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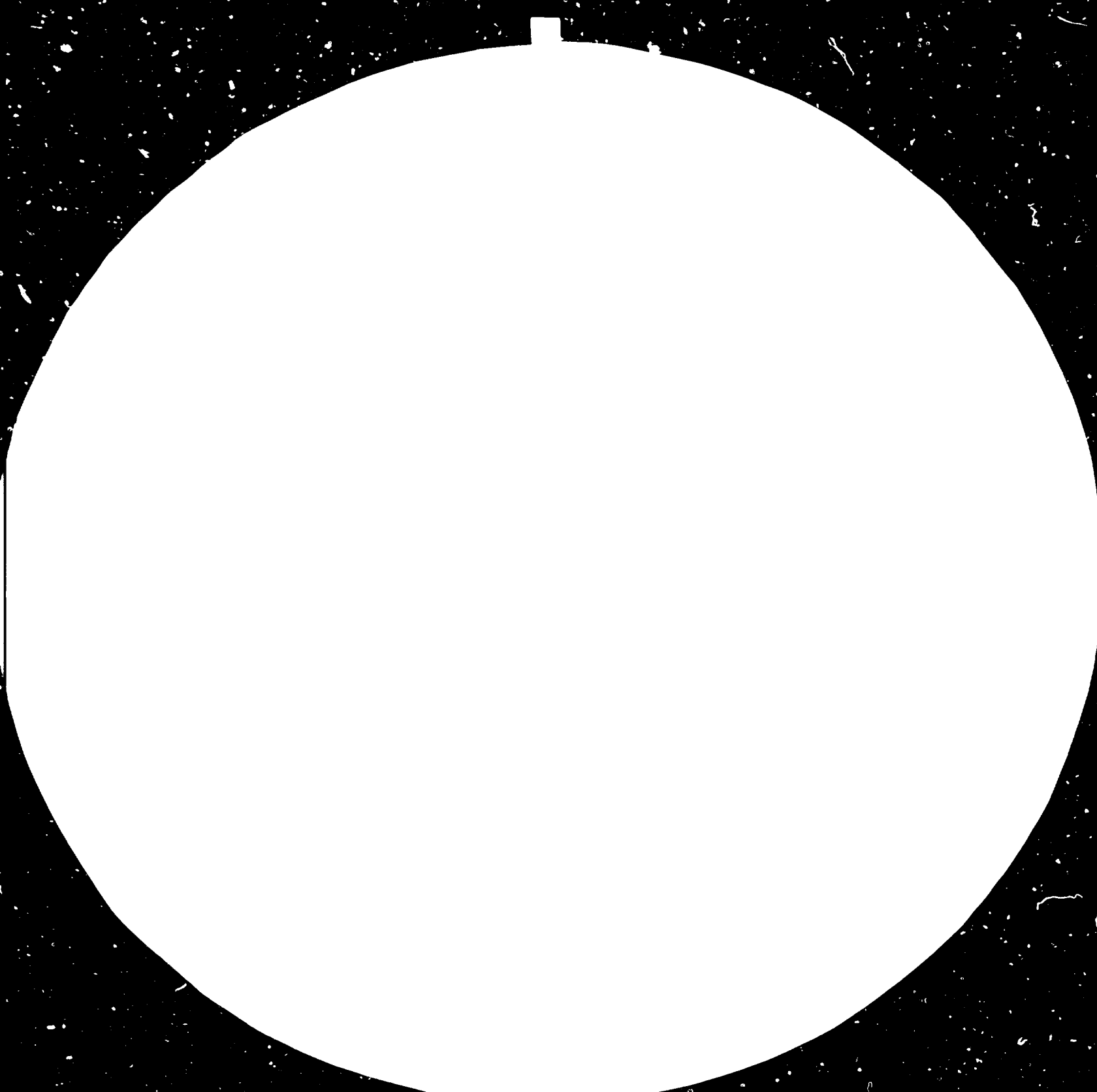
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Resolution test chart pattern 2.5, consisting of five vertical lines on the left and five horizontal lines on the right, with the number 2.5 printed in the center.



## MICROCOPY RESOLUTION TEST CHART

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Development of Human Resources for Industrial  
Development - The experience of India.

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Development of Human Resources  
for Industrial Development - The  
experience of India.

It is generally believed that the Human resources have contributed 50 to 70 percent towards economic growth and lot of research has been done of late to find out the contribution of the human factor in the economic growth. Growth in economy is attributed by growth in different sectors of the economy and one of the major such sectors is the industrial sector. Growth in economies and growth of industrial development is closely linked with the growth of technical and professional skills and surpluses and shortages of these skills can bring serious checks on economic progress. One of the most important facts of economic planning is to identify the types of technical and professional skills that the economy needs and to plan for their development. In any programme/project, manpower or human resource constitutes one of the major inputs like equipment, raw materials and other infrastructural facilities. Economic development (or growth) is closely interlinked with industrial development and industrial development requires, among other things, professional skills as one of the major inputs. In India, a major development problem is the generation of employment both in the rural and urban sectors. This is intimately connected with industrial and economic growth, where appropriate use of science and technology can play a crucial role. Therefore, a need was felt to create adequate supply of qualified S&T personnel and other skilled personnel.

The total labour force between the age of 15-59 was estimated to be 137 millions in 1980 and will be expected to grow to 268 millions in 1985. Since one of the priorities of the country is to provide employment to such labour force in the rural and urban sectors by increasing industrial and economic growth which in turn required qualified manpower in general and qualified skilled manpower in particular, it is enough to deal with the relevance of the development of <sup>qualified</sup> human resources and its bearing and relevance on the industrial development.

The development of human resources in a rapidly changing world has assumed many dimensions. In this paper, human resources development (HRD) is restricted to manpower development to achieve industrial development which, in turn, goes to help economic goals of the country. In this context, the action being taken or to be taken by Government, by industry, by institutes, by professional bodies and by international agencies becomes very relevant and important. There is a problem of organising a very large scale HRD effort in not only the developing countries but perhaps also in the developed countries. This would require large investments as well as trained faculty which could undertake this effort. Some scanty data is available as of 1975. The situation might have changed since then. It is stated that 12% of the total wages and salaries paid in US is spent on training and development of personnel. India and many other developing countries, it is much less may be of less than 1%. But the Indian Government's effort in the formal system of education is impressive. In France, every employer of more than 10 workers is obliged to pay a uniform training levy going up to 2% of his total wage bill. It is the legal right of every French worker to get periods of leave to get approved

training courses. UK introduced an Industrial Training Act in 1964 in which a varying levy is placed on different industries which, for example, is 2½% of salaries and wages in the case of engineering industries and about 2 millions are being trained systematically each year by the employers under the schemes. Sweden, Canada and Japan are reported to have well established manpower training plans. In Finland, it is said that top and middle executives go to school to study professional management probably more than those in other countries. Perhaps, the above data might have changed now but the overall picture should be the same; but more than the absolute figures, they confirm that HRD is vital for rapid industrialisation which is essential for economic growth.

The means of developing human resources in any country are manifold and would cover inter alia the following elements:

- (i) Formal education at primary, secondary and higher level of expertise
- (ii) Technical and professional education at various levels of expertise
- (iii) On-the-job training, informal training, adult education, seminars, workshops, discussion groups and memberships in cultural groups.-
- (iv) Training in Management and leadership.

The efforts being done in India on the above aspects are briefly dealt with *below*.

Realising the importance of the need for professionals for economic and industrial development, a number of nations in the developed and even in the developing world invested heavily on the educational infrastructure. India also has played her part in the supply of qualified manpower in general and science and technology manpower in particular. Post independent years

saw enormous growth in the number of universities, colleges, polytechnics and schools offering a variety of courses at various levels in different disciplines. The increase in the educational institutions has resulted in the spending of the considerable amount of national resources on education and training both formal and informal.

The Union Government is directly responsible for co-ordination and determination of standards in research, scientific, technical and higher educational institutions. For discharge of these responsibilities, the Ministry of Education has set up statutory organisations like the University Grants Commission, Indian Institutes of Technology and other autonomous organisations at the national level like the National Council of Educational Research and Training. The Government has also set up four institutes of Management and four technical teachers training institutes. In the three decades of planned development, the number of educational institutions has grown manifold. Starting with 27 universities in 1950, their number have increased to 135 in 1980-81 which includes 112 universities, 11 deemed universities, 5 institutes of technology and 7 more institutes of university level status. In addition, there are four institutes of management and one institute for industrial engineering granting degrees equivalent to postgraduate level. The number of colleges attached to these universities was nearly 4,700 during 1980-81. Science colleges alone are numbering about 1800, colleges imparting technical/engineering education are nearly 800 and medical colleges are more than 100.



Among these colleges, some are reserved exclusively for women. In addition, the country has got nearly 50,000 higher secondary schools imparting education at the second level. The total enrolment in the universities has grown to nearly 3 millions and the enrolment in science, technology/engineering and medicine and agriculture is 0.8 millions. The output of qualified graduates and above from these institutions is also growing and the S&T qualified personnel is estimated to be about 0.18 millions in 1980. Besides these third level educated manpower, a large volume of second level educated manpower from the school stage is added every year to the pool of skilled human resources. These personnel at the second and third level education get the formal training in the educational institutions by putting regular hours of study in schools and colleges and sometimes through a non formal system of education, through correspondence courses, evening courses, sandwich courses etc.

Besides the formal educational institutions, the country has got a network of research and development institutions/laboratories/in-house R&D units in the industry undertaking development programmes/projects in a variety of high technology/new emerging/frontier areas relevant to different industrial groups. One of the objectives of these institutions is manpower development in the disciplines of their work.

It is worth describing briefly the various ongoing formal/informal education and training in different disciplines/technology in the educational/research/industrial institutions for development of human resources in a variety of scientific and technological fields suitable for different industries. The

education/training facilities offered in different institutions are being dealt with somewhat on the basis of disciplinewise/industry-wise in the next few succeeding paragraphs.

Electronics is one of the potential and upcoming fields and every nation and so too India has taken note of its importance for national development. So, India has taken action to develop human resources for electronics industry. University Grants Commission has identified about 20 institutions/universities like Birla Institute of Technology and Science, Delhi University, Indian Institute of Science for intensive training and development of computer manpower. In addition, a large number of universities/Institutes of Technology has computer facilities and they undertake intensive training on software/hardware development and other peripheral aspects. In fact, there are special software development projects like National Centre for Development of Software and Training (NCDST) at Tata Institute of Fundamental Research (TIFR) which is engaged in human resources development also. Besides, there are well-known/loading consultants like Tata Consultancy Services, industrial houses and computer manufacturers who also contribute towards development of human resources in computers and allied fields. The Government of India has established Regional Sophisticated Instrumentation Centres (RSIC) in different parts of the country to create and promote an appropriate instrumentation culture in the country. RSICs are engaged in short term courses/workshops on the use and application of various electronic instruments and techniques and also engaged in training technicians for maintenance and operation of sophisticated instruments. Institutes of Technology/Engineering Colleges/University Departments offer full time theory and practice oriented courses leading to degrees/diplomas in Electrical and

Electronics, Instrumentation and Machineries. The training cover all electronic products/appliances and their maintenance and development. The large number of manufacturers of industrial and consumer electronics (including semi-conductors and computers) and their in-house R&D units have engaged in short term on the job training of manpower for production, maintenance, development of such products. The country has established several Electronics Exports promotion zones which also contribute towards human resources development in the field of electronics. The national laboratories like National Physical Laboratory (NPL), Central Electronics and Electrical Research Institute (CEERI), Central Scientific Instrumentation Organisation (CSIO) engaged in the research and training in the fields of electronics materials devices, instrumentation control systems, LSI/VLSI circuits and systems etc.

The training/academic courses on electronics in the institutes of technology/engineering colleges combine electrical engineering in its many facets vital for industrial development. Intensive training is offered in a number of fields including high technology areas and it includes programmes in control/power system engineering, electrical/machine drives, instrumentation etc.

Realising the importance of the role biotechnology is to play, now and in the near future, the high level committee on Science of the Government of India has set up a National Biotechnology Board (NBTB) with the objectives of evolving a national co-ordinated short and long term plan of research and development, utilisation of the known technologies, strengthening of existing infrastructure and wherever necessary setting up centres in the newly developing thrust areas of biotechnology. The board will be conducting workshops/

training courses among others in biochemical engineering, biomass, genetics engineering, photosynthesis, DNA technology through the existing infrastructure available at higher educational institutions/research institutions/national laboratories and if necessary through setting up of specialised advanced centres.

Communications is very vital for a country and industries both in the public and private sector have been established to manufacture communication equipments. In order to develop human resources to man the jobs in the communication industries, courses/training programmes such as electronics and communication engineering, micro-waves, instrumentation and control, tele-communication engineering, radio and radar engineering, transmission are being conducted by the higher educational institutions. Specialised training centres such as Advanced Level Telecommunication Training Centre specially set up to develop human resources in the areas of advanced traffic theory, simulation, trunk automatic exchanges, electronic exchange system, digital technology, instructional technology, digital networks, maintenance reliability etc.

University Grants Commission has named centres of Advanced Study with areas of specialisation under different departments of various universities to undertake research and to train manpower to meet the needs of the country in the specialised and emerging fields. Simultaneously the trained manpower from these centres will be available to man the specialised jobs of the industry. It may perhaps be useful to mention the specialised areas of work of a few centres. Chemistry of textile fibres and dyes, chemistry of natural production, inorganic and physical

chemistry, cell biology, proteins and vitamins, chromosome research, ecology, physical and mechanical metallurgy, Radiophysics and electronics are some of the areas on which the above centres do concentrated work. In addition to these centres of advanced study, other institutions/colleges of engineering, technology and science/specialised research institutions are engaged in the development of high level technical skills in chemical engineering and technology, chemical sciences, in pharmacology, drug and pharmaceuticals, textile technology, dyes and chemicals, food technology, plant design, process engineering, polymer science, paper technology, plastic technology, petroleum refining etc., to take care of the manpower needs of the different industries engaged in the production of chemicals, dyestuff, textile, drug and pharmaceuticals, plastics, petroleum, paper, rubber and other consumer and industrial products. It is rather difficult to give an exhaustive list of human resources development programmes offered by the innumerable institutions in different product lines in the country to suit the industrial manpower needs.

Construction industry is one of the major employers as it is a labour intensive industry. Since housing like food and clothing is one of the prime necessity of the people, since India has a large population and since development of cheap construction materials are very essential, construction industry requires adequately trained manpower in the relevant fields of construction/housing, town planning. The institutions' efforts in the development of manpower in the related areas of construction is quite impressive. There are also specialised institutions, training manpower on various aspects of construction like Structural Engineering Institute, School of Planning and

Architecture to mention a few. All technology/ engineering institutions offer civil engineering as a basic course, leading to high level qualifications. The variety of courses offered in civil engineering <sup>Covers</sup> ~~courses~~ among others, soil mechanics and foundations engineering, highway engineering, structural engineering, low cost housing, water resources engineering, hydraulic engineering, building engineering, material science, new and cheap construction materials, town and country planning and design engineering.

The industrial products and materials will have to meet certain standards to establish their quality and reliability. To meet the objectives of establishing reliability and quality standards, the Government of India has set up the Indian Standards Institution. The institute is engaged in the formulation of national standards, relating to products, commodities, materials and processes and promotion of general adoption at national and international levels and certification of industrial products. The institute offers extensive training in the various aspects related to standardisation. The Government of India has initiated a programme, National Co-ordination of testing and calibration facilities to assist the various industries seeking suitable testing facilities.

The need to initiate, undertake and promote professional activities related to labour which form an integral part of the industry cannot be minimised. The National Labour Institute, an apex organisation alongwith its regional organisations offer training in industrial relations and trade union aspects.

National productivity Council (NPC) and its Regional Directorates and Local Productivity Councils are engaged in activities with the objective to stimulate productivity consciousness in the country and to provide services with a view to maximising, the utilisation of available resources of men, machines, materials and power. The fields of training of NPC include industrial fuel efficiency, energy substitution, pollution control devices, energy planning, production and plant engineering, maintenance, management, supervisory and worker development etc.

There also exist specialised industries manufacturing specialised and sophisticated products like air crafts, boilers, steam generating plants, turbines, generators, prime movers, earth moving machineries, train coaches, buses and hydraulics equipment. The country has got an impressive list of institutions/colleges offering specialised intensive programmes/courses to make available highly trained manpower for the industry in the above product range.

Apart from the full and part time and short duration highly intensive technical programmes offered by institutions of engineering and technology, universities, advanced centres and centres of excellence are engaged in training of manpower in basic and applied sciences with a view to ~~create~~ supply of highly trained manpower to meet the needs of industries. These programmes are also very often interwoven in the programmes of engineering and technology. Realising the need for a multi-disciplinary approach in training to understand the requirements of the industry and the nation, a number of institutions of higher learning has created new departments like bio-medical, bio-mathematics, bio-chemistry and bio-physics in the recent past. Along with the development of industry, it is essential to keep the ecological balance and clean environment. Attention has been focussed on human resources development in pollution control/monitoring, environmental aspects, ecology, human settlement/habitat etc.

Due to steep increase in oil prices which in turn created adverse balance of payment and drain on foreign



exchange problem, India has geared itself up to start programmes/projects in new and non-conventional energy sources on the one hand and in optimum utilisation of conventional sources of energy. In this, the industries engaged in petroleum refining and processing, in the production of photovoltaic cells for solar energy, in the production of machineries/instrumentation/equipment for energy and fuel sector have also played a role. To meet the emerging needs of trained manpower, institutions in different sectors started courses/curricula in relevant fields.

The National survey organisations undertake several nationally important developmental surveys and mapping projects related to the coal fields, irrigation, power generation, communication, flood control, water supply and forestry. Appropriate training to S & T entrepreneurs are being planned to take to a career of self employment by utilising the untapped natural resources. This is besides the training already being provided by the survey organisations to scientists.

The above gives an overall picture of the efforts put in by India in the development of human resources catering to the needs of the different industrial groups. The above list is not an exhaustive one, but it gives an idea of the enormous effort by the country in the development of high level skilled manpower to meet the needs of the industry engaged in the manufacture of different grades of technology oriented products/processes/services. As a natural corollary

of full time educational programmes in the higher education sector, there is a building up of a vast pool of qualified personnel in S&T and medical disciplines. It is worth giving briefly the order of magnitude of the available personnel trained in a multi-faceted disciplines/fields.

The total stock of educated manpower, matriculate, graduates and above (MGP) is estimated to be 34.76 millions in 1980 and is likely to increase to 46.60 millions in 1985. Matriculates (or completed education at the second level) account for nearly 80% of the total stock. It is also estimated that the number of economically active MGP was 22.66 millions and it is estimated to go up to 30.37 millions in 1985. Graduates and above alone constituted 8.1 millions in 1980 and this includes 2.4 millions of scientific and technically qualified personnel. As mentioned elsewhere, this stock is replenished every year by the addition of new S & T graduates at the third level and such additions amount to approximately 0.18 millions for the year 1980. The number of unemployed MGP constitutes about 15%. This includes 1 million graduates and above and 300,000 S & T qualified personnel unemployed. It is also estimated that a sizeable percentage of S & T personnel is employed in banking and insurance and such other sectors where their S&T skills are not required. It is argued by experts in manpower planning, industrial development and by development economists that solution to the problem of unemployment of highly qualified S & T personnel and solution to the problem of increasing industrial development are dependent on each other and the remedy to such problems should be found out by appropriate actions to make

optimum use of available high level skills by industry on the one hand to make the skills more need based and suitable to industrial needs on the other.

The country has already taken notice of the priority for using the potential qualified human resources for productive purpose . The Government of India has established the National Science and Technology Entrepreneurship Board (NSTEDB) to take, on a sustained basis, the problem of unemployment and inappropriate employment among qualified science and technology personnel. The board has initiated action programmes among others towards imparting training to prospective entrepreneurs in traits like need to achieve, risk taking, managerial skills and aptitude for problem solving. The board has also planned to establish Science and Technology entrepreneurs parks to promote self employment ventures for unemployed and under employed scientists and technologists by fostering a research industry culture through industry university linkages.

The fact remains that India has created an abundant supply of qualified, highly skilled manpower in different disciplines and sizeable amount of financial resources is being invested to a great extent by Government and to a small extent by private agencies in formal and informal training of such manpower. India has established a good industrial infrastructure and it is ranked as tenth industrialised nation in the world.

Apart from the ongoing efforts in the field of development of high level skilled human resources, the country has also implemented several human resources development programmes at different middle level skills.

Trained manpower at middle level is needed for a wide range of professional duties, for application of knowledge in field operation, in production and construction, testing and development etc. For this purpose, diploma courses are offered in 320 polytechnics with an annual enrolment capacity of about 50,000 students. The courses are offered in a variety of specialisation in engineering and technology as well as in a few non-technological fields. About two dozen polytechnics are reserved for women. Training is provided in 32 engineering and 26 non-engineering trades to persons within the age group of 15-25 years. About 850 Industrial Training Institutes (ITI) and centres both permanently and provisionally affiliated to the National Council of Training in Vocational Trades (NCTVT) having nearly 2,00,000 seats in 1980, there were nearly 0.12 million middle or lower level technicians (provisional) seats. The training in ITI is free, in addition to concession like free workshop clothing, sports and medical facilities. 33.3% of the trainees are paid stipends of Rs.40 (US \$ 4) per month. The educational qualifications for admission to these trades varies from 8th standard to matriculation or equivalent. The Apprentices Act, 1961 makes it obligatory for employers in specified industries (217 industries have been specified to train apprentices in 136 trades) to engage apprentices. As on 1980, there were 200000 apprentices. It consists of basic training following by on the job or shop floor training. The educational qualification varies from primary to matriculation level. During the period of apprenticeship training, stipends are paid to

trainees which varies from S.130 (US \$ 13) per month to S.230 (US \$ 23) per month depending on the level of qualifications and type of trainees. Six Central Training Institutes for Instructors (CTI) train craft Instructors required by ITI and Apprenticeship Training Establishments. In addition to the above vocational training institutes, there exists other training institutes, namely Advanced Training Institute (ATI) assisted by U.N.D.P through ILO which conducts training programmes for upgrading and updating of the skills of workers and technicians, for training highly skilled personnel etc, Advanced vocational Training System (AVTS) to meet the demands of highly skilled manpower for the modern industry, Foreman Training Institute to train existing/potential shop floor foremen and supervisors in technical and managerial skills, Central Staff Training and Research Institute (CSTARI) in collaboration with Federal Republic of Germany to train officers and staff of Central/State Governments and industry who control, regulate and direct training activities, two Vocational Rehabilitation Centres for physically handicapped. Apart from the technical training/education imparted by the above institutions, training in general management and in functional areas at different levels is provided by specialised institutions. The training is arranged in short durations as well as in long duration which lead to degree earning status. In addition, various formal educational and training institutes arrange seminars/workshops/discussions and also tailor made

courses for particular industry in a variety of disciplines for industry. Government has also established a number of training institutes to impart entrepreneurship training for establishing small scale industries.

Large industrial houses have got separate training divisions which arrange in company training programmes for their employees at different levels. In these, they sometime collaborate with established training/educational institutes. In addition, there are a number of private consultancy/training organisations which also impart training in managerial/technical disciplines. There are also professional associations/societies/institutes for different disciplines and these also undertake training programmes at different levels. Leading nationalised banks and financial institutions also have training colleges or large scale training programmes for their employees. Besides the training within the country, potential employees are sent abroad for specialised training under different collaboration/bilateral agreements and sometimes on Government of India account. Some of the professional industries also send their employees abroad for training.

Though the above is not an exhaustive list of the HRD efforts ongoing in this country, it gives a fair idea of the enormous training infrastructure built up over a period of time in India. Despite the fact the training opportunities have been increased enormously and thereby increasing the availability of trained personnel in different skills, the industrial growth is not appreciable

and, there is sizeable unemployment among these personnel. As mentioned elsewhere, several reasons are advanced for this imbalance and one of the reasons is that the training imparted is not relevant or not suitable to the industrial requirements. This leads to the question then as to how to make the best use of the training infrastructure already built by bringing in greater co-ordination between the supplier and user of the trainees. Besides the national effort to bring in greater co-ordination to make the potential use of the trainees and training facilities towards the objective of industrial development, it may also be useful to dwell upon briefly on the regional and interregional efforts for utilisation of the training facilities and trainees available in India and in other countries. A number of suggestions/observations are given in the subsequent part of this paper towards the objective of optimising the existing trained human resources and the future development of human resources for industrial development and these measures are not given in any order of priority.

(1) Interaction between colleges and industry should be strengthened by introducing model of practical school; (2) at present the educational system in India is producing thousands of ordinary graduates who have no special skills where as there are shortages of weaving masters, spinning

masters, welders, fitters and shop orders and hence such as vocations have to be strengthened; (3) Training schools should be established in industries by the educational institutions where students can spend a considerable amount of their study period so as to be aware of the practical problems of industrial development; (4) Human resources development in the context of planned economic development must be reflected in expanding the relevant human capacity in relation to national production capabilities; (5) Relevant capabilities in human resources as specific in four distinct fields may be useful: (a) The mass production capability in reference to organisation (b) mass production capability in reference to skills (c) Entrepreneurial capabilities (d) knowledge worker capabilities. This implies that the development of human capabilities.

--(i) the skills to carry out mass production; (ii) the organisational capabilities of organising such skills into an integrated operation; <sup>iii)</sup> the entrepreneurial capability to bring together these skills and channel them into the particularly appropriate area of operation at the most appropriate time and place. India has adequate knowledge workers (or educated personnel) but they have to be made need based with practical skills; (6) There is a need to undertake a systematic and dispassionate audit of the existing HAD efforts with a view to find a feasible solution to HAD problems according to individual needs of different categories of organisations and to examine the reasons for lack of contribution by educationists, trainees and consultants in this area; (7) A census of present skill available



may be fitted into the code system and they are titled as (a) obsolete skills (b) surplus skills (c) obsolescent skills (d) zero stock skills and (e) transferable skills. Readjustment between them is necessary with a view to rationalise the education/training programmes for making available skills in demand now, in the near future and in the context of next five to ten years in new emerging areas; (8) Industry has an important role in the development of human resources. Industry should earmark a portion of its revenue for HRD; (9) The influence of industry over education must increase in character as well as degree. It cannot remain a passive supporter of education by handing out coles. Industry must make investment both in terms of money and time in educational institutions; (10) At the national level, there needs to be proper co-ordination for management and development of the employment and training services by restructuring existing system. In this context, it is worth examining the organisational structure, objectives, functions and special programmes of the Manpower Services Commission (MSC) for its suitability to various national governments established by UK in 1974 with the following priority objectives in framing its corporate plan: (i) to safeguard the provision of skilled manpower for industry's present and future needs; (ii) to ensure that all unemployed have access to programmes of training and work experience, as part of efforts to improve access to training and vocational preparation for all young people; (iii) to provide an efficient and cost effective employment service to meet employers' and job seekers' needs; (11) Industry could think

of establishing Industrial Training Boards (ITB) for different industries. The group can also examine the proposal of establishing links between M.S.C and ITBs to draw up appropriate training/re-training/employment services programmes; (12) There must be regional and inter regional efforts in making use of the facilities of HRD existing in different countries. Since India, among the developing countries, has got sufficient infrastructure for training/education of human resources, it could be considered by other developing countries to share such facilities especially the training/education costs, in the developed countries are prohibitive on the one hand and there is a problem of foreign exchange constraint, on the other:

(15) It could be considered to establish Regional and National manpower Commissions to co-ordinate such regional and inter regional co-operations with the following objectives: (i) to provide a system for the co-ordination of training information; (ii) to identify and maintain a reference file of training organisations and resources around the countries and world; (iii) to encourage and initiate research in HRD at the national and regional levels; (iv) to assist in arranging and conducting regional conferences; (v) to encourage the establishment of regional training organisations; (vi) to share the training/educational facilities available in different countries.

In this paper, an attempt has been made to bring out the enormous infrastructure available for formal and informal training<sup>in India</sup> and also to bring out broadly as to how best to remedy the skill gap existing between the available manpower and required skills of industry so that optimal use of the human resources for the maximum industrial development.

