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REQUIREMENTS OF SKILLED PERSONNEL FOR
INDUSTRIAL PROJECTS AND THEIR APPRAISAL

Prepared by: Sanford Cohen
Visiting Professor
University of Michigan
USA

for: The Centre for Industrial Development
Department of Economic and Social Affairs
United Nations

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Introduction

There is little point in pretending that there is a well tested set of principles or a generally applicable methodology for dealing with the various types of employment problems in the developing economies. Economists are still arguing over such fundamental questions as the relative merits of capital shallowing versus capital deepening as an appropriate strategy for the labor surplus economy, whether in fact there are large numbers of workers in the traditional sector whose marginal productivities are zero, and whether a backward bending supply curve is a characteristic feature of labor supply situations in the less developed nations. Since it is only possible to conjecture in a broad way about questions of this scope, it should not be surprising that the development literature provides few definitive solutions for the host of labor problems that are generated at the project level of development efforts. While answers are scarce, insight has improved as a result of accumulated experience and an abundance of research. In the discussion that follows, relevant parts of this knowledge will be brought to bear on some general manpower problems and upon specific personnel problems at the project level. The first three sections of this paper will deal with pertinent background considerations and the others with selected aspects of the problem of determining the skill requirements for industrial projects.

Constraints and Complications in Industrial Project Manning

Ordinarily, a discussion of skill requirements for industrial development begins with an analysis of labor demand and supply conditions and then moves on to a consideration of the educational program required to remove demand and supply disparities. The discussion here will start with a brief mention of a different order of considerations so as to stress the importance of 'non-technical' factors in industrial project manning.

The development experience of the 1950's suggests that skill shortages may not be quite the acute bottlenecks they have generally been supposed to be.¹ (This observation is most valid in certain Latin American and Asiatic nations which have been troubled less by shortages of educated persons than by an inability to provide adequate employment opportunities for the already educated.²) At the same time, the not negligible record of economic growth in many nations has frequently been associated with a rise rather than a decline in the amount of open unemployment and it is possible that the goal of reducing present unemployment will come to have a higher priority than such goals as the maximization of future employment, income, or consumption. Such a shift in priorities would have obvious and important implications for manpower profiles within industrial projects.

¹W. Arthur Lewis, "A Review of Economic Development," American Economic Review, May 1965, pp. 4-8.

²It would be hazardous to base assumptions of future skill supplies upon this feature of past experience. It has turned out that skill shortages have not been development bottlenecks in a number of countries but any one of many factors might produce a skill scarcity situation in the future.

As suggested above, manning of industrial projects in the developing countries is subject to constraints and complications that are either absent or present in a much modified form in the more highly developed nations. A constraint may result from a development plan or policy that imposes something more than efficiency targets upon the project. Examples in this respect, other than employment maximization, would be vocational training functions, and welfare functions such as the provision of medical care for employees or the maintenance of schools for children of employees.³ Social constraints flow from characteristics of the local culture or from local institutions which may severely limit management discretion in determinations of working hours, occupational wage relationships, technological changes, and hiring and discharge policies among other things. The fact that telephone linemen refuse to use climbing irons may be brushed aside as inconsequential or "transitional" by a central planning authority, but it is an industrial fact of life of no small importance to the director of a communication project. Numerous operational complications are created by such constraints and sometimes, it should be noted, by the failure of hoped for constraints to materialize. One may conceive of situations, for example, where a project manager fails to follow a planning authority recommendation to adjust capital-labor ratios so as to

³ These factors make international cost comparisons very precarious. In Bolivia, for example, the railroad administration has provided medical, educational, and power services not only to its own employees living in various of the railroad centers, but to other inhabitants of the communities as well.

maximize labor utilization.⁴ Contrariwise, there may be times when planning authorities, unfamiliar with the technical details of a project, insist upon unrealistic employment objectives. In the first case, achievement of basic policy targets may be frustrated by a lack of cooperation between levels of authority. In the second, success of projects may be inhibited by the naivete of general economic planners. Additional degrees of complexity result when more than one government ministry or agency is involved in a particular project, when there are frequent changes in the orientation of a general development program, or when selection of key project personnel is subject to political limitations.

Manpower programming plans for the industrial project, in short, must give adequate deference to the realities of the local setting. Certain of these "realities" are among the variables that must be dealt with sooner or later if development efforts are to succeed. It is important, however, that project administrators have a sense of how far and how fast they can go in slipping out from under the complex of constraints described above.

Manpower Assessment and Its Relationship to Employment Problems in Industrial Projects

A manpower assessment can be defined as a systematic effort to describe prevailing characteristics of labor demand and supply conditions

⁴This is not an unrealistic example. Many governments in the developing nations have not taken their own development plans seriously.

and to forecast or project future conditions. In a development setting, the data derived from an assessment can be used as a guide for policy formation. A manpower assessment, for example, may indicate a need to

- (1) revise planned production techniques or even the objectives of an economic plan;
- (2) supplement the plan with labor intensive projects;
- (3) establish project priorities on the basis of their employment creating effects;
- (4) establish project priorities on the basis of available labor supplies;
- (5) modify the structure of the educational system so as to increase the probabilities of having the necessary skills available when needed.

Manpower assessment is beset with many difficulties but the basic methodology can be set forth in fairly simple terms. The first step involves an assessment of the existing labor market situation and is, essentially, an inventory of existing manpower resources and a description of the prevailing balance between labor supply and demand. The current assessment, thus, should provide information about the occupational and industrial characteristics of the labor force, labor force participation rates, and the amount of unemployment and under-employment. Ideally, it would be desirable to obtain information about wage and salary structures, labor mobility patterns, and productivity ratios as well. In practice, the typical manpower assessment bypasses such subjects because of severe data limitations.

Subsequent steps involve the derivation of labor supply and labor demand estimates for some future time period. Depending upon the purposes for which the assessment is being made, estimates may be for short, intermediate, or long term periods and in varying degrees of detail. The demand estimate usually takes the form of a quantification of the labor requirements implied by given output targets. Gross labor supply estimates are usually derived from population data while estimates of supply by occupational class are generally based upon analysis of the output of formal training institutions and of the amount of training that occurs within industrial establishments. Frequently, a manpower assessment will include an evaluation of the nation's facilities for occupational preparation and recommendations for effectuating changes to correct anticipated deviations between future labour requirements and supplies.⁵

Although manpower assessments have been made in quite a number of the developing nations, they appear to have been put to very little use in any of the phases of industrial project programming. This is due, in part, to the fact that many governments have not taken their own economic

⁵For more detailed descriptions of manpower assessment procedures and problems see Jan Tinbergen, "Employment Forecasting," OECD International Seminar of Employment Forecasting Techniques, June 1962; R. G. Hollister, "On the Economics of Manpower Forecasting" International Labour Organization Meeting of Experts on the Assessment of Manpower and Training Requirements for Economic Development; John F. Hilliard, "Manpower Planning," Gove Hambidge (ed.) Dynamics of Development (New York: Praeger Publishers, 1965) ch. 9; Frederick H. Harbison and Charles A. Myers, Education, Manpower and Economic Growth (New York: McGraw-Hill, 1964) chaps. 9, 10. Various materials on manpower that have been prepared by the Manpower Division of the International Labour Organization will be of invaluable help to students and practitioners of manpower planning.

planning efforts very seriously. Within planning agencies, furthermore, manpower planning, quite frequently, is not taken very seriously. Finally, the quality of the manpower assessment is oftentimes poor as a result of deficiencies in statistical data, the difficulty of making realistic assumptions concerning future labor productivity and, hence, future labor requirements, and the difficulty of relating occupational requirements to educational programs. The results, thus, have been regarded as too vague to be applicable to the specific types of employment problems that arise within projects.

The lack of any real dialogue between manpower planners and those charged with authority over industrial projects has had serious implications for over-all development strategy. It has meant, for one thing, that critically important investment decisions have been made without reference to the availability of the required skills or to the possibility of tailoring the form of the investment so as to maximize an employment effect.

Even a crude manpower analysis can provide data that are useful for policy determination on such matters as project priorities, industrial location, and the relative advantages of labor intensive as against capital intensive projects. The rise in the level of unemployment that has occurred in many nations would seem to be ample argument for a closer relationship between government units concerned with employment

problems and the public and private entities that actually employ labor.⁶

Interrelationship Between Project Occupational Structures and National Employment Objectives

The weakness of the link between "macro-economic" policy and the actions of technicians in charge of carrying out individual projects - a condition noted as early as 1958 in a United Nations Bulletin⁷ - continues to be important among the barriers that inhibit serious attacks against the unemployment problem.

Such "administrative disorder" has, of course, been of great concern to those involved in development programs. However, an important aspect of the subject that relates to questions of occupational structure has yet to be adequately explored. A situation frequently encountered in the developing nations can be best characterized, perhaps, as "reverse bureaucracy." In the usual bureaucratic setting, the power locus is at the top and lower levels in the administrative hierarchy are bound by general rules which define degrees of authority by level; the ability of lower authority levels to frustrate basic policy is limited by the circumscribed character of their authorities. When authority by level is loosely defined or, if defined, not enforced, the possibility of frustrating top level policy is enhanced.

⁶The manpower assessment procedure itself requires a close cooperation between project planners and general manpower analysts. In phases of a manpower assessment, the analyst must rely upon specific project plans for certain types of data. Unless such data are obtainable, basic statistical building blocks for deriving important national estimates will be missing.

⁷United Nations Bureau of Economic Affairs, "Capital Intensity in Industry in Underdeveloped Countries," Industrialization and Productivity, Bulletin 1, (Geneva, 1958, No. 58.II.B.1).

In the developing economy the problem is not only that operating agencies may act independently but also that certain commitments of resources by the agencies may be irreversible. In this circumstance, authority tends to flow from the bottom to the top of the administrative hierarchy since irreversibility imposes limits upon the degree of freedom that remains with those who are, supposedly, the basic policy architects.

Applying this analysis to matters of occupational structure, what we find in many cases is that project technicians have selected a particular technology, thus defining the character of the occupational structure of the work force.⁸ At the point of time in the progress of a project when physical resources have been committed, a condition of irreversibility sets in and the options relative to the types of labor to be employed are severely constricted. There are further ramifications. The occupational structure of an industrial project may be used as an indicator in estimates of future labor requirements. Most discussions of manpower assessment methodology, in fact, imply that it will be. The structure, thus, may be fed to the educational system in the form of a datum which describes the future manpower needs of the nation. The ramifications need not be traced beyond this point other than to note that the capacitation of persons with particular sets of skills is also

⁸The choice may have been made by a particular ministry or an agency within a ministry perhaps with the assistance of visiting experts. These variations do not affect the argument.

the creation of a type of pressure to insure that the skills will be employed. This may further limit the discretion of those authorities who are attempting to elaborate a national employment policy.

Formulation of Requirements of Skilled Personnel for Industrial Projects

The gist of the foregoing discussion is that decisions on manpower requirements for projects should be compatible with broad policy considerations. With this in mind, the more technical aspects of the problem can be considered.

Skill Requirements for the New Project

If the contemplated project is a new plant or facility, it is quite likely that a sequence of work forces will have to be employed. Ordinarily, skill requirements will be quite distinct in the preparatory, construction, and operating phases of a project. In the first phase noted, the skills needed (e.g. surveyors, architects, draftsmen) will be technologically determined, for the most part, and the problem for the project will be, essentially, one of recruitment. Skills needed in the construction phase will depend largely upon prior decisions made relative to the use of capital intensive as against labor intensive techniques.

The problem becomes more complex at the operational phase. If we assume that the character of the technology and the output targets are given by an economic plan or otherwise, the occupational coefficients may be defined to an extent but they are not likely, in the usual case, to be rigidly fixed. When the possibility of using different skill combinations exists, relative supply prices become an important con-

sideration. The optimal result, of course, is achieved when skills are so combined that the supply price of the project's total labor force is minimized.

Stated in slightly different terms, when a given output can be produced with different combinations of occupational skills (assuming capital constant) the optimal combination will minimize the use of the scarce labor resources and maximize the use of the abundant ones. What is involved here is the familiar principle of marginal costing which, because of data problems, is more likely to be serviceable as a broad guide rather than a precise instrument in occupational structure determination.⁹ In the initial stages of project operation, furthermore, problems of plant coordination will tend to dwarf those of minimizing costs through fine adjustments in labor skill combinations. What the project authority is likely to be looking for is some general rule of thumb for determining the minimum number of skilled persons in different occupational grades necessary to insure the physical success of the project.

A number of approaches for this type of determination can be noted. None is foolproof. All, in fact, have serious conceptual and methodological shortcomings. They can, however, be helpful if used with appropriate caution.

⁹The labor supply price, of course, may be institutionally rather than market determined in which case there is no necessary relationship between minimizing project labor cost and economizing in the use of the nation's scarce labor resource. The usual suggestion for correcting the distorting effect of institutional prices is the use of shadow prices. It is not apparent, however, that there is any effective way of putting shadow wages into practice.

Inter - country comparisons of ratios of high and middle level manpower to total employment can be used as rough benchmarks in the derivation of a project's requirements for these skills. For the industrial project, the relevant ratios would be those found in comparable industrial sectors in other nations. Preferably, there should be separate ratios for management and technical personnel. It would be desirable, in fact, to have data showing what percentage of total technical and management personnel is accounted for by management personnel alone.

It is always dangerous to base development decisions upon international analogy and the present case is no exception. Ratios of the type referred to above vary considerably from nation to nation and the range is not narrowed significantly when comparison is limited to nations at similar stages of development. The old problem of data incomparability accounts for some of the variation but, apart from this, skill utilization practices among nations are affected by relative scarcities of particular skills, relative wages of skilled and unskilled manpower, scale of enterprises, the numbers of research personnel employed within establishments and other factors. Nevertheless while these limitations of inter-country comparisons affect the value of the data, they do not render them completely useless. In the problem under consideration, they can be regarded as tests to determine whether skilled-unskilled ratios proposed for the project are grossly inconsistent with international experience.

When gross deviations are revealed and no special justification for the deviations can be offered, proposed ratios should be reconsidered.

Inter-country comparisons of skill input-output quantity relationships might also prove to be serviceable. Data from other nations, for example, on the number of engineers per ton of steel output or per 1000 telephones in use can be used as check references. The limitations of such comparisons are of the same order as those noted for occupational ratios.

When establishments similar to the contemplated project are present within the country, the experience of the most efficient of these can be drawn upon. Here too adequate allowance must be made for special conditions that may be relevant only to the particular enterprise.

The various types of international and intra-national experience that project authorities may refer to can provide direction but they cannot be completely determinative. In the last analysis, each project must justify its own staffing pattern which is likely to be different from those found elsewhere because of production, supply, transportation, marketing or other problems that will be unique to the project. Skilled manpower profiles that are perfect replicas of those found elsewhere should be as suspect as those that show unusually large deviations from prevailing patterns.

Estimating Future Requirements

At some point in the process of programming for economic development, a judgment should be made as to whether present stocks of skill, diminished

by normal attrition and augmented by output from existing training facilities, will be adequate to satisfy future requirements. When the judgment is negative, immediate or almost immediate adjustments in the amount and quality of training that is taking place may be necessary because of the length of training time involved in skill capacitation.

A decision relative to the dimensions of the required changes in a national training system necessarily involves a forecast of future skill requirements. The forecast may take the form of a general guess or it may be based upon elaborate statistical analysis. Once made, the forecast can be used by appropriate authorities as a basis for decisions on amounts and types of education to be offered.

It should be noted at this point that efforts at forecasting in respect to scientific and technical personnel have not been notably successful. An international conference on the subject concluded that there is no established and unique methodology for making this type of forecast and that it would be unwise to regard forecasts as rigid and infallible guides to policy.¹⁰

As stated above, however, it is impossible to avoid forecasting and the conference statement might be more meaningfully interpreted as a warning against regarding mechanical forecasting methods as rigid policy guides. What we are driven to, then, is the necessity of relying upon informed opinion for the final shaping of a manpower forecast. While this may be unsatisfactory to the scientifically minded, it may be misleading to suggest that there is any workable alternative.

¹⁰ Forecasting Manpower Needs for the Age of Science, OECD, 1960, p. 113. This report includes descriptions of specific forecasting techniques that have been used in a number of nations.

The problem of forecasting future skill requirements for the individual industrial project may not be as severe as that associated with industry-wide or economy-wide forecasts. A popular method of forecasting long run needs of particular skills such as engineers or specialized technicians, for example, is to express the need as a simple function of industrial production. While this method is not too trustworthy for an aggregate such as an industry, it might provide reasonably good results for particular projects. At the project level, furthermore, it might be fairly obvious as to what additional variables ought to be taken into consideration. Another forecasting method is to project, by regression analysis or otherwise, ratios of skilled persons employed to total employment. This method too with some modifications might give good approximations for individual projects. In all cases, however, it would be wise to treat forecasts of the types described as starting rather than terminal points of the estimate for future skill requirements.

Detail in Skill Requirement Forecasting

The precise nature of the problem of forecasting project skill needs will depend upon the type of industrial situation involved. The project, for example, may involve a fundamental change in technological level such as occurs, say, when 1000 small and primitive rice processing plants are to be replaced by 50 medium size plants by some target date. The estimation problem here is basically that of the new project or facility as described above. A different order of problem is involved when the estimation is of skills needed in view of a contemplated expansion of output. How many more engineers, for instance, will be needed if

electric generating capacity is increased by 50 per cent? The problem now becomes that of inferring a relationship between change in scale and quantity of engineering skill.

Methodological problems involved in making these types of forecasts have already been referred to. Another problem is created by the detailed occupational structure of modern industrial plants. The individual project is not interested in "engineers" or "chemists" or "technicians" or "middle level manpower" but in petroleum engineers or physical chemists, or cost accountants, or tool and die makers. A complete forecast of future skill requirements for the modern industrial plant, thus, might involve estimates for hundreds of occupational classifications. A surprisingly large number of projects have been planned with no reference whatsoever to manpower matters and the details of occupational structures may be important among the factors that have discouraged project planners in this respect.

It is impossible to avoid questions of occupational detail but the problem involved can be minimized in a number of ways. As a general rule, the higher the skill level, the greater the importance of a precise specification of the occupational requirement. It is pointless to specify a need for a chemist when the actual need is for an organic chemist. At lower points in the skill scale it will usually be possible to use broader specifications. Another approach is to select key occupational classes for forecasting purposes and to infer relationships between the forecast of needs for the key classes and the needs for closely related classes. Still another possibility is to focus attention upon the skill requirements

that are most rigidly determined by technology or upon those classes of labor where supply shortages are likely to create production bottlenecks. Through these or other methods, it will usually be possible to circumvent the need to forecast skill requirements for very large numbers of occupational gradings.

Labor Supply Considerations

Labor market information of particular interest to the industrial project would include data about the general state of supply for particular skills and about any special recruitment problems that may be present. The geographically isolated project, for instance, may find that incentives of one sort or another will be necessary to attract a sufficient supply of a skill grade from the urban centers.

Ordinarily, labor market information of the type described will not be readily available. Here, as in other cases, the absence of high quality data will not have the same significance for the industrial project as it does for a national planning board or a national manpower assessment unit. What the project authorities want to know is whether there is any point in searching for particular skills within the country and, if so, where to search. Data that are low quality from the standpoint of macro-economic analysis may be quite useful for this type of problem. Professional associations, trade associations, labor unions, the universities, the national employment service, and particular ministries may be able to provide information that the project will find helpful.

Such a probing about for data is highly inefficient, of course, and in many of the developing countries, the compilation of a register of highly skilled persons could be defended as a high priority undertaking. In the absence of a central source of data, however, there would seem to be no alternative to a resort to informal information sources.

Skill Shortage Problems in the Short Term Period

Much has been written about skill shortages in the developing countries. In many cases, however, what is called a skill shortage could be better described as a skill wastage. Once again it is necessary to qualify by noting that conditions differ greatly among countries, but in a number of the developing states it is possible, with only cursory investigation, to uncover an incredible waste of talent. It is not necessary to belabor a point that has been amply documented in numerous studies. From the perspective of the industrial project - and that is all that we are concerned with here - the presence of a large amount of underutilized skill means that there is a supply source that can be fruitfully tapped.

If the major barriers that have limited the rate of economic development within the past decade were to be ranked, it is not likely that skill scarcities would be near the top of the list. This situation may change in the future and some nations currently suffer from marked shortages; on the whole, though, there has not been a vast gap between the need for and the supply of industrial skills.

One reason for this is the existence of the pool of underutilized skills described above. Another explanation can be found in the imperfect occupational specialization that is frequently encountered in the underdeveloped areas. Division of labor is limited by the extent of the market and when the market is small, persons will usually work at a number of tasks rather than in a single occupation.¹¹ There are, thus, many persons with experience in a variety of occupations and when the development process has been underway for some time there will usually be a supply of persons who have worked in an industrial or infrastructure project but who are now employed in other jobs.¹² An occupational census, incidentally, will not reveal much about this labor supply since persons generally report their main rather than their subsidiary occupations. Difficulties may be encountered in locating the "hidden" supply but some assistance for this type of recruiting problem may be available from a national employment service.

Another important method of bridging the gap between skill supply and demand has been through the international movement of professional and technical personnel. A large part of the flow has been in the form of technical assistance missions but there also appears to be a rather active market for some of the more specialized industrial skills.

¹¹For a good development of this point see Peter T. Bauer and Basil S. Yamey, The Economics of Under-developed Countries (Chicago: The University of Chicago Press, 1957) chap. 3.

¹²It should be stressed that the skills resulting from imperfect occupational specialization are at the lower end of the skill scale that is usually found in the industrial establishment.

It is the impression of the writer that the imported specialist is most likely to perform effectively when his assignment is narrow and technologically oriented. Thus, a specialist called in to supervise the installation of some complicated machinery is more likely to succeed in his assignment than a specialist concerned with over-all plant productivity, and a plant productivity specialist is more likely to succeed than an advisor on national industrial development. If the hypothesis is valid, importation of specialists should be a relatively effective way of coping with short term skill shortages in the industrial project.

To summarize then, possible sources of skilled employees for the industrial project are (1) qualified persons employed in jobs that do not fully utilize their skills, (2) persons with "hidden" skills, and (3) foreign specialists.

Skill Shortage Problems in the Longer Term Period

The methods of dealing with skill scarcities that are discussed above can be regarded as short term expedients. Over time, a substantial amount of capacitation in modern industrial skills will have to occur if industrialization is to progress.

The subject of skill formation in the developing economies has attracted a great deal of attention and a large literature is already available for those interested in the different aspects of what is a complex problem. The discussion below is limited to those parts of the problem that are of particular interest to project planners.

The following classes of skilled personnel are usually found in modern industry: semi-skilled workers, skilled manual craftsmen, technicians, professional persons, and managerial personnel. For the industrial project, the challenge of satisfying its requirements for each of the skill classes involves a separate set of problems. Each of the classes will be discussed briefly.

Semi-skilled workers might be described as the foot soldiers of modern industry. They drive the vehicles, operate the metal working machinery, man the assembly lines, tend the looms, and perform the thousands of other industrial tasks that require some but not a great deal of training. In the developed economies, the large majority of persons in the semi-skilled classifications have had less than a secondary education.

The great advantage enjoyed in most of the more highly developed economies is that young men reaching working age have already acquired the basic tools for being at home in a work environment that is crowded with people and machinery. They are literate, they can drive and perform simple maintenance work on vehicles, they are familiar with machinery, they have visited factories, they are aware of the basic requisites of industrial discipline. The employment office, in other words, can safely assume that almost everyone applying for a job has the ability to function successfully as a semi-skilled worker.¹³

¹³In the automated facility, semi-skilled job requirements have changed in character and something more by way of writing and number skills is necessary than had been the case before. Expressed in terms of formal education, a minimum of a secondary education has come to be regarded as part of the preparation essential for the present equivalents of the older type of semi-skilled jobs.

The situation in the developing economy is usually different to the extent that the industrial establishment there must assume the burden of doing a number of things for the semi-skilled worker that are done by society as a whole in the developed economies. As opportunities for formal education in the developing states increase, the burden will be lightened but it is a mistake to think of the problem solely in terms of formal education. In many respects, exposure to industrialization is as important as formal education and such exposure occurs, if it occurs at all, only in a few of the urban centers of the developing countries. Certain of the constraints in industrial project manning that were discussed earlier result directly from this lack of exposure.

The strategic importance of the industrial project in the development process thus becomes evident. In order to function successfully as a technical unit, the project will have to serve some, perhaps all, of the semi-skilled workers as a stepping stone between the non-industrial and the industrial society.

Skilled craftsmen have learned their trades in many ways. As the demand for their services increases, the less formal training methods will have to be supplemented by organized training programs either within the industrial enterprise or in pre-employment vocational training schools. Efforts to increase manual skill supplies through vocational school programs have had dismal results in some of the developing countries and the experience has led a number of observers to express skepticism about the future of the pre-employment vocational training institution.

Completely negative judgements on the potential of the trade school type of training are premature, however. The weaknesses of these schools - high drop out rates, poor equipment, inadequate teaching staff - are, after all, no different from the weaknesses of education in general in the underdeveloped countries and if one is optimistic about the prospects of improving the quality of secondary and university level education, there is no obvious reason why the same optimism should not extend to the prospects for the vocationally oriented school.

It might be risky, however, for the industrial project that is dependent upon large supplies of skilled manual labor to make any guesses about the future success of the vocational training schools. The safest strategy for assuring an adequate supply may be to assume that it will be necessary to train the workers on the job. Should other supply sources develop, there is generally little problem involved in terminating or reducing the scale of in-service training programs.

Technicians have become an increasingly important component of the modern industrial work force and the danger of a severe shortage of technicians in the developing economies must be recognized. Training for technician level occupations usually involves a year or two of schooling beyond secondary education, but those who complete the secondary education cycle will probably prepare for the professional occupations where the monetary and status rewards are highest. It may be optimistic, in short, to expect that the formal educational system will be able to do much by way of satisfying the need for technicians unless special steps are taken. Possible approaches that might be considered by

industrial enterprises are subsidization of the full-time formal education of younger skilled workers who show promise and encouragement and subsidization of night-time education for other employees interested in personal advancement.

The capacitation of an adequate supply of indigenous professional persons will require a modernization and expansion of national educational programs and there is little that the individual industrial project can contribute in this respect other than to make its needs known to the appropriate authorities. By expressing its needs for professional skills, the project, in effect, votes for a particular direction in higher education. The importance of coordination of the efforts of manpower planners, educational authorities, and individual project planners which was stressed earlier is reaffirmed at this point.

The management factor will be discussed in some detail in the following section. At this point we shall note only that in-plant training for supervisory personnel and middle level management has an advantage in that the training can be shaped in terms of the management problems that are peculiar to the particular establishment. Ideally, in-plant training should be supplemented by a variety of management courses that are usually offered by the economics or business faculties of the universities.

The Management Factor

Management is a special factor of production that must be considered separately from the other skills required by an industrial project It

is difficult for one thing, to make a meaningful assessment of the demand and supply of managers. The manpower assessment methodology, it will be recalled, begins with an enumeration of the current supply of a particular skill and, next, projects future supplies and requirements. On the basis of estimated deviations between future supplies and requirements, recommendations are derived in terms of the numbers to be trained. At all steps in the analytical sequence, particularly difficult problems of concept or method are encountered when the methodology is applied to the management factor. It is not clear, for example, as to how one would go about enumerating a present supply of management talent and the problems associated with an estimate of future requirements of technical personnel, difficult as they are, appear minor in nature in comparison to those of estimating future management needs. Fortunately - from the standpoint of manpower analysis - precise quantification of the need for managers may not be as essential as it is in the case of some other skills. While an erroneous forecast of the requirement for other occupations might eventuate in an oversupply there is little chance of this occurring in the case of managers. Management talent, particularly of the type required for the organization and administration of large industrial projects, is in short supply and the condition is likely to prevail for a considerable time.

The subject of management training also raises a different family of problems from those associated with the preparation of persons for other professional or technical skills. One can be reasonably confident that a person who completes the prescribed course for agronomists in a

creditable training institution will be able to function successfully as an agronomist. It is dangerous, however, to infer that graduates of a business school with a specialization in management will necessarily be good managers.

The question of what type of educational preparation is best suited for potential managers is far from resolved. In the United States, for example, where managers and the management function have been intensively researched, there is little agreement on this matter. Within business colleges in the United States, there has been continuing experimentation with curricula and in recent years far reaching changes in educational programs have been instituted. At the present time, the most popular approach concentrates upon the decision making functions of the executive. Case study teaching methods, simulation games, and quantitative tools are emphasized more and vocationally oriented courses such as accounting, personnel practices and marketing have been de-emphasized. It remains to be seen, however, as to how much of the new approach will survive in the light of experience.

The importance of this for the developing economy is that there is little certainty in the case of management training that a given input of students will produce a desired number of capable managers. Add to this the uncertainty as to how managers are best trained and the dimensions of a serious problem become apparent. The need for managerial talent is severe but there is no clearly marked route for relieving the shortage.

A number of fairly obvious points have been belabored here because of the relationship between capable management and the success of

industrial projects. Shortages of other skills can frequently be dealt with through one expedient or another but there is no way to substitute for management talent.

If management is an exacting occupation in the developed economies, it is infinitely more so in the developing ones. Before examining this point it is necessary to note that we are concerned here with industrial project management rather than the broader function of entrepreneurial activity. If we follow the usual definition of the entrepreneur as the person who performs the economic functions of (1) the bearing of risk and uncertainty, (2) innovating, and (3) organizing and managing a business enterprise, then our focus is on the third of the entrepreneurial functions listed.

The extraordinary part of the challenge to management in the developing economy comes from the fact that the project manager is the key figure at the operating level of the effort to make industrialization compatible with the prevailing political, social, and economic characteristics of what is largely a non-industrial society. In addition to the full range of the organizational and administrative problems that face the manager of an enterprise in the more highly developed economy, the manager in the underdeveloped setting must mediate between the requisites of an industrial order and the pull of tradition. There is a school of thought that argues that the pressures for uniformity will prevail over those for diversity in the industrializing states and that industrialization

will sweep before it the behavioral patterns of prior times.¹⁴ Perhaps this is so but the proposition has nothing to do with the experience of a specific project where, all too often, a contrary proposition may be a more accurate description of the state of affairs. Technical competence, thus, may be a necessary condition but quite often it will not be a sufficient condition for managerial success. In many cases, the manager will have to be at home both in the new world of modern industry and in the older tradition ridden society. The extent to which this is so, will vary, of course, from nation to nation and within nations from region to region.

Maximizing work force productivity, at least at the outset of a project, may depend upon management's success in finding just the right combination of industrial discipline and deference to tradition. In relating to the political environment, the manager may have to cope with such factors as a capricious tax system, an overly ambitious social security code, and continuing shifts in the political power structure. At the same time he must be alert to opportunities for slipping away from the restraints imposed by traditional behavior patterns.

This is a tall order for the industrial project manager, of course, and it underscores the main point of this section of the paper: in formulating requirements of skilled personnel for the project, the usual concern over quantity of skill, should turn, in the case of management, to a concern over quality.

¹⁴ See e.g. Clark Kerr, "Changing Structures of the Labor Force," in Kerr, Labor and Management in Industrial Society (New York: Anchor Books, 1964) pp. 329-344.

Some loose generalizations in terms of management quantity can be made. Generally speaking, a large and complex enterprise will require higher ratios of management to non-management personnel than small and simple ones. In particular industries, certain ratios of work supervisors to production personnel seem to produce better results than others. The contention, here, however, is that these are secondary considerations. The first concern within the industrial project should be over the quality of top level management.

While the challenges to management in the developing economy are substantial, the opportunities for constructive action are abundant. Oftentimes, relatively, slight changes in such matters as work flow, material handling methods, and work motion can produce large increases in output. And traditional behavior patterns are not in all cases incompatible with industrialization. As often as not, however, it takes managerial ingenuity to discover and take advantages of the compatibilities.

Appraisal of Project Skill Requirements

Preceding sections of this paper have dealt with (1) the need to achieve better coordination between industrial projects and government agencies concerned with employment and manpower matters, (2) the problem of determining the types and amounts of skill required by the project and (3) labor supply considerations that have relevance to the industrial project. In this section the problem of appraising project plans for skill utilization will be discussed. An appraisal might be limited to a judgment of the technical accuracy of a project's skill requirement

estimates or it might involve an evaluation of the estimates in terms of supply and other considerations as well. It will be argued below that a "broad" appraisal, if well done, can play an important role in the development planning process.

A practice of appraising the skill staffing patterns proposed by industrial projects would produce an immediate benefit in the form of a more systematic preparation of project manning plans. Project authorities, more often than not, have ignored manpower considerations or have treated them casually. In part, this is due to the fact that persons trained to think in terms of manpower problems are rarely included among the personnel involved in project planning and, in part, to the difficulties in manpower analysis which have discouraged serious efforts to specify project skill needs. Unless it is made known beforehand that an estimate of skill requirements will be among the factors to be considered in the appraisal of project plans, the amount of attention devoted to the subject is not likely to increase by any significant degree.

The raw material of an appraisal will be a list of job titles with the number of persons to be employed under each title. Job titles, however, are poor indicators of actual job characteristics and if there is to be a serious effort to judge the merits of project occupational patterns, the duties associated with each title will have to be described in some detail. The use of a standard system of occupational classification (preferably the International Standard Classification of Occupations, (Geneva, International Labour Office, 1958) should be encouraged in order to facilitate comparisons and otherwise simplify the evaluation process.

Standardization of job titles, however, will not eliminate the need for job descriptions since similarity of titles in different establishments oftentimes masks wide differences in actual job duties. It is not unusual, for example, to find employees holding professional job titles but engaging in what are generally regarded as technician level duties.

A comprehensive appraisal will involve a judgement of three distinct aspects of project plans for skill utilization. These are (1) whether the quantities specified are reasonable from the standpoint of project technology and scale, (2) whether the need for certain classes of skills has been overlooked and (3) whether the specified requirements are compatible with various supra-project considerations.

(1) Depending upon the character of the project, a smaller or larger share of the skills required will be determined by the technology. There is little problem involved in appraising the technologically determined requirements except, perhaps, where the local custom is to combine the use of a particular skill with other occupational grades that are not, strictly speaking, required by the technology. In certain areas of South America, for example, it is common for a tractor to be operated by a "tractorista" and a "tractorista ayudante". The assistant usually stands behind the operator and helps in a number of ways but his contribution to tractor productivity is minimal. The appraisal may not be the place to attack long standing practices of labor wastage but such practices can at least be pointed out to project authorities as possible sources of future productivity increases.

The more difficult appraisal problem will arise in connection with the specifications for skills that are less rigidly determined by the technology. Judgment of project specifications for first line supervisors, middle level management, maintenance personnel, engineers, etc. will require reference to a standard and a number of possible standards were suggested at an earlier point. Reference, for example, can be made to ratios of technical and supervisory personnel to total employment found in similar enterprises in other countries or in modern facilities within the country. While it is important that benchmarks of this type not be applied mechanically, they can at least indicate whether the ratios proposed by a project are clearly out of line with international or relevant national experience. The burden of justifying large deviations from prevailing practices should be placed upon the project authorities. Special circumstances might very well warrant the employment of particular types of skills in larger amounts than are found in similar establishments elsewhere but across the board deviations from prevailing patterns of skill utilization should be brought to the attention of project personnel for reexamination.

(2) The success of certain types of industrial projects may depend upon the extent to which there has been anticipation of the need for skills that are not directly involved in project operation. When the project involves a geographical relocation of the work force, for example, there may be a need for personnel such as social workers, community development experts, health officers, etc. There is no simple way to identify the skills that will be required and certainly no

mechanical method of quantifying them. Knowledgeable manpower experts, however, should be able to detect the circumstances under which such skills are likely to be required and to render a judgement as to whether an industrial project is alert to the importance of the type of manpower involved.

(3) The part of the appraisal discussed under (1) and (2) above is concerned, essentially, with the technical accuracy of an estimate of the skill stocks needed for a particular industrial project. This might be regarded as the "narrow" dimension of an appraisal. The broader dimension evaluates the relationship between the estimate and various factors that are external to the project.

Supply Considerations

Since a project's estimate of its skill requirements can be regarded as a potential bid for the skills specified, the economy-wide implications of the estimate warrant evaluation. An appraising unit, especially if it is part of a planning group, is in a position to evaluate the project's bid in the context of simultaneous bids that are being placed by other projects, perhaps, and by existing public and private establishments. When the sum total of the skill requirements as indicated by the bids exceeds current or anticipated supply, the merits of the bid of the project must be evaluated in terms of the competing claims.

It is difficult to go beyond this point in the analysis because of possible variations in circumstances. The project may be a private or a public venture, there may or may not be an economic plan in operation and, if there is a plan, there may or may not be well defined order of

project priorities. Possible policy lines that might be recommended to the appropriate authorities can be listed, however. Thus, in the face of skill shortages, the appraising unit might recommend:

- (1) changes in project timing;
- (2) variations in the planned technology that would have the effect of easing skill scarcities;
- (3) the use of wage incentives to allocate skills on the basis of project priorities;
- (4) the use of the national employment service to direct skilled persons to particular projects.

This listing is suggestive rather than exhaustive, of course, and it should not be interpreted as a recommendation in favor of any special policy. All that is intended here is to note possible ways in which a manpower appraising unit might insert itself as a link between micro-considerations (project skill requirements) and a macro-variable (national or regional skill supply).

Employment Objectives

An appraising unit might also serve to link national employment objectives with the industrial project's labor utilization practices. Here, too, the range of possibilities will vary depending upon the character of the development strategy. Some nations have no clearly defined set of employment objectives whereas others have made ambitious attempts to formulate educational programs in terms of skill requirements and to maximize employment opportunities by one device or another. When

employment objectives have been elaborated either through policy statements or an economic plan, those making an appraisal will have an additional reference point for evaluating project manning plans.

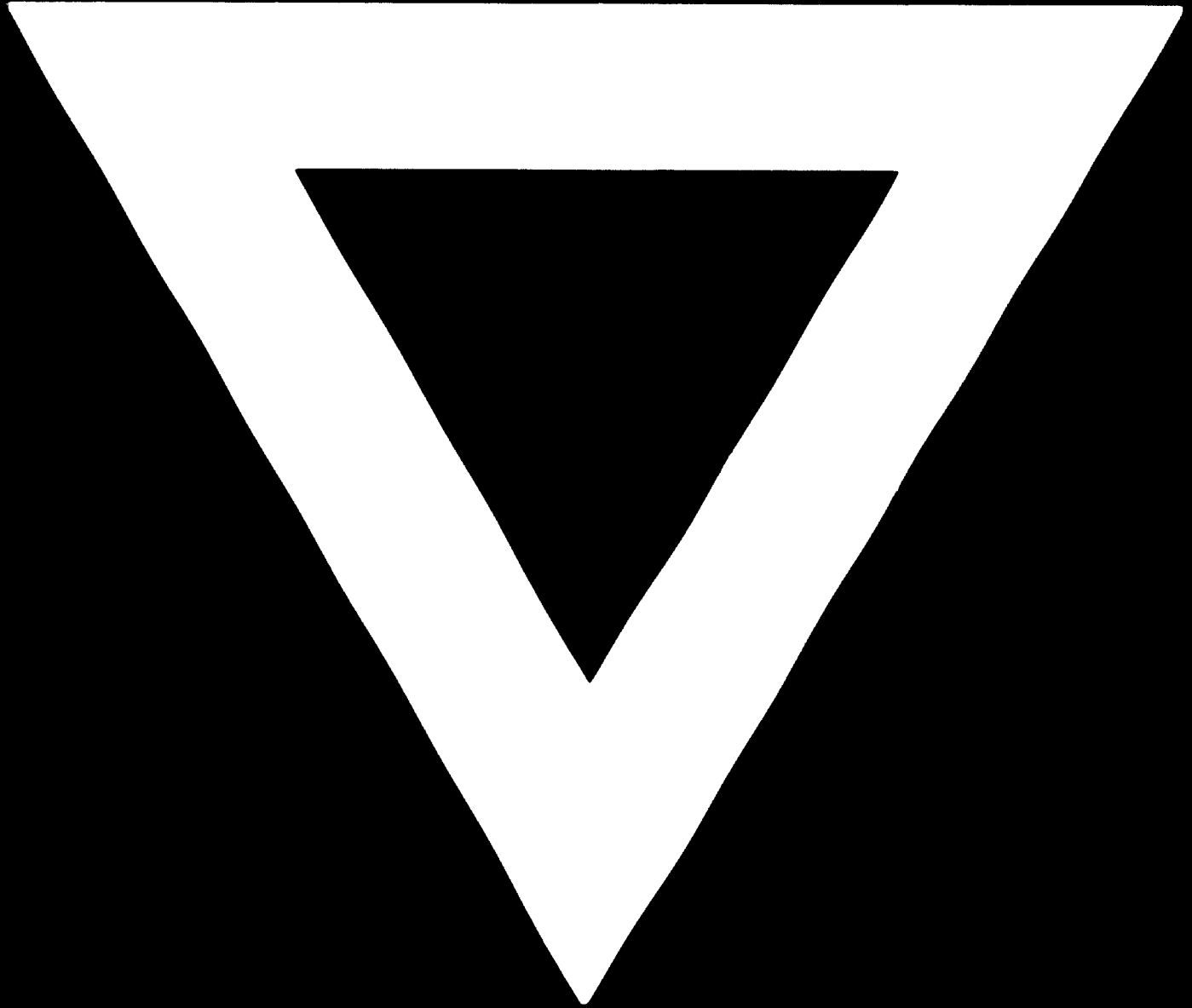
Conclusion

A major theme that has been stressed in this paper is the need for a finer coordination between employment decisions made within projects and macro-economic employment policy. Efforts at achieving such a coordination have not been too successful and one reason for this has been the absence of a link between "high" and "low" policy making levels. The practice of appraising project manpower plans would seem to offer some promise as a method of establishing the link.

The project's manning patterns, as noted above, can be evaluated from the standpoint of (1) technical feasibility and (2) consistency with supra-project considerations. A somewhat different order of expertise is required for each type of evaluation but, hopefully, there will be persons available who will be experienced in both areas. It can be anticipated that appraisals of the type recommended will be relatively crude at first but refinement should follow with the accumulation of experience. Even a crude appraisal, however, should provide some general guideposts for development policy.



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