and when a service is set up to advise management on the selection of technologies, financial institutions should be encouraged to insist on its use and send personnel to be trained in courses which could be provided by that service.

APPENDIX

CASE A

Walla Textile and Garment Manufacturing

This company is part of a private joint stock conglomerate. It employs 2,500 - 3,000 operatives and 400 administrative, technical and supervisory staff.

It processes wool through cleaning, combing, spinning, weaving, finishing and dyeing. There is also some manufacture of men's suits and trousers. There are 16,000 spindles, of which about half are in very modern frames and 74 shuttleless looms named 12 per weaver and helper, capable of very high production. 24 more looms of the same type are on order. These represent a very high capital investment. The machinery makers sent technicians to install the equipment and train the workers; shop managers and assistant managers were sent to the maker's works for training.

Distribution of the cloth and garments is through chain stores, wholesalers and exporters. About 70 per cent of the suits and trousers are exported. An office is maintained in London.

Three shifts are worked and the productivity of the plant is very high. The organization of the production management is characteristic of good textile industry practice. Routine servicing and maintenance is carried out by shop maintenance squads with a central maintenance department responsible for major overhauls and dealing with the rare breakdowns. Quality control is the responsibility of individual shop managers who are provided with modern inspection equipment. Cloth inspection is 100 per cent. A central quality control department whose chief reports to the Executive Director maintains overall supervision of quality and makes checks.

The organization structure is classic and has no special points of interest. The Sales Department is divided into home and export sales. Some further division of responsibility for export sales is under consideration.

The company employs most of the modern management techniques appropriate to the industry and the highly competitive market. Business forecasts are prepared annually and updated at intervals, taking into account general economic conditions, government policies, (important in a country where industry is closely controlled by the Government), consumer demand, market potential, sales trends in the industry, both at home and in the export markets and competition. Reports are also prepared annually on working capital needs. Production is planned on the basis of sales budgets and tight cost controls are employed.

Evaluation of performance is made by comparing actual with budgeted sales, increase (or decrease) in sales volume against the previous year, profit margin and return on investment. One of the most highly regarded consultants in the country is retained on a part-time basis.

The firm has for some time been expanding its operations continuously; plant and equipment is added to in accordance with planned expansion. Planning for expansion has to be done in advance owing to the need to obtain import licenses; the same applies to raw material supplies and spares. At present Marine wool imported from Australia is used, but the firm is starting a sheep farming operation with 1,000 Marine sheep within the country.

New advanced equipment, for example, the shuttleless looms, has been introduced to meet increases in demand and the need to improve quality. Management practices are modified to meet the technological changes. The result has been improved output and quality.

Managerial staff have management education and training. The firm supports national management development programmes and where necessary sends executives abroad.

Summary

This firm is efficient by any standards. The top management appears to understand very well the management needs of a capital intensive firm in a competitive market and the need to meet technological changes with modifications in management structure and practices. It seems to be unusually well staffed at the middle level.

SAREE

Cotton Textile Manufacturing

This company is state owned. It was set up in 1967. It employs 2,000 workers in three shifts, of whom 200 are administrative, technical and supervisory staff. Cotton cloth is produced from indigenous cotton and is dyed and printed. There are 20,000 spindles and 660 automatic looms operating @ per weaver, which are being increased to 900. Preparatory and finishing processes are standard. Output in 1974 was 14 million metres. This industry must be considered as capital intensive.

Distribution is through the firm's own shops and agents and is almost wholly confined to the domestic market, in which the potential demand greatly exceeds the supply. Its output represents one fifth of the current total output for the country.

The plant was designed and all equipment supplied by China on the basis of a long term no-interest loan. Chinese managers and technical staff set up the management organization and trained managers, technicians and workers. This aid has now been reduced to two or three technicians.

The efficiency of the spinning and weaving departments is said to be about 94 per cent; a visual check during a tour of the plant suggests that this is probably true. Servicing and preventative maintenance are carried out by a central maintenance department in accordance with a pre-determined schedule. At any one time, five per cent of machines are under overhaul. Each department is well equipped with quality control laboratories and cloth, both grey and finished, is subject to 100 per cent inspection.

The firm has its own design department for printing patterns in which a number of young men are being trained and are producing attractive designs.

The organization structure is standard for this type of plant and industry, the only unusual feature in Western eyes being, perhaps, an economist among the top managers, who is responsible for both planning and cost control. Planning is done on the basis of a yearly sales budget, which is broken down into monthly, weekly and daily operating programmes. Shop managers are brought in at all stages of planning and know what is required of them. Failure to reach planned targets is reported to the President who looks into the causes. Once a year there is a meeting with the principal agents and retail shop managers at which they are shown new patterns, asked what they like and what quantities they think they can sell. An analysis of sales of past patterns is maintained.

Very strict cost control is enforced. Financial estimates for working capital and investment capital are made.

Profitability is one of the criteria of performance; however, it is difficult to determine through the profitability exactly how efficient the operation is, since the firm is operating in a sellers' market. It is making a substantial profit and has been able to lend money to other state enterprises at 5 per cent interest.

Two features of this company were particularly impressive. The first was the stocks of spares which showed clear understanding of the need to maintain the machinery in operation and not to have any machines idle for lack of parts, an essential characteristic of good management in capital intensive industries.

The second feature of special interest is the personnel policy and practices. Workers are among the highest paid in the country. Over and above their basic wages they receive an additional one month's pay per year if their attendance record is good. They also receive one free meal a day, transport, cloth and medical care and, in addition there is some form of output bonus. After three years' service, they receive an additional month's pay per year.

This is the first enterprise in the country to employ men and women on the same type of job and to pay them equal wages. Women work on both spinning frames and looms. It is understood that there were some problems at first but these are now minimal.

Summary

This firm is operating under much simpler conditions than the company in Case A. Having a sellers' market, the management is able to concentrate its prime efforts on efficient production, which it clearly does. It is a striking example of what can be done with industrially inexperienced personnel within a framework of management organization, technical standards and norms of performance in which each individual at all levels can be trained to play a clearly defined part and, in effect, "drilled" to do so. The textile industry, being one in which processes are highly standardized, lends itself especially well to this kind of treatment, but it can certainly be extended in other industries.

The first national President of the firm is recognized as one of the most dynamic men in the country who now holds a high official position. The fact that the company continues to operate at a high level of effectiveness under his successor and without most of the original foreign technical aid is a testimonial to the methods originally employed. Important lessons may be learned for application in countries where industrialization is in its early stages.

CASE C

Medina and Henry Engineering

This company is a member of a multi-product group manufacturing a wide range of engineering equipment for atomic energy, chemical, food processing and related industries. The firm is a private, joint stock company employing 10,000 workers, including 3,000 staff. The plant visited employs 5,600. The products made at this plant include heat exchangers for atomic energy plants, pressure vessels of various types, bulk transport tanks for rail and road and heavy switches.

The products are sold directly to end users. The market is mainly domestic and for certain products the firm has a virtual monopoly. However, the market in the country is limited. Except for the bulk tanks, orders are on a jobbing basis.

It was not possible within the time available to make a study of the operation of the firm as a whole, but it was quite evident from discussions with senior managers and an observation of the plant that the management was highly sophisticated and that the firm could compare not unfavourably with European firms in the same field. Most of the managers and senior technical staff had technical or managerial education abroad.

Although there is a huge investment in machinery, a lot of the work is labour intensive. 90 per cent of the labour force is skilled, some very highly skilled. Working capital tends to be heavily tied up in raw material, most of which is imported stainless steel, representing 60 - 70 per cent of the cost of the finished product. This is compounded by the long process of obtaining import and currency licenses.

Discussion on management practices centred round the problems involved in investing in advanced technology. The example given illustrated the management approach to this problem and its capacity to learn by experience.

Some years ago the firm invested in a numerically controlled multi-spindle drill for the heavy engineering unit where great accuracy is needed in the drilling of very large end frames to take the tubes of atomic heat exchangers. The selection, it was admitted, was not done well. The numerical control equipment was outdated before it was delivered and its manufacture was, in fact, discontinued shortly after the placing of the order with European manufacturers. Once it did arrive it was found that the electronic gear would not stand up to the hot and humid conditions. The machine gave a great deal of trouble.

In this case the technology of the machine had not been sufficiently studied, nor had the economics of its installation and operation. It was not known in fact whether it would make savings. A great deal of money was lost.

As a result of this, before any further acquisition of sophisticated machinery, markets are studied to see whether future market potential will justify further capital expenditure given that, in the first place, capital in the country is very scarce. Senior technical staff are sent to study machines at the makers' and users' works in the major countries producing them. Political and credit problems of seller countries are examined, since changes in national policy might result in the drying up of supplies of spares or credit facilities.

Once the purchase has been decided upon, mechanical, hydraulic and electronic engineers are trained. Labour problems which might result from the introduction of the machines, such as changes in skills required or displacement of labour from traditional jobs, are studied.

Such a study resulted in not buying a machine worth over one million dollars, whose utilization after three years might only be 70 per cent, in favour of an attachment at less than half the price which, although somewhat slower, would do the job as well. For a comparatively small additional sum the chief maintenance engineer was sent to spend a month at the makers' works studying the machine and its electronics.

Summary

It is clear that this firm has developed highly sophisticated management approach to the problems of installing new technology. The example is a striking confirmation of what is said in Section III of this paper regarding the need for extensive technical, economic and financial planning in all activities relating to investment in capital intensive plant.

SAARL

Automobile Manufacturing

This company is one of a large conglomerate involved in a wide range of industries. The parent company is a private, joint stock company, but control is still effectively in the hands of the former proprietors.

The company employs 9,500, of whom 2,800 are administrative, technical and supervisory staff. It manufactures passenger cars and commercial vehicles under license and, until recently, air conditioning equipment. Standard machine tools are employed, organized by departments according to the components such as engine, gear box, back axle and so on. The company also employs sub-contractors. Only the cylinder block machining is partially on flow production. Most of the machines are several years old. The machining operations are fairly capital intensive; assembly operations are labour intensive.

Distribution is in the hands of members of the principal shareholding family or other close connections. Until recently little selling effort has been required; there has been a long waiting list of several years for cars. It is reported that both marketing and after sales service were poor. The situation has changed radically with the increase in oil prices and the firm is cutting back production. In spite of past sales, the past profit margins in the company were low due to government price controls and, as a result, the firm had been unable to build up substantial cash reserves. The price controls have now been lifted, but this has so far done little good in the changed situation. The company has liquidity problems because it is forced to carry large stocks of imported steel, usually at least nine months.

A tour of the production shops suggests a general absence of production planning and control. It is understood that the supply of components to the assembly line is often on a hand to mouth basis and cars often reach the end of the line with parts missing. There was too much work in

progress on the shop floor and the general impression was that the productivity of both labour and capital equipment is very low. Although the cost of raw materials is an important element in the total cost of the product, low productivity due to a general absence of proper production management must certainly represent one reason for the low profit margins in the past.

The present managing director was brought in from outside. One of his major problems is the lack of an effective management information system. The firm has a computer but this is used solely for wages and general accounting. It is not used either for stock control or production control.

The chairman was persuaded to use the services of consultants who have prepared a comprehensive study for a management information system and covered a much wider field in their report and recommendations. They have pointed out that technological advances have not been accompanied by equivalent managerial and organisational advances and that the existing management information system has collapsed and resulted in a proliferation of "little black books". A management information system is needed urgently to improve the materials management - the rationalisation of inventories, reduction of space and capital needs and expediting, especially as regards sub-contractors. Computer based production planning and materials management sub-systems will also permit planned expansion without an equivalent expansion of resources.

Other recommendations include a corporate planning cell, improved office procedures, a strengthening of the currently weak industrial engineering group and personnel department. A new organisation structure is also proposed.

So far little action has been taken to implement the recommendations since there are conflicts within the top management. It may be noted that this company is not one which in the past has supported national management development and training institutions by sending its executives for training.

Summary

The founder of the conglomerate and the dynamic personality in its development died a few years ago. He was typically one of the great entrepreneurs responsible for the development of the country's industries. He did not leave behind him either a structure or sufficiently trained personnel to allow his enterprises to continue their development after his personal drive was removed. The company is just emerging from the centrally controlled structure which characterizes the entrepreneurial stage of development and lacks a strong and competent middle management which is essential for the implementation of management practices and techniques. It is clear that in the immediate past the top management had little knowledge or understanding either of the nature or the importance of these techniques in the running of a large and complex manufacturing operation.

A firm operating in an environment where there is scarcity, where government controls and regulations have a considerable influence on almost every aspect of operation, where there are credit problems and often inappropriate labour agreements is faced with many factors outside its control. If, in addition, its internal systems and management practices are such that it cannot maintain close control of matters within its own domain, the task of management becomes almost impossible.

CASE I

General Engineering and Heavy Goods Vehicle Overhaul

This state owned plant employs about 1,000, of whom 900 are administrative staff. It was set up 10 years ago with foreign aid, primarily as a central overhaul and maintenance workshop for heavy goods vehicles. Since then it has entered into the manufacture of agricultural pumps, bus bodies and metal furniture.

It is well equipped with modern machine tools, although these do not appear to have been well maintained. Most of the present production is by more or less labour intensive methods.

This company is included in the cases for this study because to all appearances no modern management techniques are practiced here. It represents the other extreme to the cotton textile mill described in Case II. None of both staff and workers is very long workers have security of employment in a country where there are few industrial opportunities and, in the absence of any leadership, see no reason why they should put in major efforts. It is clear that there is no understanding of the management implications of the technologies employed.

Aid is currently being given by a United Nations agency but the consultants themselves are doubtful whether their work will have any lasting effect on the operation of the firm as a whole.

Summary

Whatever the original condition of the firm after its establishment with bilateral assistance, it has long since deteriorated to the point described above. This is not to say that the technical and managerial staff are ignorant of some modern management techniques. They have no incentives to apply them. Salaries, even of senior executives, are so low that none can live reasonably comfortably on his salary alone and much energy has to be devoted to finding other sources of income.

In the state sector government regulations tend to hamper initiative and state sector managers are not, in general, encouraged by any display of interest from the top. Under these conditions, which obtain in other countries in the early stages of industrialization, little can be done by outside technical cooperation to improve industrial management.

CASE F

Light Engineering

This small company is privately owned and employs about 80 workers. It started operations in 1974 to manufacture replacement pistons for imported automobiles. These are die cast from imported aluminium ingots and subsequently machined. Current production at the time of the visit was 500 pistons per day. The firm also manufactures brake cables for motor cycles.

The owner has for twenty years been an importer and distributor of automobile spares. The marketing of the manufactured product is still handled by the original family company and through other distributors closely connected with the owners. The market is purely domestic and the only competition is from imported pistons.

After deciding to go into manufacture to replace imports, the owner analysed his sales of pistons and the numbers of cars of the principal imported makes. On this basis he decided that 33 models were worth manufacturing, other imported makes being too small in number to be economically feasible. He was able to obtain the necessary finance through a government loan.

The plant was purchased from abroad as a "package deal", apart from a few machines bought separately. Machines at present in use are manually controlled and operations are fairly labour intensive. The plant was installed by the makers' technical staff who trained the supervisors and labour. One of the technicians is currently works manager.

The labour is mainly female and is paid on set hourly rates. Scope of work was observed to be rather low. Housekeeping is fairly good, but there is no evidence of any industrial engineering or formal systems of production control. Productivity of both labour and equipment could be considerably improved, although this may be less important than efficient utilization of the raw material, which is by far the most expensive item in the product cost.

The owner himself works most of his time in the manufacturing shops and appears to have a very thorough grasp of the production processes. He has no cost breakdown and said that he could not see the need for them. He keeps his records in a small book and claims to know when he is making a profit. No provision is made for depreciation since the plant is considered to be too new to warrant it. Office staff is minimal; there is no functional staff. He sees no use for outside consultants.

Although the main product has been in production for such a short time, the owner has decided to branch out into a line of by-products. Even if he does not keep detailed cost records, he is well aware that the raw material is his most costly item. He was accumulating large quantities of scrap from the machining operations for which he could find no purchases. He therefore decided to buy a very expensive extrusion press and start making aluminum window frame sections. He does not appear to have made any serious market studies nor to have considered what would happen if the demand grew and he was forced to import additional raw material to meet the orders. However, he seemed confident of success.

General

This is first stage entrepreneurship in its purest form which has at all times and in any countries been the basis of industrialization, except where governments have been the initiators. In spite of the lack of formal management practices, it is often successful in the early stage because complete attention to all details of the business plus imaginative common sense on the part of the entrepreneur replace management techniques. It must not be forgotten that much of management and many management techniques are the systematization of common sense. Many techniques have been developed when the size of an enterprise or the increasing complexity of its operations prevent the top management from being able personally to supervise every activity. Just as machines are in one way an extension of arms and legs, so management techniques may be thought of as extensions of the entrepreneur's eyes, ears and mind.

Branching out into a new field without proper studies may well bring unexpected problems but it seems likely that, given the energy and obvious assistance of the owner of this company, these will be overcome.

SMELT

Steel Rod Mill

This company has been in existence since 1955 manufacturing steel rods for reinforced concrete. Until 1974 it produced 70 tons a day by an old process, using open hearth furnaces and, as raw material, local scrap and pig iron imported from a nearby country. In 1974 a fully automatic rod mill was purchased with a five million dollar government loan and output of rods was raised to 400 tons per day. The operation is now highly capital intensive.

Distribution of this product in the private sector is in the hands of a strictly limited number of family concerns with which the firm under study has no relations. The owner therefore sells direct to the government or through government channels. He is anxious to obtain substantial additional capital so as to be able to set up his own marketing organization and compete more effectively with the private sector distributors who, he claims, are undercutting him.

The study for the change in technology was made by a reputable firm of management consultants. Such studies are mandatory if bank loans are required for expansion or to start new industries. The study appears to have been well carried out. The owner appears to have ignored some of the recommendations of the consultants and primarily the need to furnish the much greater output of the new rod mill with an equivalent in furnace capacity. In addition has been made to the existing open hearth furnace which can now only meet less than one fifth of the rod mill's capacity. It is necessary to import pig iron from the United States at much higher prices to meet the deficiency of 300 tons per day.

The report of the consultants was very comprehensive and covered all aspects of the expansion, macro- and micro-economic, managerial and technical. It advised substantial modifications to the organization structure to meet the changed conditions imposed by the new technology, but the owner admitted that so far nothing had been done to implement this recommendation. Management and control remain firmly in the hands of the owner and his immediate family.

The firm is now faced with a serious liquidity problem and the owner declared himself anxious to find a foreign partner for a joint venture.

Comment

This was the only instance directly observed in the course of the study of a change from the old and relatively simple to a highly advanced technology taking place comparatively shortly before the study was made. It is evident that the management was not really aware of the implications of the change, either technological, in the sense of needing to balance the rod mill output with increased furnace capacity, or the need to improve the management structure to deal with a much more "demanding" technology. Nor were adequate marketing studies made and the necessary channels of distribution established before raising production to nearly six times its former level. In other areas the recommendations of the consultants were ignored. It is often characteristic of entrepreneurs who have built up businesses successfully to a certain point that they prefer to rely on their own judgments rather than those of outside "experts". The entrepreneur in Case F took the same attitude and might well run into similar problems as his business develops.

SAME

Electronic Components

This firm was founded in late 1974 by a national who had graduated from one of the major U.S. schools of business. It is a joint venture with a U.S. company manufacturing resistors and currently employs 60 workers and an office staff of 10.

The company is at present wholly dependent on its U.S. partner for supplies of the components which are assembled and finished at the works. The partner also markets the finished products, but this can change in the near future, since enquiries are starting to come in from other countries.

After graduating and working for a time in the United States, the managing director decided that he wanted to come home and would like to set up a manufacturing company. He understood the U.S. markets and conditions in his own country and knew that the government was setting up duty free zones where goods could be manufactured for export. He examined a number of industries, taking into consideration new technologies and the possibility of using them in his country, new products and markets. He finally came to the conclusion that the electronics industry offered the best possibilities, since the products were easy to export.

He had discussions with a number of U.S. electronics manufacturers before coming to an agreement with his present partners. One of the factors which influenced him in favour of partnership with them was that, whereas most other electronics firms had an annual output of 15,000 to 20,000 dollars per employee, this one was producing only 11,000 dollars per employee. This meant that they were using more labour intensive methods which were at once more suited to his home country and involved less initial capital outlay. Most of the plant and machinery were obtained second hand from the partners.

Current production is on one shift per day but will shortly go on to two shifts and in four months three shift working may begin. A start is being made on extension of the factory building and it will take on the distinctive shape and characteristics. At present the working methods

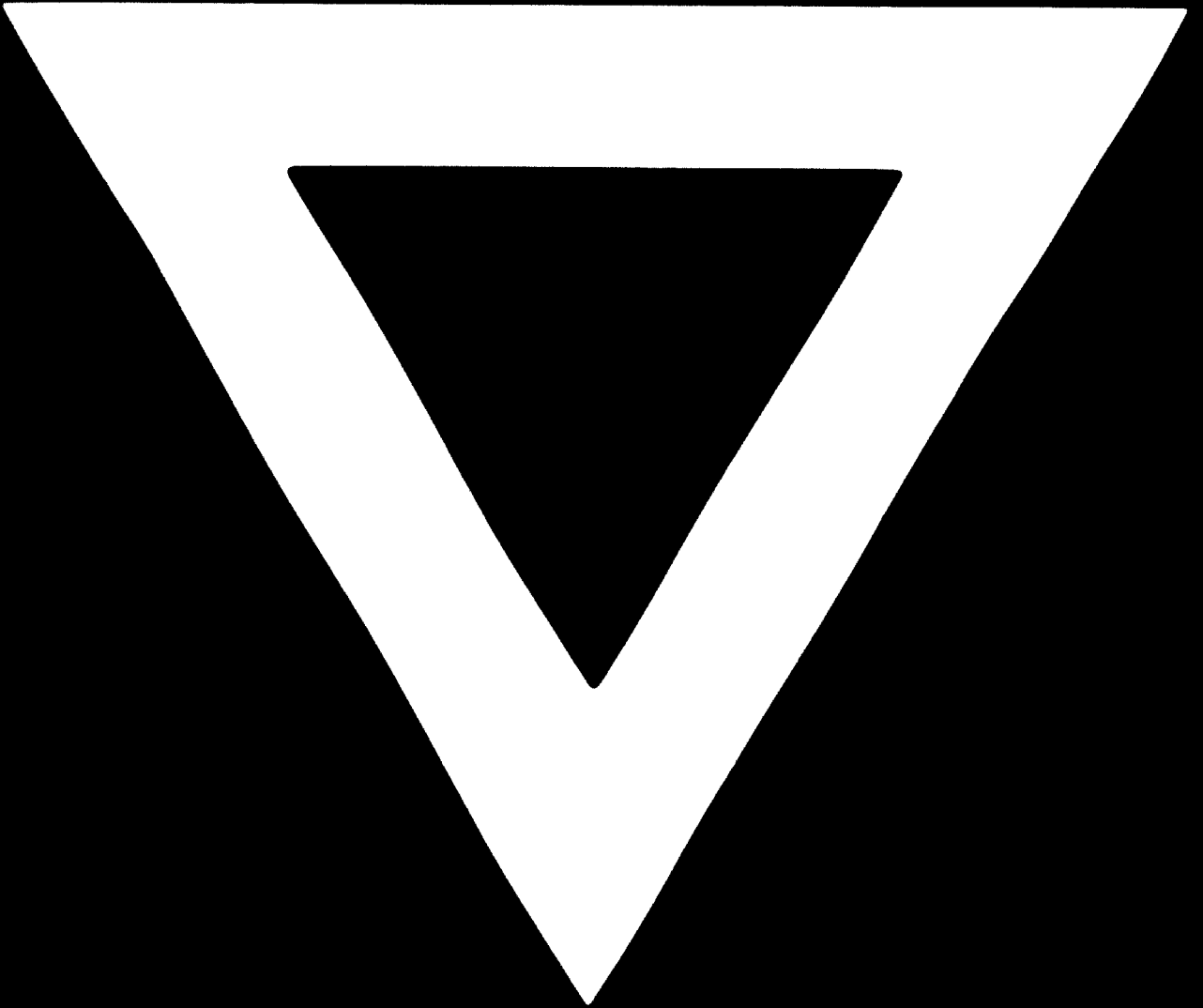
an hour; as a labour intensive operation it lent itself to method study, work measurement and the other management techniques associated with labour-intensiveness. The managing director is aware of this and has engaged a consultant and an architect to help him improve working methods and plan the new workshops. An exceptional feature of this area of the country is that the bulk of the labour consists of young, unmarried girls and women. The plant is currently overmanned because a number of workers under training are required for the expansion.

The company is at present little more than a department of its joint venture partner with all the risks that this entails in total dependence on one market. This is well understood and a strenuous effort is being made to diversify the markets and thus maintain full production in the increased facilities.

Comment

As a study in intelligent entrepreneurship using modern methods of analysing and selecting the field of industrial activity, this case is exceptional in a developing country. Further, the lucidity with which the managing director approached the question of appropriate technology for his country is also rare. While not a specialist in production, he recognised the need for improving methods and the value of consultants in this respect. He has made an interesting social innovation.





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