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**TRAINING OF TECHNICAL PERSONNEL FOR ACCELERATED
INDUSTRIALIZATION OF DEVELOPING COUNTRIES**

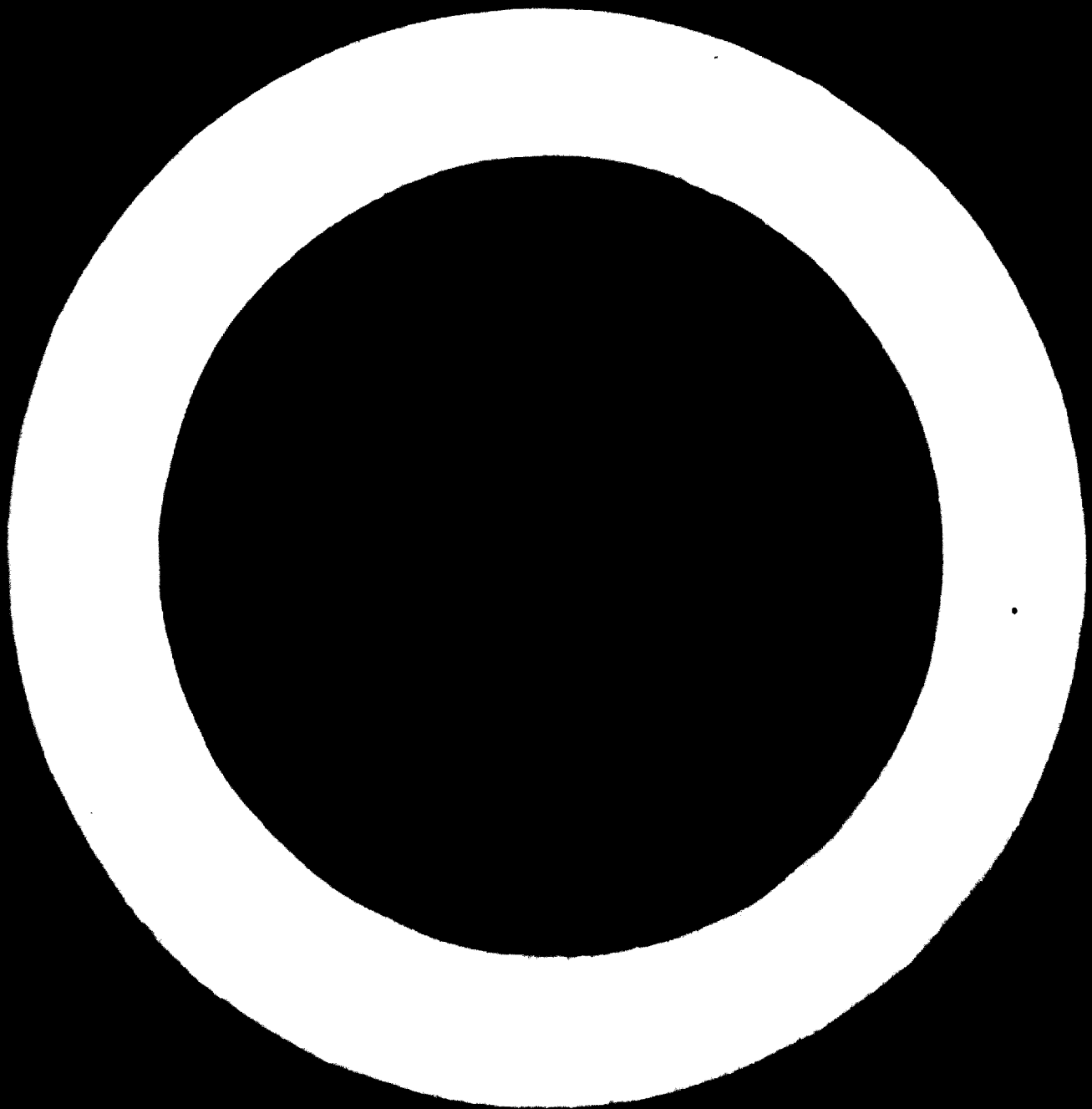
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INTRODUCTION

Economic growth of the developing countries depends mainly upon their possibilities for speedy industrialization which requires wide complex of favourable conditions and prerequisites to be created in economic, social and other fields. No efficient and speedy industrial growth is possible without optimal solutions to a key task of providing a necessary supply of technical personnel. This category of qualified non-manual industrial cadres includes, in a broad sense, the middle and top-level personnel in organization, administration, planning, production, research, management, supervision and other industrial services. To supply such personnel presumes to train and upgrade them for the needs of accelerated industrialization on the basis of the latest achievements of world science, technique and technology.

The training of technical personnel is a very vital and complicated task for the young states. Of course, the developing nations have plenty of other urgent tasks in the developing process, but it is undeniable that unless a country has its own skilled forces technical personnel it cannot achieve economic and cultural progress, lay a stable base for accelerated industrialisation.

On attainment of independence practically all of the young states have been confronted with an acute shortage of qualified cadres and/or sharp imbalance in their availability. It is common knowledge, that the roots of this situation are found in the colonial past.

Characterising its deplorable consequences in India, the well known scholar P.C. Mahalanobis notes, that "only a very small proportion receive vocational or professional training. A very large number receive what is called general education which does not make them fit to undertake any particular productive work".^{1/}

The position of many other nations has proved to be the same or much worse as disclosed in a number of research works.^{2/}

^{1/} National Institute of Sciences of India. Anniversary address by the President, Professor P.C. Mahalanobis, 20 January 1959, p.9,10.

^{2/} Vide for example, G. Hunter, Education for a developing Region (A study in East Africa), London 1963, II9 p.M.S. Hug. Education and developing strategy in South and South East Asia, Kingspot, 1965, 286 pp.

Among other consequences this led to a very small proportion of labour force in technical and related occupation. In the fifties the percentage size of this group, even including health and teaching personnel, was, for example, in the Philippines-2,3, India-1,6, Indonesia-1,1, Pakistan-1,0, or 4-8 times less than, say, in the United States or in the United Kingdom.^{1/}

It is clear that the proportion of actually technical personnel in the labour force is much smaller than shown by the above figures.

Despite all changes which took place in the Asian and other developing countries, the task of supply and accordingly training of technical personnel for industrialization is, up to now, far from successful solution. Moreover, it is becoming "overgrown" with new complications, reflecting the numerous difficulties of the young states in early stages of industrialization.

It is obvious that the task of providing industrialization with technical personnel cannot be settled - despite all expectations - by itself, spontaneously. Quite on the contrary, this task is among those which need, for optimal solution, a scientific approach, coordinated efforts organized on both national and international levels. In this connection, of course, one can hardly overestimate all those useful aspects of activities, already made or planned by the United Nations family organizations, such as UNIDO.^{2/}

The purpose of this brief paper is limited to elucidate and analyse some problems of vital importance for policy and practical solutions, concerned with the organization of technical personnel training for accelerated industrialization of the developing countries.

HUMAN RESOURCES AND INDUSTRIALIZATION

It is a truism, that the wealth of any country is based upon its power to develop and to effectively utilize the innate capacities of its people. Of course, one can ask the pertinent question as to whether human beings are just a resource for serving the interests of economic development,

^{1/}"International Labour Review", Geneva, October 1962, p. 364, 365.

^{2/} In this respect are of special interest, for example, the documents and proceedings of the International Symposium on Industrial Development (Athens, November-December 1967) organized by UNIDO, which have proved to be very helpful in the preparation of this paper.

including industrialization, or whether they are the very ends to which the development process is designed.

While this question could be debated endlessly there is no doubt that human beings are both the creators and the ends of the economic and industrial progress, the human resources being a principal prerequisite to it. Indeed, a look around various countries confirms that the speed and excellence of industrialization flows essentially from the state of their human resources.

As one of the principal agents of industrialization, human resources have a number of attributes and qualities which broadly may be divided into two main groups. The first one comprises those aspects which are directly measurable such as the total population, its rate of growth, the number constituting the working force, the number and structure of gainfully employed persons etc. In the second group may be included knowledge, skills, good health, adaptability to changing conditions which are the principal attributes that affect the productivity of the individual.

Industrialization as an integrated process of economic, social growth, and of introduction of new productive methods and technique is undoubtedly the result of human effort. It fulfils a wide range of functions to discover and exploit natural resources, to train and employ personnel, to mobilise and utilize capital, to develop and apply technology, to construct plants, infrastructure, to manage, plan, organize all the above mentioned production processes, to create appropriate living and cultural conditions for employed manpower, etc. All these human functions cannot be but an integral part, core and engine of industrialization from its very starting point.^{1/}

The importance of "the human factor" for the industrialization in developing countries has proved to be especially high through the following main reasons:

- (a) magnitude, complexity and novelty of the economic, technical tasks in all spheres of industrialization;
- (b) necessity of fast and useful accumulation of industrial "know-how" and training of personnel in more advanced countries;
- (c) impact of the contemporary scientific-technical revolution placing new demands, primarily qualitative (in the technical managerial and other fields), upon human efforts and their constructive role in the industrial

^{1/} Meanwhile, it is sometimes alleged that the human factor influences the economic development only "in the final analysis", "ultimately".
Vide-Manpower + Education. Ed. by F. Harbison + Ch. Myers, N.Y. 1965, p. IX.

growth;

(d) vast dimensions for active development and utilization of the creative capacities and talents of the people's thanks to the national sovereignty gained;

(e) comparative scarcity or under-development of internal resources, material and financial;

(f) expanding horizons to make use of the developed countries' industrial experience and assistance, which to a considerable extent, is the more possible and effective, the better is their apprehension and utilization in the developing states.

The extremely significant role of "the human factor" for the industrialization of developing countries makes, naturally, increased demand upon these countries' human resources, in particular, upon the latter's qualitative characteristics - the people's skills, labor enthusiasm, ability and desire to work hard, and their creative aspirations, discipline, team spirit, etc. Thereby, the human resources' proper development turns out to be one of the most essential factors in the industrialization of the developing countries.

This leads also to the policy conclusion that a country is required to undertake development of human resources at a much faster rate during the initial stages of industrialization than at later stages.

The human resources' development as a whole and for the needs of accelerated industrialization is to embrace a very wide range of measures to improve radically the peoples' living conditions, their nutrition, health, housing, education, employment, etc. Thus, the human resources development to be real is quite inseparable from the social transformation and, accordingly, from all necessary reforms and changes, which are unavoidable, whether progress in the peoples' interests, including accelerated industrialization, is to be attained.

Among the starting points to develop a country's human resources are: spreading of literacy, introduction of compulsory education, setting up of numerous general and specialized schools, institutions, training centres, steady growth in the number of books, magazines and other printed publications, of libraries, educational societies and clubs, cinemas etc. A fast rising cultural level of the people is one of the indispensable conditions to develop the human resources for the needs of industrialization.

The human labour resources, in a broad sense and for the purpose of

this paper, may be divided into the following main categories: unskilled workers, semiskilled workers, skilled workers and technical personnel. Industrialization in the developing countries places high demand upon all these categories, the stress being put on the more qualified ones, and the technical personnel in particular.

Very complicated and responsible functions, performed in the preparation and during the course of industrialization, connected with its organization, make the technical personnel - engineers, technicians, administrators, planners, etc. - a truly leading force in this process, and accordingly, the most valuable elements in human resources.

Many developing countries are making efforts to solve the sore problem of human resources development. Campaigns are in progress to abolish illiteracy, schools are being built, educational establishments opened, technical training introduced.

In the light of this picture there are some questions which remain open to elucidate and to be discussed: what priorities should be given in the whole development, industrialization process and its planning to the human resources development and education, training personnel, what is likely to be the overall human resources strategy, importance and consequence of its corresponding components and measures; what must be administrative arrangements which hold out most promise of formulating and realizing human resources strategy in respect of training technical personnel for the accelerated industrialization.

STRUCTURE OF SKILLS REQUIRED

The technical personnel to be trained efficiently and in accordance with the needs of accelerated industrialisation should cover, in principle, its skills requirements of that category in all quantitative and qualitative aspects. It means that before training is undertaken and to be gainful, a contingent of technical personnel with qualifications and professional levels needed should be defined as precisely as possible.

The guiding approach for this definition is given by the patterns and paces of industrialisation undertaken. It is well known that in large number of the developing countries, producer goods industries have tended to grow much faster than consumer goods industries; there has been a building up of heavy, rather than light industries; and emphasis on rapid

expansion and development of import-saving and export industries. Many developing nations are striving to build a more diversified, balanced and fortified industrial base conducive to sustained industrialization.

The pattern and pace of production growth and structural change, which industrialization brings about during the course of transformation of the traditional into modern economy, point out the required structure of technical personnel.

Horizontally this structure consists of a large number of very different skills needed to operate in organization, planning, projecting, construction, functioning plants, their management etc. Thus, it would be inappropriate to equate the technical personnel required for industrialization with those needed only for a single, even leading sector or branch, say, for manufacturing, constructions, consulting services etc. The range of this personnel to man all activities in the public and private sectors of industrializing economy is very wide: from actually technical specialists to innovative entrepreneurs, from scientists to managers, from educationists to planners and so on.

There is no single formula to reply a question what are to be requirements in all those and other skills. It depends, as already mentioned, upon the pattern and pace of industrialization, planned and/ or undertaken in different conditions of developing countries. At all events, the preparation and early stages of industrial growth push especially high demand in the whole horizontal structure of skills required, upon planning, projecting, constructing, pure technical, managerial specialists. In the subsequent course of industrialization, with its diversification and complication, the role of more skilled specialists, notably in scientific research, technology management, planning fields, steadily rises. On the other hand, in general, the demand upon these and other more skilled personnel is inevitably increased by higher paces of industrialization and/or its greater emphasis on the technical reconstruction of a developing economy, building up of heavy industries, etc.

The process of industrialization brings about as well certain changes in the personnel specialization within the horizontal structure of skills required. As a rule, initially, broadly skilled cadres are needed, afterwards - or in case of higher paces and more complicated pattern of industrialization - highly specialized personnel is becoming preferable. Moreover, rapid technical and technological changes require personnel to

be able to adapt easily from one type of work and its conditions to another.

Vertically, the structure of technical personnel required embraces specialists in conformity with their level of education, training and, accordingly, with posts to be filled by them in industrialization services. It is of prime importance for an industrializing economy to ascertain requirements in technical personnel of different qualification levels: on the one hand, in absolute terms and, on the other hand, in terms of rational correlation between contingents of, mainly, high-level and middle level cadres. To stress the meaning and complexity of the latter problem one should be reminded about a torny search in many countries for an optimal ratio between the numbers of engineers and technicians. By no means this problem is easier to solve, say, as to the personnel needed in planning, managerial, scientific fields.

There is a very close relationship between the qualification levels of personnel required and the course of industrialization. As a rule, the more complicated and rapid the process is, the higher qualifications levels of personnel are necessary. Coinciding with this natural tendency is the great importance of the technicians-equivalent, middle-level personnel at the contemporary stage of industrialization in many developing countries. This category of qualified cadres is called upon to play really a central role in this process because of (a) its, in general, initial character, (b) critical scarcity of highly skilled specialists, (c) relatively less costs and time period to train middle-level personnel.

Any sober analysis of the structure of skills required for industrialization cannot but to take into account such phenomenon in developing countries, as (i) acute shortage of technical personnel, coupled with (ii) widespread unemployment and underemployment among the educated. As to the shortages, they are especially critical in respect of qualified mechanical, electrical, chemical, metallurgical and some other specialists, physical scientists, planners. This means that apart from the future skills requirements even the current ones are far from satisfactory. On the other hand, the availability of unemployed among the educated persons reveals, by the way, serious miscalculations in educational and general economic planning and in structure of personnel needed. Therefore, it is of vital necessity for each developing country to conduct comprehensive technical personnel registers and systematic surveys of skill requirements.

All the foregoing considerations give an idea of how intricate is the problem to calculate the needed stock of technical personnel. We may here touch upon only one of the possible methods used for this purpose.

The basic relationship, on which a forecast of skills requirements for industrialisation must rest, is the relationship between future production volumes and the stock of technical personnel of various types needed to attain such targets. It should be stressed that the process of training usually takes a considerable time span and that the relevant production volumes are to be those for a rather remote future. Production must be specified in a number of branches, sectors, making use of different types of technical personnel. For some types of training, fairly wide branches, sectors can be quite relevant; for the others, very precisely defined branches, sectors with highly specialised requirements in technical personnel are necessary.

On the assumption that there is a certain relationship between the volume of production and the stock of technical personnel, it is possible to work out general and sectoral requirements in qualified cadres. These requirements are then to be converted into (a) job descriptions, (b) educational/training/upgrading qualifications, (c) enrollments, (d) outputs. This enables, further, to calculate numbers of people to be trained in all professional categories required for the needs of accelerated industrialisation.

Thus, forecasting of skills requirements and practical measures to cover them, is a procedure that gives much scope for coordination, planning programming, organisation, and, accordingly, for the efficient work of administrators. The more so, that a number of questions are not sufficiently cleared up: what extent does the scientific-technical revolution raise professional and qualification requirements to, how to translate job needs into professional categories and qualification levels, by what criteria may a sufficient supply with technical personnel be determined, what relationship should be between industrialisation processes and skill requirements in the specific conditions of developing economies.

TRAINING PROGRAMMES AND PROBLEMS OF THEIR UNDERTAKING

Generating technical personnel for industrialisation consists in principle of the following phases:

general secondary education

specialised training

upgrading and refreshing

The situation prevailing up to now in many developing countries, is characteristic of serious deficiencies therein. General education is underdeveloped, far from realities and needs of these countries, under the influence of Western standards. Specialized training at the middle and higher level is very weak, too academic, nearly or at all not connected with the current and future needs of industrialisation. Upgrading and refreshing are at the very early stages of organisation. Typical also are imbalances and disproportions, lack of planning and relationship between all the mentioned phases and links of training. Furthermore, there is no unification in syllabuses, training methods, textbooks, qualification requirements. Beyond that, single national organisations, responsible for technical personnel training, are usually lacking. These are, very briefly, the main negative features of the prevailing situation, showing the essence of many problems in the field of training technical personnel for industrialising economies.

If based on the afore-mentioned phases approach is to be adopted, then the technical personnel training programmes should be organised, proceeding from the necessity of their (a) being an integral part of human resources and education national development, (b) planning and coordination, (c) unification. Especially much depends, of course, upon planning and coordination, which is indeed of key importance.

The two central problems which, in the sphere of organisation of training technical personnel, economic planning being confronted with are: (1) how to allocate resources as between competing ends? and (2) how to ensure that the resources allocated to a certain direction are used efficiently? Arriving at a proper decision as to these two key problems depends, to a considerable extent, upon a substantiated solution of the following questions, pertaining to the strategy of cadres training development:

- (a) relative reliance to be placed on different forms of training;
- (b) emphasis on quality versus quantity; (c) rational relationship between

enrolments and output of graduates at various levels and in different forms of training; (d) appropriate distribution of enrolments and graduates among the different professionally specialised streams in technical training.

The business-like consideration and any solution of all these questions must proceed only from the analysis of specific conditions and needs of a developing country.

However, we must, in purely methodological aspect, touch upon at least the comparative importance of different forms of training, since this is one of the starting points for that analysis and subsequent policy decisions.

What are the most appropriate forms of technical personnel training; which of them deserve first priority?

Experience shows and science confirms that industrialisation - oriented training programmes should be, as well as general education, institutionally based in kind of schools, centres, colleges, institutes, departments of universities, upgrading and refresher courses, and similar specialised establishments of middle and high levels. These are the core of training programmes despite many reasonable arguments in favour of in-plant, inhouse training, if really scientific contents, high quality in training are to be attained.

Of course, the realisation of such a guiding approach in the context of developing countries is inevitably rather a long process (problems of financing or teaching personnel supply suffice to mention). Therefore, important are, not as a substitute, but as a supplement to institutional approach, in-house and in-plant training programmes, especially for broadly and lower skilled personnel and for middle qualification levels. These forms may be actively undertaken also at early stages of industrialisation and for upgrading and refresher purposes.

The contemporary conditions of industrialisation sharply raise the importance of systematic upgrading and refreshing of the personnel already employed. It should be also borne in mind that sometimes this way is preferable to training of fresh entrants for reasons of immediate utility and low gestation period. The best forms for this are special courses, based at training institutions or modern plants, factories, projecting organisations, etc.

Efficient planning, coordination and unification of training processes are scarcely probable without careful balancing of several basic

consideration in training programmes to be undertaken, which may be briefly summarized as follows:

(1) Conformity to the latest achievements in science, technique, technology and organization. As much as possible syllabuses must take into account new progressive tendencies in these fields of theoretical and applied importance for accelerated industrialization in developing economies.

(2) Liaison with practice, with vital needs and problems of industrialization in the context of developing countries. Actually the realities of these countries should be the starting-point and core in technical personnel training programmes.

(3) Adaptability on the part of the technical personnel trained to adjust themselves to the new technological and/or organizational processes new types or machines and technical equipments, new kinds of raw materials and methods of handling them, new forms of control devices and occupational safety measures, etc. Any type of training should facilitate acquisition of new skills and application of new skills to industrialization processes.

(4) Flexibility as a "built-in" quality of technical personnel trained to allow inter-occupational changes within rather a broad group of jobs. The rapid pace of progress in technology, technique and organization render some skills occupations either relatively less important or even obsolete. The training programmes should be such as could enable personnel to move freely from one occupation to another within the broad range of similar or associated occupations.

(5) Effectiveness, enabling the people trained to develop their inherent capacities and aptitudes so as to make substantial contribution in improving their knowledge, skills, productivity and providing their gainful employment.

(6) Economical organization so that the results from training programmes should be commensurated with the resources spent. This approach requires careful balancing of the costs involved and the likely benefits that may accrue as a result of the training programmes undertaken.

If one attempts to indicate the broad design and framework of strategy most appropriate to the developing countries, for organization of well-conceived system of training technical personnel, the following main elements and measures must be at least provided:

- (a) detailed evaluation and thorough account of technical personnel requirements for the process of industrialisation;
- (b) close relationship between the development of general education and training of technical personnel;
- (c) integrated system of institutional, in-plant, in-house and other forms of technical personnel training and upgrading in close conjunction with practice;
- (d) industrialisation - oriented and unified training programmes, methods, textbooks and other materials;
- (e) centralised distribution of all graduates and promotion of employment opportunities for them;
- (f) systematical planning in all spheres connected with the organisation of technical personnel training and in close conjunction with general economic planning;
- (g) state guidance, management and control over the whole process of training technical personnel and its efficient use for the needs of industrialisation.

The mere enumeration of the above elements and measures evokes a number of questions to examine and discuss, among which there are the following ones directly connected with the needs of accelerated industrialisation in developing economies: whether the rate of formation of technical personnel should be higher or lower as compared with the rate of industrial growth, by which ways general education may be developed along industrialisation-oriented lines; how to attain flexibility of the unified programmes, textbooks, etc. in view of changing economic, technical and other conditions; what are the most appropriate fields and periods for planning, should it be long-term and/or current; what must be the main lines for state guidance, management and control over training technical personnel and its efficient use; whether a positive role can be played in this process and under what conditions, by the private sector and its institutions.

CONCLUSION

The optimal organisation of technical personnel training steps out as one of the major tasks, confronting the developing countries on the path of industrialisation. To speed up and modernise the industrial

growth is impossible without providing, in good time, all its lines and sectors with the technical personnel in sufficient numbers and of appropriate categories, specialization and qualifications, which itself requires both preceding and simultaneous human resources development.

The technical personnel training organization pushes forward a number of problems in economic, social, pedagogical and any other fields. In the administrative sphere these are mainly connected with the set-up and functions of the mechanism for technical personnel training, especially of the complex of bodies, agencies, services to organize, manage and control such training. It should be stressed that these administrative activities may be fruitful not in isolation from but only in close conjunction with a wide range of progressive reforms to develop efficiently human resources and to speed up the whole economic and social growth.

From the above brief outline it is, perhaps, quite clear how much is yet to be done as to identifying, analysing, solving the problems of technical personnel training for the needs of accelerated industrialization of the developing countries. However, this organization of the training process cannot wait until the fruits of all that to be done become available. In this connection a few points must be mentioned, which may be useful for administrators in the policy and practical organization of technical personnel training.

(a) Resources - material, financial, qualified manpower - constitute a great restraint. The essential function is to arrange priorities and select programmes in the fields of technical personnel training permissible with the resources which may be mobilized and available. It is also imperative to examine whether the resources already allocated to training are utilized efficiently or not and to adopt appropriate measures.

(b) Rational and economical approach is quite necessary in forming the administrative mechanism to plan, guide, manage and control the system of technical personnel training to be created for the needs of accelerated industrialization. Minimum number of bodies and services, strict coordination, compulsory obligation, business-like approach, maximum effectiveness are to be among the main features of such administrative mechanism.

(c) Systematic collection and analysis of data regarding human resources development, relationship between industrial growth and demand for qualified manpower, quantitative and qualitative requirements for technical personnel, etc., may prove to be of great assistance in planning

and organisation of training this personnel at the aggregative level.

(d) The most efficient utilization of resources and functioning of the training systems cannot be organized without long-term forecasting as to resources, requirements, skills, structure, forms of training, enrolments, outputs, employment lines etc., which must be an integral part of the general long-term planning.

(e) As a very important prerequisite, the experience of developed states is to be necessarily studied and used in the organization of technical personnel training in the developing countries, their real possibilities, specific conditions, of course, should be taken into account.^{1/}

(f) In consequence of a certain similarity of problems in technical personnel training and with the aim of rational utilization of limited resources, regional and subregional approach may be highly expedient for many developing countries, especially in organization of training institutes, centres, supply of teachers, instructors, in working out programmes, textbooks, etc.

(g) In order to avoid a considerable wastage in the training systems, which is characteristic of a number of developing states, improvement in the efficiency of these systems and, accordingly, in the quality of training, steps out as a task of high priority and must be given even greater emphasis than mere expansion of enrolments and outputs.

(h) Any success in the technical personnel training organization depends, to a decisive degree on the administrators themselves, upon their knowledge, skills and, consequently, on their own education and training. Therefore, technical personnel training for the needs of industrialization presumes availability of the highly qualified administrative cadres to function efficiently in the spheres of planning, organization, management and control.

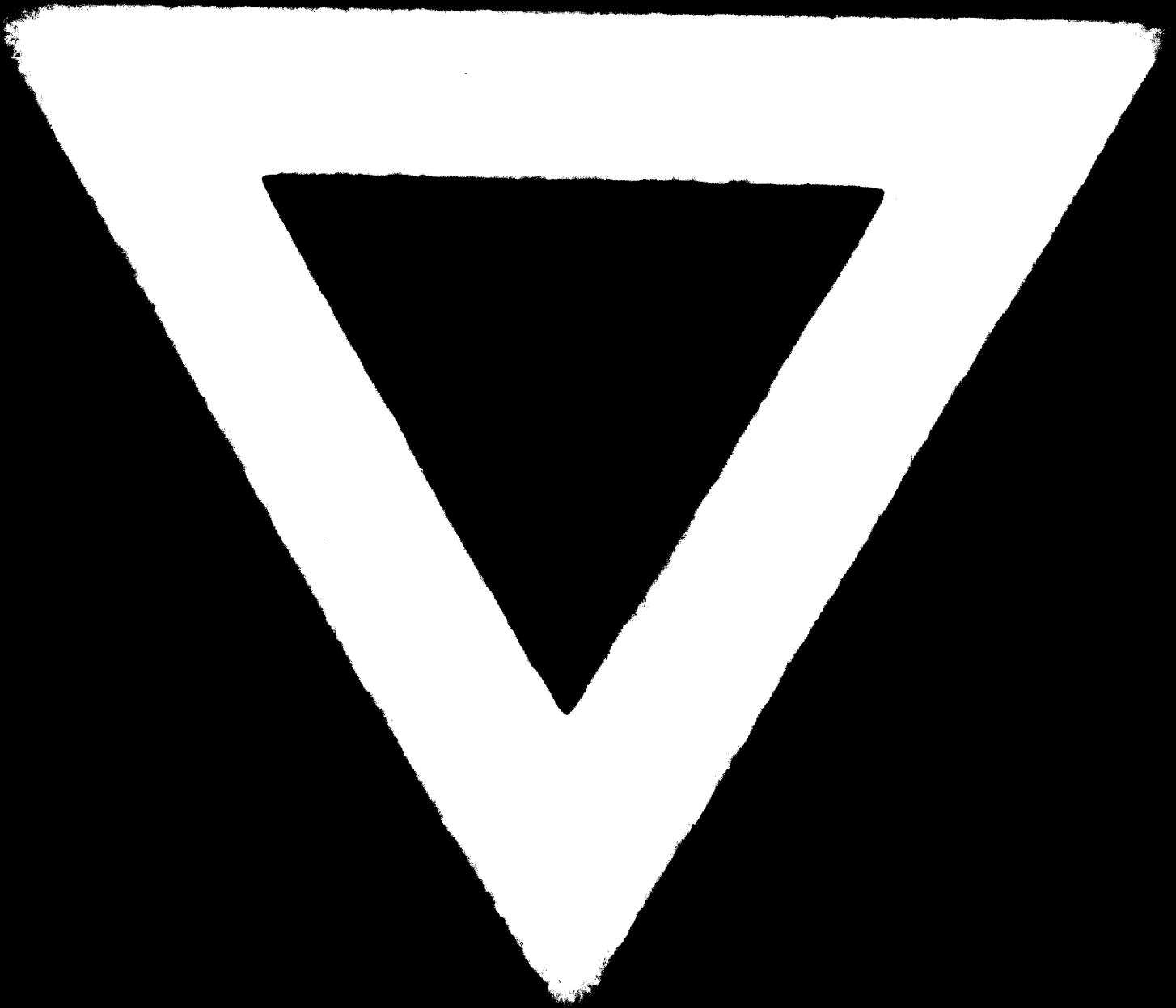
(i) Efficient training and utilization of technical personnel is possible, provided real industrialization takes place which, in its turn, is unfeasible without certain economic, social prerequisites, conditions and a favourable political approach.

^{1/} In this respect the experience in technical personnel training organizations of the Soviet Middle Asian Republics (Uzbekistan, Kazakhstan, Tajikistan and others) having made the leap from previous backwardness to fast progress, might be of special interest and value for many developing countries, solving the similar task.

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