THE PARTICIPATION OF ENGINEERS IN NATIONAL DEVELOPMENT

By

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The Paradox of Pakistan's Slow Progress and Unemployment of Engineers

Pakistan is supposed to be a developing country. To achieve a respectable standard of living, to be a strong and prosperous country, it has to build and develop rapidly in all spheres. It is an incontestable fact that development without engineers is unthinkable. To do anything, from building small houses to schools and hospitals, buildings and factories, canals, dams, power-houses, roads and communications, ordnance factories for defence; from supplying water and electricity to running airlines and numerous other requirements of national life, engineers have to play a major and essential role.

Pakistan needs engineers. With all the reconstruction that has to be done in our country, it would be reasonable to assume that there would always be a shortage of engineers. Yet the position is quite different. The fact is that for over two years now there are hundreds of graduate engineers who are unable to find jobs.

This is a paradoxical situation. Engineers should be a major instrument of development. Engineers are a nation's wealth. We are not developing sufficiently or rapidly enough; yet we have hundreds of engineers who are not employed. This situation only exists because defective planning and wrong policies have been pursued.

Conditions obviously exist that prevent engineers in the right numbers and in the right positions from leading the nation to progress. If the electricity supply does not satisfy, if the buses do not run properly, if even the simplest manufactured items are imported; most often it is because the top men in the concerned organisations are non-engineers without professional management skill and experience in related fields, who do not understand the problems, or because engineers are not being used where they should be, or being managed the way they should be.

Pakistan cannot progress unless the whole nation is allowed to participate. The general elections have been successfully conducted as promised

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by the President. A most essential remaining step is making the services efficient and professionalised. The President's consciousness of the importance of this was demonstrated in his very first speech to the nation. The setting up of the Services Reorganization Committee was one of his first acts and he is pledged to bring in a clean and efficient administration more attuned to the needs of the country and people. The terms of reference that he gave the Committee showed his realisation of the necessity and depth of reorganisation needed. At the Institute of Engineers' Annual Convention in Dacca last year he personally assured the engineers that the services would be reorganised and the engineers would be allowed to play what they consider their due role of giving their best to the nation. The nation's interest demands that the exclusion of engineers from National decision-making policies must end.

But practical steps are urgently required for this problem has been and is gaining more and more serious proportions. Protests and demonstrations at the Convocation of the University of Engineering and Technology at Lahore sometime back, at the Engineering Congress opening at Lahore, at the Institute of Engineers' Annual Convention at Peshawar recently, and at other places, only highlight it.

We in the Engineering profession have been concerned about this problem for quite some time now. Engineers' Associations as well as individual engineers have been trying in the past to make the Government see the serious implications of the improper and inadequate utilization of engineers and to act. Special studies have been carried out, reports with definite solutions submitted at very high levels, and other necessary steps taken.

Rough estimates now indicate that the figure of unemployed engineers in Pakistan is in the region of 1500 to 2000. It brings into focus the fact that Pakistan is grossly under-utilizing its precious technical manpower resources. (It does not require much searching to see that so many of our other resources are not being utilized and wasted). In Pakistan today there are only about 12,000 engineers in a population of 130 million: less than 1 engineer for over 10,800 people. A small but developed country like Denmark with a population of 4.5 million has about 10,000 engineers *i.e.*, one engineer for 450 people. In Turkey, the ratio of engineers to people is about 1 : 2200. These figures clearly show that we do not possess anywhere near the number of engineers we require. Yet we are confronted with a situation where there are hundreds of engineers unutilized. Our development objectives have obviously not been clear. For a developing country, this is alarming.

A study of this problem indicates certain reasons for the terrible state we find ourselves in. A further catastrophic effect of this could be the disenchantment of our bright young students with the engineering profession, as indeed with science and technology.

The early reorganisation of the Services should improve conditions tremendously. A departure has to be made from the set patterns of thought and action adopted over the last twenty-three years.

Some measures suggested in this article, besides other places, require executive action by the Government, in the form of some reorganisation of its own departments and their method of working or changing certain practices; others would require a certain amount of new nationalistic and progressive legislation.

Fuller Utilization of Engineers

Pakistan's backwardness is in large measure due to the wrong stratification in our society. Looking at the prosperous, strong and developed countries, one fact stands out : The scientist, the engineer, the technologist is in every important place; whether advising Presidents, conquering space or landing on the moon, running universities, heading large corporations (60% of American corporations are headed by Engineers), or sitting in the cabinet. In Pakistan the importance of the role of the scientist and the engineer is still not properly understood. Does history not indicate this fact as the cardinal reason for the downfall of the Muslims and their subjugation by the West?

More often than not, the engineer is deliberately kept down and used as an auxiliary at best, with the result that he cannot give his best to the nation. It is seldom realised that because of his training, technical, economic and managerial, and experience in the management of projects and organisations, he is better qualified in administration than most so-called "administrators". Too often it is deliberately, or out of ignorance, overlooked that in senior positions an engineer has to administer and manage besides giving technical direction; that there is a vast difference between an engineer and a mechanic. Too often the false argument is advanced, that the engineer is so specialised in his technical line that he cannot administer an organisation.

Engineers in Government are employed in only the few engineering organisations and these organisations too are normally headed by non-engineers. This relegation of engineers to only a few Government engineering departments and engineering bodies is unhealthy and not desirable for the country. Many jobs that should rightly be manned by engineers in the country's interest are blocked to them. Engineers must be allowed to play a fuller and broader role in the development of their country, if Pakistan is to prosper and grow strong. Could China shock the world with a satellite if it had relegated its engineers and scientists to a secondary role? Can any nation hope to make progress if it does not utilize its scientists and engineers to their maximum capability at all levels? Nobody can question that without technology no nation can make

progress. Equally clear stands the fact that technology is not only based on machines but also on people. If the people concerned, *i.e.*, the engineers are hostile to programmes or policies or the top management of development organisations, what chance is there of success?

There is no reason why Government departments and agencies like the Planning Commission, Planning and Development Departments, Improvement Trusts, Municipal Committees, Rural Works Programmes, Industries Departments, Small Industries Corporations, Agricultural Development Corporations, Industrial Development Banks, Agricultural Development Bank, PICIC, Road Transport Corporations etc., as also the public sector industries and industrial complexes, besides WAPDA's, PIDC's should not utilise engineers at all levels, particularly including the top. There is a great deal of logic in anticipating much better efficiencies if this was done. The oft-repeated blame of inefficiency in Government organisations may well become unjustifiable if this was done.

A survey would have to be carried out to find out the actual number of engineers with these organisations and how many should be employed with them in the best interests of the country. But it is evident that many of these organisations either do not employ any engineers or if they do, they are in much smaller numbers than required and instead generalists and non-engineers are employed in the places. Engineers are excluded from the top positions of even the engineering and industrial organisations. When so many high calibre engineer-administrators are available, there is no valid reason why generalists should head these organisations and even industrial complexes like the Petro-Chemical complex, the Steel Mill etc.

There may have been some justification in the past to employ non-engineers in place of engineers in such organisations and departments when there was a shortage of engineers. But this was supposed to be only a temporary solution. The starting of new engineering institutions and the aim of educating large number of graduate engineers was to fulfil the requirement of technical expertise for these organisations. The problem has arisen because the required follow-up has not been carried out. As soon as sufficient number of engineers were available, the non-engineers, in what were essentially engineering or engineering management positions, should have been replaced by engineers. This was not done. Today we are reaping the ill-effects of the absence of engineers and scientists (as well as other professionals) in these important activities and have to repeatedly admit that this was wrong policy.

The majority of our people live in the villages and there too the development has been most unsatisfactory. As an example there were 35 non-engineer civil servants as Project Directors of Rural Works. About Rs. 5 crore per year is spent on these works out of which about Rs. 2 crore goes in building con-

struction. Instead of adopting a penny-wise policy, much better results could have been achieved if engineers and engineer-administrators were used. About 100 engineers could have been employed on these works to make them really productive. (This figure is quite reasonable when one finds that the ex-West Pakistan Buildings Department had a yearly budget of Rs. 10 crores and employs about 270 engineers). The employment of engineers to develop the rural areas could have and can produce great results and solve various problems. Under the direction of engineers, rural surplus labour could work on soil conservation, afforestation and on the construction of dams, canals and roads.

Furthermore, in a developing country, it is essential that even non-technical or non-engineering Government departments should have a number of engineers attached to it for engineering and technical advice. If this was done there would not be the hit-and-trial decisions taken so often in these departments, that we are seeing all around us.

Pakistan is a young country and needs new ideas and progressive concepts to flourish. Engineering is a profession which is progressing so rapidly, (without further education the half-life of an engineer is supposed to be ten years) that generally relatively younger people are better qualified to cope with it and to bring with it the required transformation of our country. We engineers are aware that we ourselves have many defects. These we should remedy urgently. We should also be bold enough to weed out from amongst the engineers in service, those whose performance has not been as high as required. The Armed Forces do this as a matter of routine; surely not all those in civilian services could be perfect. (The Armed Forces personnel administration system is the best in the country and its emulation by the civilian services would be of great benefit to the country).

Retirement of engineers at 55 should be enforced. Besides improving the employment situation, it would also have many other benefits.

The importance of training in all spheres of activity in a modern nation cannot be over-emphasised. In Pakistan this aspect has not received as much attention as desirable in any civilian government department or service. (The Armed Forces are the exception and major reason for their efficient performance is thorough and continual training).

The system of training for the engineers, after they have graduated from the universities is also very deficient. In fact the only training the engineers in Pakistan generally get is on-the-job training. It would be beneficial, actually necessary, to arrange that before an engineer is put on a job, he has been given a detailed and thorough apprenticeship for about 2 years. This is the generally accepted practice in all the developed countries. A portion of this time

should be spent in the Engineering Academy which should be set up without any further delay. (The Institute of Engineers particularly and the Engineering Congress should set up the Academy. Help from the Government can be sought but there is no reason why we should totally rely on it).

Training should also be continued throughout the career and career planning executed according to proper schemes.

The existing engineering cadres should be expanded for this purpose by about 5% of their present strength, to provide for training. With proper training the engineers would logically be able to serve the nation in a far better manner. This measure would also enable the absorption of a great number of unemployed engineers. The total strength of engineers working in the various Government departments/autonomous bodies is estimated to be in the region of 7500.

Elimination of Foreign Engineers and Technicians from Government Organisations

With such large engineering and technological manpower resources as ours, some of rather high quality, with our present non-committed foreign policy, and with the greatly diminished loan levels from the developed countries and serious doubt existing about using foreign loans for national development, there is no more any justification, if indeed there ever was, of allowing such large numbers of foreign engineers and technicians to work in Pakistan. Besides being a great drain on our resources, and a major factor in the high costs of our projects, as well as a restraint on training opportunities for our engineers in many important fields (instead of foreigners learning from making mistakes on our projects our engineers should be learning); besides being a great factor towards reducing our nation's lack of faith in its own engineers and contributing to many results detrimental to our national interest, they also reduce the employment opportunities for Pakistani engineers.

Even the developed countries, short of engineers, place severe restrictions, by law, on giving work permits to foreigners. In Pakistan there are hardly any such restrictions and if there are they are too easy to dodge. The countries from which Pakistan is crowded with the so-called experts, are the very same which keep on increasing the restrictions on Pakistanis working in their countries or even on entering them.

Almost any foreigner in Pakistan is dubbed an "Expert". Most of the foreign engineering consultants do not even possess an engineering degree. When they do, the situation is not rare in which Pakistani engineers find themselves saddled with or working under a foreigner less qualified than themselves, with lesser qualifications, experience and merit than themselves from the same or even less reputed foreign university. There are cases where even

a foreigner who was working under a Pakistani engineer abroad, becomes his boss and adviser in Pakistan !

Foreign consultant engineers are employed for anything from mosque designing to house building to writing/copying instructions manuals/duty charts. Can it be believed that we cannot do even these things ourselves and can afford to waste our treasure and foreign exchange on, and be in debt for generations?

One of the reasons for graduating engineers from the engineering institutions in such large numbers was that they should replace all foreign engineers. Since this was not followed up, hundreds of Pakistani engineers have to remain without the opportunity to serve their country and unemployed.

For West Pakistan WAPDA alone, there are still about 150-200 foreign engineers working in Pakistan and in their home countries. Most of these could easily be replaced by Pakistani engineers.

The cost of the foreign consulting engineers to Pakistan is phenomenal. It is estimated that, to start with, the average cost of bringing him and his family and setting him up was about Rs. 1,25,000. His monthly cost to Pakistan is about Rs. 25,000. For Rs. 25,000 a month, at least 25 Pakistani engineers could be employed, if not more.

For similar important engineering works financed under the same Indus Basin Treaty, whereas Pakistani allowed around a thousand foreign engineers and technicians for the Mangla dam project, the Indians managed to do without them for their Beas dam project and built this gigantic project with their own engineers.

This habit of allowing foreigners to be employed in Pakistan indiscriminately has reached such proportions that hardly anything is considered to be done without thinking in terms of foreign assistance. On the one hand we are told, when putting forward a modern concept or a progressive idea that we cannot expect these to be implemented simply because they are in the advanced countries; on the other hand it is conveniently forgotten that an engineer from an advanced country would take a long time to acclimatize himself to our conditions and to suggest solutions according to our particular requirements. Even those things which were previously, even in pre-independence days, built by Pakistani engineers and technicians are now constructed through foreigners. We used to build our own canals, our own high-voltage transmission lines, but hardly any more. Turn-key contracts are now given to foreign firms for even these works.

The grid stations which supply power to towns and cities consist of buildings, transformers, some structures, some switch-gear and a small amount

of ordinary control equipment. These have been built here for decades. WAPDA has built them by the dozens over the last 12 years. They are certainly not outside the technical competence of Pakistani engineers and technicians. (They have proved their mettle, when allowed, of doing far more complex and sophisticated things). Yet even today WAPDA continues getting erection done of these grid stations by foreigners. After all these years even the over-hauling of simple switch-gear is done through foreigners. It would not be unreasonable to expect a little more patriotic zeal, a little extra effort, to get these things done by Pakistanis and get out of this old groove of foreign assistance that persists.

The cost of foreign construction work is also phenomenally high. We are a poor country and this should be a very important consideration. Projects done by foreigners cost very considerably more than if done through Pakistani engineers. The expensive habits that get implanted on our minds in working with them, are even a more seriously damaging.

Some of our foreign constructed power stations are the most expensive in the world. This was not so long ago commented upon even by Lord Hinton, former head of the British Electricity Authority. A 90-mile stretch of foreign constructed highway has cost Pakistan over Rs. 11 crores *i.e.*, over Rs. 12 lacs per mile. With tens of crores of machinery in Pakistan and so many engineers, we cannot even make a road ourselves! It must also be remembered and stressed that just because a work is foreign constructed does not necessarily mean it is of good quality. Many foreign designed and foreign constructed projects have been very expensive failures for Pakistan. One mistake alone at Mangla dam cost Pakistan over Rs. 6 crores. Many foreign constructed power stations have been defective. A number of foreign designed and foreign constructed barrages have defects and have been giving trouble. Many trans-mission towers of high-voltage transmission lines have fallen causing power failures on a large scale for days. A list of such items would demand another article.

The other harmful effects of foreign loans and foreign consultants are too numerous to recount here. We have foreign advisers and foreign engineers in all aspects of our national activity, from the Planning Commission to domestic water supply works. But yet even a cursory look at the state of our country and our people today would show that they have not been all that good for us.

An appraisal of our economy not only shows the stark reality of its present declining state, but more important it shows how silently but inexorably its problems were developing in gravity. There may have been some slight justification for Pakistanis to hesitate to condemn what their countrymen were doing or aspiring to do and due to wishful thinking believe in Pakistan's economic

miracle and its being a "model developing country". But the Western foreign advisers with their traditions of clarity of approach, critical analysis, objectivity and integrity, to have only joined this chorus and actually encouraged it, should make it easy for us to grasp as to how much reliance can be placed on them. Can we be sure that key sectors like agriculture have even had the correct direction in planning? Have we achieved self-sufficiency in food after all the propaganda? Miracle strains of wheat and rice undoubtedly give high yields, but what of their great demands on water, which we are short of, and fertilizer production, for which we further get in foreign debt? In industry with an investment of about Rs. 12,000 crores, the goods produced are said to be valued at Rs. 5,000 crores only. Its like somebody investing Rs. 1200 to produce goods valued at only Rs. 500. Is this industrial development or insanity? And we could not even give the excuse that national security demands this. For we produce hardly any items necessary for national security. We are dependent on foreign countries for all those products of industry which are the basis of equipment needed for the Armed Forces. As I have stated earlier, after all the talk of development, we do not even make a single truck, a jeep or a transmitter. We have no basic industries, not even a steel mill.

Is it not obvious then that the very concepts of our economic policy for development despite foreign advisers were faulty and fallacious?

The cliche-ridden justifications that are given in support of foreign advisers centre on the argument that they are imposed upon us in order to get foreign loans. The word "aid" is a euphemism to be avoided. Nobody can convince us that foreign governments could successfully impose foreign consultants in such indiscriminately large numbers (in hundreds) if our negotiators could plead our case competently and with ability. Under same or similar treaties other countries have successfully been able to keep the numbers very low. But must we be so completely dependent on foreign loans? What have we achieved with it? It is pertinent to ask this for we are already in debt to over $6 billion. There has been no improvement in our economy in terms of real prosperity. Our standard of living is amongst the poorest in the world. The value of our money has reduced. Apart from creating a few islands of affluence in an ocean of poverty, the gulf between the haves and the have-nots has been so widened that an uneasy feeling of estrangement and revolt has emerged in their relations. As eminent a body as the Pearson Commission, has even found very serious disadvantages from foreign loans for the developing countries. The renowned American economist J. K. Galbraith even states, "Debt creation is a major source of uncertainty in economic behavior". Had true professionals and Pakistani engineers of the right kind been employed in planning, they would surely have given serious thought to and made a sincere

effort to find an alternative to foreign loans as an instrument of development. Serious thinkers have questioned that any serious development can be effective with foreign loans. And I am not even touching on the political implications. The example of other countries also proves this. We shall never be self-sufficient if we keep on relying on foreign loans and because of them on foreign engineers. Hoping for real progress with foreign crutches is futile. Our untapped resources, manpower and material, can only be put to full use for the prosperity and well-being of our people if our own engineers are allowed proper opportunities.

It is essential that a detailed survey and appraisal be made, on foreign consultants and advisers by a special commission set up for this purpose. But instructions should be issued by Government to all its departments, agencies and autonomous bodies to start drastic reductions in the numbers of foreign consultants as well as for rapid phased replacements. It is ironic that whereas other departments like the Armed Forces have succeeded in becoming completely Pakistanised, the opposite has been the case in Engineering departments.

A statutory ban must be imposed on the import of foreign consulting engineering firms. A healthy and necessary by-product of this measure would be to also help the growth of Pakistani consulting engineering firms.

Reduction of Foreign Engineers in Private Firms

Outside the government departments and agencies, foreign firms have been given unrestricted freedom to employ foreign engineers and representatives etc., when Pakistani with similar or better qualifications and experience are available or could be available. Even the foreigners themselves concede in private that the going is too good for them and is bound to change. They themselves state that even in neighbouring India they would never be allowed to employ foreigners for jobs that Pakistan allows them.

Urgent instructions are necessary from the Government for reduction in the number of foreign engineers and representatives of foreign firms, and their replacement by Pakistanis. A detailed survey should also be carried out. Laws should be framed that prohibit the employment of foreigners in positions, where Pakistanis with requisite qualifications are available. We are the only country now in South-East Asia without this law. Even small countries like Malaysia and Singapore have enacted it and are enforcing it. The employment of and replacement by Pakistani engineers in foreign firms requires to be enforced within a stipulated short period. Advantageous side-results would also follow.

Employment for Pakistani Engineers Abroad

Not only must we remove foreign engineers from Pakistan to provide opportunities for our own engineers to serve the country, we should also send

our engineers to countries where there is a shortage of engineers.

Although there is serious unemployment amongst engineers in Pakistan at the present time, the impression still seems to persist in Government that there is a shortage here. All kinds of restrictions are placed on engineers' employment abroad. Even for important assignments in the United Nations and the World Bank etc., in cases when special requests are even made for certain Pakistani engineers, they are not allowed. Actually the procedure for sending the bio-data of an engineer to be placed on, say, the roster of the United Nations Technical Assistance Recruitment Programme is so lengthy and goes through so many channels and objections, that it is impossible for it to get there. Officials at the U. N. belonging to other countries as well as to Pakistan, have often complained about the difficult and unhelpful attitude of the offices of our Government in this regard. The successful effort of India in having its people in good positions in all the important international agencies is too well known to be detailed here.

Many countries including the developing countries in the Middle East, South East Asia and Africa could utilise Pakistani engineers and wish to do so, because it is known that Pakistan's engineers are generally of a good calibre and some of them are amongst the topmost in the world. Pakistani engineers are rich in experience in irrigation systems, dams and waterworks, power systems, land reclamation projects, railways, roads and bridges, telecommunications, airports and all other fields of engineering required by these countries.

Even in the developed countries of Europe, there is a tremendous shortage of engineers. During a recent assignment in Europe, I gathered from many manufacturers in Sweden that they could not expand and accept new orders because they just could not find engineers. We should actively go in for utilizing this great opportunity.

One rather easy measure for easing the engineers unemployment situation would be for the Government to remove the ban on the engineers both in service and out, seeking employment abroad. Furthermore, Government should provide active help and encouragement to them to get assignments abroad—at least up to the time that we can remove this problem.

Export of engineers could be a great foreign exchange earner. A thousand engineers could easily earn twelve million dollars a year !

About 100-150 Pakistani engineers could easily be employed within a short period, it is estimated, if Pakistani engineers are posted with our Missions at the U. N., and in the developing countries with the express purpose of finding employment opportunities for our engineers. This number would soon increase. Besides earning valuable foreign exchange, these engineers could come back to Pakistan to serve it even more usefully.

Of equally great, if not greater importance, would be the goodwill created by the Pakistani engineers in those countries. They would undoubtedly be acting as our unofficial ambassadors. Pakistan has always been keen in developing its relations with all countries particularly the fraternal Muslim countries. This step would take us a long way in that direction.

Higher Efficiencies in Private Enterprise by the Utilization of Engineers

A proper and correct utilization of its scientific and technological manpower by Pakistan is essential if it is to prosper and progress. In the last 23 years of our existence this has not been done with the result that Pakistan's development has been nowhere as rapid as desirable. The greater tragedy is that although Pakistan had the major tools for development available, its scientists and engineers, yet they were not given the right opportunities to lead the nation to real progress and development. Other countries, particularly China, has used its manpower as capital.

Planning was started on the right lines to produce large numbers of engineers. But the follow-up requiring the engineers, once they were available, to fill up positions in industry in the right numbers and to replace non-engineers in technical and engineering jobs, was not carried out. To a great extent, serious problems have resulted because private enterprise has not employed anyway near as many engineers as was necessary for proper operation. As a matter of fact one of the major reasons for the low productivity and inefficiency, and the extremely high and unreasonable prices, one often finds in our industry is due, in large measure, to this factor. And it is obvious that improvement of productivity is the one sure way of fighting against price increases that are plaguing us. A look around shows that some of the most efficient private sector industries are those which are managed and operated by engineers.

With all the talk of efficiency in the private sector enterprises, the fact cannot be ignored that in spite of every form of preferential help and assistance from the Government, liberal licences, subsidized foreign exchange, bonuses, tax-holidays and other privileges; with the strongest form of protection against outside competition provided to it, its record has not been too bright. The deficit industry that it has created and the unrenumerative investment made of the nation's wealth has only led us to an existence of recurring crises.

The private sector has hardly even ventured in the producer industries where some real hard effort is required and the gestation period are long. Today there are no basic industries set up by them. They do not manufacture a single truck or a single car, let alone a transmitter or anything more elaborate.

In India, when they set up a sugar mill, a textile mill or a fertilizer factory, almost all the machinery is indigenously manufactured. Our private sector

only orders complete plants, with everything made abroad and with foreign technicians assembling them, and with the high costs that result. Even bicycles in Pakistan, it is said, are not completely made of Pakistani manufactured components.

Undoubtedly the private sector produces some consumer goods, its pride being cloth. But the quality of even these goods and their prices could hardly be worse. Even cloth is produced and sold at prices which are up to ten times the price of similar cloth manufactured abroad and beyond the reach of our common man. The daily rush to Landikotal and Bara is ample evidence of the efficiency and popularity of most of our private consumer industry.

It is not possible that the Government should employ all the engineers that graduate from our universities. Neither can this be the aim of producing engineers. It would be appropriate for private enterprise not only to employ the engineers produced by the universities but also to pay a considerable portion of the cost of their education.

Since private enterprise is itself not taking the requisite steps, it would be incumbent on the Government to make, by law, private enterprise take the the following steps in some of the sectors given below :

(*i*) All light and heavy industries must have paid apprenticeship schemes for appropriate numbers of graduate engineers. These engineers, after practical training would be most suitable for employment in the same or similar industrial organisations. This is the general practice in all industrialized countries.

(*ii*) All heavy and light industries must employ the required number of engineers commensurate with their size. The scales for this could be worked out after studying the operation and requirements, but it was roughly estimated that about 100-150 additional engineers could be given employment in Punjab, NWFP and Sind alone, quite easily.

(*iii*) Construction contracting is of course an industry, and thus it should be declared by the Government.

No class I contractors should be entrusted with the execution of major works, by any department, or agency of the Government, unless there is proof of employment of the required number of suitably qualified graduate engineers. In this the engineers themselves can help other engineers by ensuring that this requirement is actually met.

This step should also go a long way in stopping the deterioration in the quality of our constructions.

Once this is done the foreign construction contractors in Pakistan would find it much more attractive to sub-contract their work to Pakistani construction contractors. This will also help the latter and create further employment opportunities for Pakistani engineers.

This could institute a very healthy chain reaction. For once this is started the level of Pakistani contractors is bound to go up and there is no reason why they should not be able to get work abroad, particularly in the Middle East and South-East Asia and earn valuable foreigh exchange for Pakistan.

At present not many of the contractors, Civil, Electrical or Mechanical, employ qualified engineers as they should. It is estimated that for proper execution, about 200 engineers could be employed by them in NWFP, Punjab and Sind alone.

(*iv*) Our mineral resources have not been properly or successfully exploited. So many mining engineers are unemployed. If properly utilized, these engineers may be able to add wealth to the country. Private mining firms must be made to employ qualified engineers.

(*v*) An additional tax should be levied on all industry, this could be called the "Training Tax". But this could be rebatable. Those concerns investing in recognised training programmes should be paid back twice as much as they spend on such training.

These steps and laws could be worked out in detail with, say, the Institute of Engineers, Pakistan, and procedures worked out similar to those prevailing in the developed countries.

(The Institute of Engineers, Pakistan and the Engineering Congress will have to play a much more active role in this as well attack directly and vigorously the problems facing the nation).

Industrialization through and by Engineers

The best interests of the country lie in the Government creating conditions in which further industrialization in the private sector, as far as possible, is made under the ownership of engineers and scientists, instead of non-technical financiers. Loans and licences for factories should preferably be given to technical people under preferential terms. This would actually, and not merely verbally, encourage new-comers. This would, to a large extent, remove the oft-repeated blame on the Government of making the rich richer and the poor poorer.

But more important and practical, more industrialization through and by engineers and scientists would be a great step forward towards putting the country on the road of self-reliance. It is only because private industry is in the hands of non-technical people that foreign firms are getting an opportunity to provide everything required in the plants from abroad at exorbitant prices, when large portions of the requirements could be locally manufactured. This causes a loss in foreign exchange to the country, deprives it of secondary industries and hence job opportunities and encumbers it with unnecessarily heavy loans. (Public sector is equally to blame on this count, of course).

Non-technical people in our country do not go in for manufacturing even the least sophisticated items and machinery. They feel shy of going into the more technical enterprises. Engineers and scientists would have no such reservations.