



**Development of technical education in India—a brief report
on the discussions with Sir Willis Jackson held in the Planning
Commission on January 19, 1966.**

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I. INTRODUCTION

During the recent visit to India of Sir Willis Jackson, Professor of Electrical Engineering, Imperial College of Science and Technology, London and a consultant to the Education Commission, discussions were held in the Planning Commission between him and Prof. V.K.R.V. Rao, Member (Education) at 3 P.M. on January 19, 1955 regarding development of technical education in India in the five year plans. Dr. A. C. Joshi, Adviser (Education) and Shri A. Mitra, Additional Secretary in the Planning Commission, Dr. T. Sen, Member and Shri J. F. Mc Dougall, Associate Secretary of the Education Commission and Shri G. K. Chandiramani, Educational Adviser and Shri L. S. Chandrakant, Joint Educational Adviser in the Ministry of Education were among those who were present at the meeting. Discussions had to be limited to a few aspects of the problem for want of time. A brief resume of the discussions is given in the following paragraphs

2. Sir Willis Jackson was later interviewed by Prof. Rao for an All India Radio broadcast on the role of industry in technical education. A transcript of the interview is appended to this report †

II. ROLE OF ENGINEERS VIS-A-VIS TECHNICIANS

3. Prof. Rao stated that the Planning Commission has generally held that, with a view to ensuring optimum utilisation of technical personnel, the number of diploma technicians in engineering should not be less than three for every graduate engineer. The Task Force on Technical Education of the Education Commission had also been considering a similar ratio. On the other hand, the present ratio was about 1.4 diploma holders to 1 graduate. In a memorandum of the joint project of the planning unit of Indian Statistical Unit and the unit for economic and statistical studies on higher education of the London School of Economics in collaboration with Perspective Planning Division, it was understood that a ratio of 1.5 to 1 had been assumed for projecting engineering personnel requirements upto 1986. This did not seem to take into account the under-utilisation of some of the engineering graduates or the

*A list of those present at the meeting is appended to the report (Appendix I).

† Appendix II.

possible changes in the manpower utilisation patterns during the next two decades. Sir Willis Jackson was requested to offer his comments in regard to the correct proportions to be aimed under the conditions obtaining in India.

4. Referring to the memorandum of the joint project, Sir Willis Jackson stated that he found himself in conflict with the conclusions drawn in the memorandum and therefore he had made enquiries about the basis for the assumption of a ratio 1:5 diploma holders to 1 graduate. He had been informed that the projections were only in the nature of extrapolation of existing trends and not the results of any detailed study of the engineering activities involved in different industries. It is inconceivable that the present ratios of engineering manpower would not change during the next 20 years or so.

5. There can be no correct definition of the term "technicians" which could apply to all the countries. In the United Kingdom, it has been realised that the technical manpower for development should consist of four broad categories, viz. professional engineer, technician engineer, technician and craftsmen and artisan. In view of the many methods available in U. K. for entry into these categories, it might be better to consider the German system which was more clear cut as an example. The Dip. Engineer could be taken as professional engineer, the Engineer corresponding to the U. K. technician engineer, and technician and craftsmen forming the lower categories. The ratio between the first two categories is at present 1 to 3—4.

6. Compared with the German example, a large proportion of graduates in India do not conform to the Dip. Engineers in as much as the present system in India does not provide for sufficient industrial training for the engineering graduates. A number of them are not real professional engineers and have been engaged in doing technician functions, even though they have not been trained or prepared for these functions. The situation in regard to the diploma courses is also the same and needs immediate attention. The diploma courses need to be brought to much closer relationship with the needs of public services and industry. At present these were diluted degree courses and not oriented objectively to needs of technician functions. Resources and efforts should be concentrated to this problem of technician courses, if necessary by freezing, relatively speaking, the entry to degree courses for some years to come.

7. Regarding the optimum ratios between engineers and technicians, he stated that in India the ratio could be very different from that in England, keeping in view the fact that for

some time to come most of the development activities would be in the form of incorporating and applying the products of technology developed in other countries. This would mean that there would be a larger demand for practical rather than theoretical jobs. It would call for courses which are neither narrowly vocational nor purely academic and analytical in character. The emphasis has to be on experiments and practical work.

8. In terms of British or German pattern, it is noted that there would be for every professional engineer, three to five technician engineers and technicians. In India, the ratio could be larger rather than smaller. This is closely related to the question of self-sustaining economy vis-a-vis local technological development. India may have to take technology from other countries for some more time so that attention should be focussed on improving diploma courses directly related to employment situation. This would be done by introducing part-time courses and sandwich courses. The graduate system can be halted partly because it is more expensive and partly because it is not easy otherwise to prepare the students sociologically and psychologically for the diploma courses. This is not peculiar to India. A similar situation is being faced in the U.K. in the implementation of the Robbins Report. In Africa, where the technicians' cadre is sociologically unattractive, there is virtually a vacuum between the professional engineer and the craftsmen.

9. Technician engineers could be distinguished from technicians in terms of the levels of responsibility and of educational qualifications. These non-graduate engineers would be performing functions such as designing, organisation and supervision of manufacturing processes, inspection, draftsmanship, testing, installation and maintenance of equipment. Sir Chandiramani said that technician engineers are those who assisted the professional engineers directly while the technicians were engaged in production processes, manufacturing processes and in supervision. Sir Willis Jackson pointed out that while technician engineers would work under the supervision of professional engineers, the technicians would work under technician engineers.

10. Dr. Sen stated that if our diploma courses were geared to the training of technician engineers, then the trainees from the Industrial Training Institutes (ITI) after further training would have to meet the need for technicians.

11. Relating the categories of engineering personnel to the educational opportunities in U.K. Sir Willis Jackson said that

the graduates of the universities, holders of external degrees of London University, the graduates of the Colleges of Advanced Technology and the holders of corresponding awards of the National Advisory Council of Academic Awards could be taken to represent professional engineers. For technician engineers, the facilities were the Higher National Diploma Courses and Higher National Certificate Courses. Technicians pass the appropriate technician certificate courses of the City & Guilds (London) Institute while craftsmen take the crafts certificate of the same Institute. These certificates are taken by the boys who are engaged in industries as craft apprentices, attending part-time technical colleges—usually one day in a week. In Metropolitan Vickers*, for example, about 100 craft apprentices are recruited every year for a 5 year period of apprenticeship. If some of the craft apprentices show promise, they are transferred to the technician courses and enabled to take the appropriate examination of the C & G Institute. Similarly technicians are transferred to the National Certificate Courses. A few of them go further for sandwich courses leading to a professional qualification. The Metropolitan Vickers have a well established works school for training purposes and allow one-day-a-week-release to their craft and technician apprentices to attend technical colleges.

12. In this connection, a reference was made to the Industrial Training Act under which all the engineering firms are subject to a levy of 2½ per cent on salaries and wages for training purposes. This would provide about £ 70 million per year to ensure facilities for training at all levels within the engineering industries. Similar arrangements, but with varying amounts of levy, apply to other industries.

13. It has been stated earlier that the diploma courses should be revised in the direction of making them more closely related to industrial functions. Along with that, it would be necessary to consider the question of salaries available for technicians. At present, the maximum salary for a diploma holder in India is not very much higher than the average minimum for graduates. On the other hand in the U.K., a holder of HNC or C & G Institute Technicians' certificate can reach a salary more than the average of graduate engineers. Unless this question is settled, it would be difficult to draw students to technician diploma courses.

*Now Associated Electrical Industries (Manchester) Ltd.

14. Prof. Rao wanted to know what should be the content, duration and method of training for diploma course. He was not sure if the Task Force of the Education Commission had discussed these details. In view of its importance, he said, the Planning Commission was considering the setting up of a Working Group on this subject. Sir Willis Jackson suggested that the academic preparation in diploma courses should be related to actual situation in industries and services. This is done through part-time and sandwich courses in the U.K.

15. At the professional level, the academic preparation and analytical faculties of the Indian students were comparable to those in advanced countries but they lacked industrial practice. Under-graduate courses needed to be supplemented so that the graduates would be prepared to carry professional responsibility. This could be done under a programme of planned practical training in industries either informally or formally. How this is to be arranged during the present period of transition, when industrial units have not yet fully developed needs to be further examined. Prof. Rao pointed out that the progress made in the industrial sector in India is enormous in absolute terms, though in terms of the vastness of the country and its population it is not adequate. It should not therefore be difficult to organise practical training on a large scale. Shri Chandirmani explained that some of the institutions have already established the inter-link with the industry for training programmes.

16. If the present output of engineering graduates could be supplemented with properly identified industrial experience, they could be brought to the level of professional engineers, comparable to the Dip. Engineers in Germany. Then, there would be enough professional engineers in India to meet the demand for some more years to come, and emphasis could be laid on improving the efficiency of the existing institutions. According to Dr. Sen, the industries in India felt that the training of engineering graduates should be completed within the institutions. The Education Commission is seized of this problem of supplementary inplant training of engineers. Dr. Rao pointed out that the nation is spending a lot of money on the training of engineers and we should therefore aim at making them really useful for doing professional duties. With an annual admission of 24,000 students for degree courses in engineering, there would be large numbers of graduates to be provided with supplementary training. It is important to give some thought as to the kind of supplementary instruction we have to give, keeping in view the type of industries and facilities available for this purpose. This will have to be considered

both for the graduates who have already completed their academic course and for the steady output of 20-24 thousand graduates expected every year.

17. In this connection Sir Willis Jackson stressed the importance of the willingness of employers to identify themselves with the educational programmes. Industries should consider themselves as a part of the system of training engineers. In the United Kingdom this has been provided for under the Industrial Training Act passed recently which covers all levels of personnel including junior managerial manpower. Even the nationalised industries accept the obligations under the Act except to the extent that are not subject to the levy for the purpose. In India a beginning should be made with the enterprises in public sector. The practising engineers should consider it an integral part of their professional duties to sponsor and initiate new graduates to the profession. They should take up the responsibility for training the fresh graduates in employment. The scheme for the purpose which was implemented by the Heavy Electricals Project, Bhopal proved to be successful and needed to be extended. Shri Chandrakant pointed out that the Heavy Electricals were training engineers for meeting their own demand. On the other hand, our aim should be to take over such facilities for training engineering graduates on a national basis.

III. TECHNICAL TEACHERS

18. In U.K., training centres are being set up in existing technical colleges and colleges of education for the training of industrial training officers required under the Industrial Training Act. The longest of the courses are at present of 2 months' duration. According to Sir Willis Jackson, industrial training officers should be employees of the enterprises offering the training rather than their being appointed or supported by the Government.

19. As the bulk of teachers for technical colleges came from industry, there was no need for arranging practical training for them. Recently however, in the context of expansion programmes for implementation of Robbins' Committee recommendations, difficulties are being experienced to draw enough teachers from industries. Even in the technical teachers training colleges, admission is limited to National Certificate holders or their equivalent who are over 25 years of age and with industrial experience. Sir Willis Jackson would not suggest graduate engineers for teaching in diploma level institutions. In view of the greater demand for teachers, these

colleges are not able to provide trained teachers on a 100 per cent basis. For those who enter teaching jobs directly, there are in-service courses offered at these colleges. It was noted at present there were 1,500 seats for technical teachers at these colleges.

20. One way of strengthening the faculties at the degree level was to encourage consultancy work by the teachers. In Imperial College of Science and Technology, London, the teachers would ordinarily have 40 per cent of time for doing research or consultation work. While allowing teachers to do consultancy work, it is ensured that they fulfil their teaching obligations in full. There is no limit to the fees that may be earned through consultation work. In case the laboratory, technical staff and other facilities of the institutions are used for this purpose, 50 per cent of the fees would be paid to the institution. Any such assignment is covered under a contract. It was mentioned that in the U.S., faculty members were allowed to do consultancy work for one day per week. In India also, consultancy by teachers could be encouraged though in the context of shortage of teachers, it would be difficult to make much progress.

IV. ENGINEERING RESEARCH

21. In the developing countries, efforts are being made to ensure economic allocation and utilisation of resources for maximum results. In such cases, it would not be possible to allocate large amounts for research. A suggestion had been made by Prof P M S. Blackett at the Science Congress in Chandigarh that developing countries should endeavour to buy over technologies from foreign countries and develop them further for local adoption. Sir Willis Jackson supported this suggestion and stated that in India, a few fields should be selected for development of such technologies which are of value to the country's development and related to the indigenous natural resources. This could be done keeping in view international priorities and export possibilities. In such fields, there should be no delay because the country cannot afford to wait. Such a consideration should guide research topics for Indian students abroad, otherwise the results of their research work would have no relevance to Indian problems. His view, therefore, was that we should identify a limited field such as atomic energy, biology, etc., and concentrate efforts so as to develop growth potentiality in these sectors in a shorter period of time.

V. NON-FORMAL COURSES

22. Referring to correspondence courses in engineering, Sir Willis Packson said that one cannot produce an engineer by correspondence instruction alone. Employed persons could be given opportunities to avail of these courses for improving their professional competence. There was scope to try this experiment in India on a limited scale. Prof. Rao explained that correspondence courses, contemplated in India, are not postal instruction but would include personal contact programme for specified period in a year. Emphasis is also being laid on other forms of non-formal courses such as part-time and evening courses. Shri Mitra stated that at present educational courses were salary-oriented and did not provide for mobility from one level to the next higher level. According to Prof. Rao this was a sociological problem. Shri Chandrakant explained the scheme of part-time courses at diploma and degree levels. Sir Willis Jackson referred to the practice of Metropolitan Vickers, as already explained, which permits, holders of ordinary or higher national certificates to avail of national scholarships and go to the University or more frequently to the Colleges of Advanced Technology.

23. Prof. Rao pointed to the need to make the polytechnic courses terminal in character so that the students would not be tempted to join higher education rather than join employment. The non-formal facilities should be availed of by them after they have gained practical experience for a minimum period. Sir Willis Jackson agreed with this view, but, he said, this should not amount to the "trapping of talent".

APPENDIX I

A list of those who were present at the meeting of Sir Willis Jackson with Prof. V. K. R. V. Rao on 19th January, 1966.

Planning Commission

Dr. A. C. Joshi,
Adviser (Education).

Shri A. Mitra,
Additional Secretary.

Shri K. R. Sivaramakrishnan,
Senior Research Officer.

Education Commission.

Dr. T. Sen,
Member.

Mr. J. F. Mc Dougall,
Associate Secretary.

Shri S. Venkatesh,
Deputy Educational Adviser.

Ministry of Education

Shri G. K. Chandiramani,
Additional Secretary.

Shri L. S. Chandrakant,
Joint Educational Adviser.

Shri Biman Sen,
Deputy Educational Adviser.

Shri T. C. Ajmani,
Deputy Educational Adviser.

Shri D. V. Narasimham,
Deputy Educational Adviser.

APPENDIX II

Transcript of the interview between Prof. V. K. R. V. Rao and Sir Willis Jackson on the role of Industry in Technical Education.

Prof. Rao:—I am glad, Sir Willis, you have found it possible to spare a few minutes during the course of your very brief stay in this country. You know, as Member dealing with Education in the Planning Commission, I have been very much bothered by the subject of practical training for our engineers and diploma holders. I am always told by employers that the kind of technical education that we are giving in this country is very academic and theoretical and when the engineers or diploma holders go out of the institutions, they do not know enough about the job. At the same time when asked what should be done about it, I have not been able to get satisfactory answers from them. But I wonder if you could tell us something about your own experience in this field and, may be, advise us what we could do in this matter.

Sir Jackson:—Well, Dr. Rao, I think what I would like to say, to begin with, is that in my opinion the most important raw material of industry is its young people and there are many sectors of industry in my country, no doubt as in yours, which have not yet recognised this and have not given effect to the responsibility which it imposes. There is too great an assumption, I find, that the preparation of professional engineers—and technicians and craftsmen, for that matter,—is something which can be dealt with inside educational institution. In my opinion this is fallacious. The adequate preparation of the young people whether it be of the craft, technician, professional or executive level, is a joint responsibility of educational institution and of industry. Each has a part to play and playing of these two parts is a partnership, which required a clear definition of the respective contributions and the carrying out of these two contributions in a collaborative way. In other words, what I am saying is that the planning of the curricula within universities and inside polytechnics is not wholly a responsibility of the teachers in these institutions; equally responsible are those

who are to employ the young people who come out of these institutions. Also, industry must formulate the supplementary educational process, which we call training within the domain of employment and it must fulfil this as an integral part of its industrial responsibility. Now, as I said coming in the car, I would not wish to claim that we in England have fully satisfied these requirements. But the Government of U. K., about two years ago passed an industrial training act which imposes on industry an obligation to provide good training facilities at the craft, technician and professional levels. And, if I may illustrate this with reference to the Engineering Training Board, this Board is to impose a levy of 2½ per cent on the whole of the engineering industries in U.K., 2½ per cent of the composite salary and wage bill. This money which will amount annually to about £ 70 million will be fed back into industry to finance approved schemes of training and it may well be, that a firm which is willing and able to provide training not only for its own recruits, but for those who, in due course, will be employed in other organisations will receive more "backing grant" than it has paid in levy. Those firms which are not either willing or competent to afford adequate approved practical training, will contribute through the levy to the provision of training facilities elsewhere. Now, this, I hope, is going to create through the guidance of the Industrial Training Boards, the kind of partnership to which I was referring. One would wish naturally that this could have happened voluntarily without the entry of Government into the situation. But this did not happen; Government has now taken action and we had, I think, a most gratifying response from industry under this kind of pressure which was not present before.

Prof. Rao:—Yes.

Sir Jackson:—So, this perhaps, is the first statement.

Prof. Rao:—Thank you very much indeed. I think this is going to be most useful for us here. When you say that the forming of the curricula in these engineering and other allied institutions, one should not regard it as the sole responsibility of the universities, did you find any opposition on the part of the university teachers to people from industry participating in these academic matters?

Sir Jackson:—There is a considerable willingness in the U.K. on the part of industrialists to help the formulation of curricula and there is an increasing willingness on the part of

significant people in industry to participate in the teaching itself. Perhaps I can illustrate this by my own department at Imperial College. I have a full time staff of between 30 and 40 and I have, what I call, special lecturers and I have a special professor. These are industrialists who spend a day a week in my department to participate in the teaching work; but more particularly they discuss with my staff what should be taught, how it ought to be taught and how what is taught should be related to what is happening in industry. In other words, the job of the full-time teacher is to ensure an understanding of principles. But these principles must be properly related to the situation for which the young men are being prepared and the danger is that the full-time teacher is in divorce from this real situation and unless he is helped by the industrialist it is very difficult for him to keep in touch with the outside.

Prof. Rao:—Tell me, do your teachers also get a chance to get some acquaintance with practical work by doing consulting work or going to work on deputation in industry and so on?

Sir Jackson:—A very considerable proportion of my staff are acting as consultants for small or large industrial organisations or for Government establishments. And I encourage them to do this because I don't see how otherwise they can keep in close enough touch better. But I don't regard this as sufficient. I have tried to persuade them to be willing to go back to the industry for some months or for a year at intervals. Not all of them wish to do this, I must say. But I am gradually applying little pressures here and there and at the moment two of my full time staff are away from my department in industry.

Prof. Rao:—You think, I suppose, it is essential in addition to that, to have the industrialists themselves, industrial executives or managerial or technical personnel spending short periods in institutions. . . .

Sir Jackson: . . . participating, yes. I think, otherwise you see, just as the full time teacher has difficulty in understanding the problems of industry, so the full time industrialist has difficulty in understanding the problems of academic involvement and what is wanted is a sufficient understanding of these two sets of problems and to regard them as parts of a single problem.

Prof. Rao:—You mean it is not merely a question of partnership but of mutual education.

Sir Jackson:—It is a question of mutual respect and mutual education.

Prof. Rao:—One thing, Sir Willis, which I was very much interested in what you said, and perhaps I hope this might have some bearing on our own problem in India. You said under your industrial training act, your engineering board is levying a fee of 2½ per cent on the industry, and something like £70 million will be collected from which the Government will finance the training programmes of the industry. And you also said a few minutes back, that these training programmes have to be related to the academic programmes so that, taken together they form an integrated whole. I am sure, our listeners here in this country, would be very much interested to get from you some brief account as to how these industrial training programmes in the industry operate and how they are linked with the academic programmes.

Sir Jackson:—Yes. Well, industry is being recommended by the industrial training boards to recruit training officers. Clearly, a training programme cannot be operated, cannot be organised and supervised without the presence in the company concerned, of a man whose responsibility it is to do this and who is given a proper status by his employers. And there is at present being organised courses of training for training officers. In other words, we are in the process of creating a body of industrial training officers. Then there are going to be under and employed by the industrial training boards a number of inspectors who will have the right to investigate what is happening inside industrial concerns and finally to approve or not to approve the training. Now the industrial training act is concerned not only with the formulation and implementation of proper training programmes in industry but it is responsible for ensuring a proper coordination of these training programmes with what is happening in the technical colleges. And, therefore, the implementation of the Act is a joint responsibility of the Ministry of Labour and of our Department of Education and Science and therefore, there are associated with each board committees which are jointly representative of education and of industry to formulate the programmes and formulate the courses which should go with these programmes. Now this may sound, you know, rather perfection. I am not claiming

that we have achieved all this. But this is what we are determined to achieve.

Prof. Rao:—But it sounds most impressive. With one more illustration of the partnership we have been talking about, it almost sounds to me, as a university man, that these training schools started by industrial establishments are almost academic institutions, subject to inspection and having trained staff who are to possess certain qualifications and so on. I think this is most interesting Sir Willis. Before we conclude I wonder if you would like to make any additional remarks. I know you have been in this country for a short while. But you have been here before and you are now currently advising the Education Commission on problems of technical education. You must have had a look at our technical education; we are very keen that our technical education should play a most important part in our programmes of industrial and economic development and we have spent a lot of money for the purpose in the last fifteen years. Now, is there anything generally you would like to say on the whole subject before we conclude

Sir Jackson:—Yes. I think Dr. Rao, I would like to say this; that we in the U.K., like you in India, are living in a rapidly changing situation, a situation where the nature of industry and the nature of individual employment is changing quite rapidly. And therefore, it will not suffice to terminate your educational processes at the point where a boy achieves a diploma or a degree. What he learns inside the courses leading to his qualification will probably be out of date within a decade. Therefore you must assume if you can begin, to introduce schemes of re-education and re-training at appropriate points within a career so that selected people may be brought back to short courses run jointly by educational institution and by industrial units and formulated, I believe largely, by industry. Thus they may be helped to achieve adaptability which the situation is going to require. And finally, I think I would like to say this, that there is a tendency for industry to fail to recognise that it also is a part of the educational system, that the problems of education cannot be resolved by educationists by themselves. In other words, that industry has an education part to play at a different level and at a different stage in a career, that it is an integral part of the educational process and if it does not fulfil, nothing that the educationist can do by himself will achieve the desired result.

Prof. Rao:—It is most refreshing to hear you say that. Well, I am most grateful to you, Sir, Willis, for the time that

you have spent and for the very fresh light that you have thrown on the problems of the relationship between technical education and industry and the responsibility of industry in the matter of technical training. Thank you Sir.

Sir Jackson:—Thank you very much.