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EDUCATION AND TRAINING IN CONSTRUCTION

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EDUCATION AND TRAINING STAFF IN CONSTRUCTION

Introduction

1. This paper has been prepared as a contribution to the UNIDO expert meeting on "The Construction Industry in Developing Countries" held in Vienna from 29 October to 2 November 1973. It describes some of the activities of Unesco in developing countries in the fields of education and training that are relevant to the above topic, identifies key problems, and makes some suggestions for future action in this field.
 2. It must first be noted that the manpower needs of the construction industry are very wide, and that it is not enough to think only in terms of the more highly qualified personnel such as engineers, technicians and management personnel. Whether, for example, unskilled workers or equipment operators are literate or not may be an important factor in planning and execution of construction projects, and also will have implications on the type and extent of on-the-job training that will be required. Thus in any discussion of manpower needs it is necessary to consider the education and training of all types of personnel that are involved in the industry, at all levels.
 3. The most striking features of the worldwide construction industry when viewed in the light of its manpower requirements are its enormous size, its diversity, its demand for resources, and its dynamism. Within one country it may include enterprises ranging in size from those comprising several men to huge state or private construction organizations employing tens of thousands and often widely diversified into other fields such as real estate developing, manufacturing or mining. Some of these larger organizations are international in their activities, either alone or as members of consortia, and employ many categories of technical and management personnel.
- X This paper is partly based on a Unesco paper "Problems of Education and Training in the Construction Industry" contributed to the ECE Third Seminar on the Building Industry, Moscow, 5 to 17 October 1970.

4. The dynamism of the industry is related to the continued growth in the volume and magnitude of its activities, and to the changes induced by new materials, techniques, and methods of management. This has in recent years resulted in demands for trained manpower that have in many instances been only met, especially in the case of the developing countries, by improvisation and adaptation.

The Role of Unesco

5. The programme of Unesco includes many activities that relate to the prerequisites for the economic and social development of its Member States, especially those concerned with the development of appropriate educational and scientific infrastructures. They include encouraging and assisting Member States to evolve coherent national systems of education that will be suitable to the social, cultural, and economic environment.

6. The programme ranges over primary, secondary and higher education, teacher training, the promotion of life-long education, functional literacy programmes, new methodology, and educational research and planning. In scientific and technological fields the programme includes such aspects as science policy, scientific information systems, scientific and technological research, teaching of basic sciences, computer sciences, engineering education, technologist and technician training, environmental sciences and natural resources research.

7. In these areas there are Unesco Regular Programme activities that can be regarded as being mainly focussed on promoting international cooperative action in areas of concern to all Member States, but there are also very large assistance programmes being executed by Unesco. The assistance activities are financed mainly by the UNDP, but an increasing number of other sources of development aid are also entrusting Unesco with the execution of specific projects.

8. Over the past decade Unesco has executed over 70 large scale UNDP assistance projects in developing countries in the areas of secondary technical education, technician training, engineering education and

technological research. Examples of such projects are the Faculty of Engineering, Nairobi, Kenya; Middle East Technical University, Ankara, Turkey; The Polytechnic, Quito, Ecuador; Ipoh Polytechnic, Ipoh, Malaysia; and many others throughout the world. These projects have very often involved civil engineering or building and construction engineering, and also other fields important to the construction industry, such as surveying and mechanical engineering. In many instances they have included collaboration with other specialized agencies, notably with ILO.

General Issues in Education and Training

9. The construction industry has usefully been classified into three sectors, traditional, intermediate, and modern, with all three often co-existing and complementing each other. The traditional sector of building craftsmen, dominant until very recently in many countries, has never demanded educated personnel, and within it training has been carried out informally, often with the result that inadequate techniques are passed on and persist. Vocational training programmes such as those executed by ILO can be effective in this area, but they are not considered within the scope of this report.
10. The intermediate sector, comprised of small and medium sized firms, will in industrialized countries have a demand for technicians and well educated supervisory personnel, particularly where there is mechanization. In less developed countries the variety and complexity of the work carried out by such firms will often be limited and traditional materials and methods will merely be used on a larger scale, so that technically educated personnel will not be vital to the success of the enterprise.
11. It is the modern sector, dominant in highly industrialized countries and expanding rapidly in many developing nations, which has the greatest demand for trained manpower. A wide spectrum of trained personnel may be required, including such categories as skilled labour, tradesmen, machine operators, maintenance personnel, technicians, supervisory staff,

surveyors, inspectors, draftsmen, clerical staff, accountants, data processing staff, quantity surveyors, estimators, architects, engineers, and management personnel.

12. A very high proportion of the personnel employed in the construction industries of many countries will have received no institutional training specifically directed towards construction, and their formal education qualifications, if they exist, are likely to be in more general fields, particularly civil engineering and architecture. In spite of the trend towards education and training in construction as a specific field it seems probable that in many instances this situation is likely to continue, and that much training will continue to be carried out in the industry itself, and not in educational institutions.

13. In this regard the history and reputation of the construction industry has had an influence on its present manpower situation. In many countries it has traditionally been considered as one area of human activity where academic attainments are of secondary importance, but where success only demanded enterprise, hard work, and a keen business sense. It also has often suffered from the reputation of providing little security of employment, because of climatic and economic factors, and in many countries the result has been that the industry as a whole has suffered, and often continues to suffer, from a bad public image which inhibits its ability to attract talented manpower. The social implications of its vulnerability to economic controls and the migrant nature of its work force are also often relevant.

14. That this reputation is being overcome in many countries is to a large extent due to the growth and sophistication of the industry, its improved leadership, the increasing role of institutions of higher education and building research organizations, better government control of its activities, and more public appreciation of the vital part played by the industry. In fact, in most countries the industry should be able to offer excellent careers, with technical interest of a high order, rapidly increasing responsibility, good material rewards, and the

satisfaction of participating in national development.

15. Another feature of the construction industry is that its requirements for supervisory and management personnel have in the past been relatively small, compared to other industries and services. These requirements could often be met by promotion and adaptation of personnel, usually coming from a wide variety of backgrounds. This situation has often been regarded as a strength, on the grounds that capacity for innovation was increased because of the diversity of the backgrounds of the personnel in the industry, but the increasing scale, complexity, and competitiveness of construction operations is now tending to reveal the inadequacies of this method and to show the need for a more systematic approach, even in countries where the total national requirements for such skills are small. Increasing specialization in construction and greater depth of its treatment is thus likely within education, at technician and degree levels, although it must be stressed that wide variations in the ways in which different countries approach this problem may occur, depending on their traditions in education and the state of the industry itself.

16. A useful distinction can in many countries be drawn between the control and the high level manpower needs of two major sectors of the construction industry. On one hand the civil engineering profession is usually dominant in the heavy construction sector, comprising bridges, dams, pipelines, ports, highways, and heavy industrial structures. Within the building sector, comprising residential, commercial and industrial building, the leadership is often that of architects or of commercially oriented personnel, with the technical assistance of the engineering profession. In both sectors, particularly the latter, there is a growing need for personnel with skills in the field of management, industrial engineering, commerce, and urban renewal.

17. There is a worldwide variation in approach and practice in education specifically for the construction industry, and in many countries no formal technician or degree courses exist, the field being regarded primarily as part of civil engineering. This appears often not to be

to the satisfaction of the leaders of the construction industry, although the diversity and fragmentation of the industry and its lack of communication with the educational system may mask some of this dissatisfaction. In other instances, well planned courses in building and construction have been developed, often in specialized institutions.

18. Close cooperation between educational institutions and the construction industry must be secured if technical manpower training schemes are to be effective. This has been emphasized in Unesco assistance projects and in Unesco Regular Programme and regional activities for example at the Unesco expert meeting held in Nairobi in December 1972, and at the Unesco/UNDP regional seminar held in Cordoba, Argentina, in May 1973. Not only must industry make its voice heard in the elaboration of curricula, it must also be prepared to provide practical training for students and systematic training of new graduate technicians and engineers. For these and other categories of personnel, more concern needs to be shown by employers and organizations within the industry, who must become more active in training and use their considerable influence to improve and promote education and training at all levels. This will, in turn, improve the image and prestige of the industry as a whole.

19. The practical training of students and recent graduates in industry is particularly important in improving the relevance of institutional training allied to the construction industry. The periods of training spent in industry should conform to an agreed programme, carefully established by the officials of the institutions and the industrial undertaking who have been designated to be responsible for this training. The importance of this activity is such that it should not be entrusted to lower level staff, subject to the daily pressures of production, but should be the concern of higher management and receive adequate support. There will probably be little in the way of immediate economic benefits to the undertaking, often the contrary, but in the long term both industry and the educational system will certainly benefit.

20. The organization of practical training in the construction industry is, however, more difficult than in many other fields because of the non-repetitive nature of many operations with the possible exception of some housing projects, and because of changing locations of work. There thus exists a need for regular review of the programme of each trainee, to make best use of the opportunities arising from the progress of the work, and close cooperation between the unit responsible for training and other units of the organization.

21. The supply of adequate numbers of technicians to the construction industry for work in such areas as materials testing, site surveying, quantity surveying, drafting and accounting, is normally not an acute problem in the more developed countries. It is usually more a problem of the quality of their education and training, particularly their adaptability and of their capacity to benefit from further training. Where shortages of particular specializations have occurred crash type courses in technical schools have sometimes been used, but these have often virtually failed, because of inadequate planning, shortages of teachers or lack of cooperation between the training institution and industry. It is apparent that systematic long-term planning is a prerequisite for sound technician education, based on permanent institutions with well coordinated curricula, and with adequate financial recognition and recognized status for technicians employed in industry. Otherwise industry itself will be obliged to do its own training, and in most instances it is not equipped to perform this role.

Problems faced by developing nations

22. In the development of education in a field such as construction engineering the problems faced by less industrialized countries are daunting. Often the local traditions and values are such that the best students in both engineering and technician education are attracted towards design or office work in the civil service, or they emigrate to industrialized countries as part of the "brain drain". Teaching

staff who have attained qualifications abroad are most unlikely to have studied construction or to have worked in construction, and their research topics may be in fields which have little relevance to their home countries and which they are unable to pursue further when they return. Furthermore, the local construction industry may be relatively underdeveloped and education-industry cooperation difficult to achieve.

23. Shortage of teaching staff is a widespread problem for which no quick or easy solutions exist. Fellowship programmes which send national teaching staff to industrialized countries to obtain advanced degrees have in many instances been only partly successful. It is becoming apparent that, whenever the level or potential of the university allows, research work and higher degree programmes within the developing country should be stimulated and aided so that M.Sc. and Ph.D. degree work can be carried out at the home university, which will thus be itself strengthened. Any overseas travel undertaken after completion of such degrees will then not need to be of long duration.

24. Obtaining effective cooperation between educational institutions and industry is difficult enough in any country, in a developing country this is formidable, especially for the construction industry. Control of the industry may be in foreign hands, and key personnel may be foreign. The industry may be scattered, with major construction projects in locations remote from polytechnics or universities. On the side of education, many teaching staff members may be foreigners, perhaps little interested in local practical problems, and all staff may be fully occupied with day to day teaching responsibilities. National staff may, because of their previous studies, be theoretically inclined and uneasy about venturing into practically oriented topics. Thus there may be insufficient coverage of areas such as construction management, use of labour-intensive methods, economics and cost control, labour relations, and materials handling, even in courses allegedly on construction.

25. In some of the larger developing countries there may be representative bodies capable of expressing to government and educational institutions

the views of the construction industry on matters concerning education and training. In many developing countries, however, the industry will have no mechanism for making its needs and views heard. On the other hand, regardless of whether such bodies exist, educational institutions should themselves be responsive to the needs of industry and always have an effective mechanism for collaboration with it, such as an industrial liaison officer or liaison unit.

26. In civil engineering courses at degree level in developing countries there is a need to orient curricula to local problems, notably civil engineering construction. The temptation must be resisted of trying to model curricula on those overseas, trying to give strong emphasis on engineering sciences and academic topics such as advanced structural design. Instead there must be stress on practical applications of basic engineering principles, relevant to the way in which civil engineering is carried out locally. Practical work in industry should be an integral part of such courses, and the use of project methods in teaching should be encouraged.

27. Where international contractors are working in a country, or where local organizations have grown and have adopted large scale modern methods, very useful institution-industry cooperation can sometimes be initiated. If the educational institution has reasonable laboratory facilities they may be used for testing purposes. Arrangements can usually be made for practical training of students in industry. The widespread use of traditional building methods and equipment, even in the modern sector, will often highlight the gap between education and industry, providing a challenge to both educators and industry. The development of active building research institutes is a high priority, to adapt foreign technology to local needs. The establishment of such centres presents many opportunities for bilateral and international assistance.

28. The need for competent technicians to complement and assist engineers is often particularly acute in developing countries, and this deficiency has been reflected in many requests for assistance in institution building

and for help in general educational and manpower planning. This shortage sometimes occurs concurrently with a surplus of graduate engineers, and is usually a direct result of inadequate educational planning, coupled with the low esteem in which manual and practical work is held.

29. The problem of the image of the construction industry is even more difficult to resolve in developing countries than in industrialized countries, as building work is very often held in low regard, and thus a major effort is required to attract able students into any courses to serve the industry, particularly at the technician and supervisory levels.

30. Although it is now undergoing its most rapid development in the most highly developed countries, continuing education has great potential in the developing countries. Not only can it remedy deficiencies of initial education or give learning opportunities to those who, through no fault of their own, have been denied good initial education, it can also provide a mechanism for those in technical fields to keep abreast of technical advances or, if necessary, give them competence to work in new areas. In recent years a number of Unesco meetings and publications have highlighted the potential of the various forms of life-long continuing education.⁽¹⁾

31. In the context of the construction industry in developing countries, continuing education may include activities such as seminars on management or new planning techniques for senior personnel; short training courses for technicians and job supervisors on such topics as use of new surveying instrumentation, plant maintenance techniques, or language training; and short training courses for operators and skilled workers.

32. In some countries the construction industry may be structured and organized such that it will be able to establish continuing education training courses without recourse to educational institutions, but this will be the exception, except in the case of major projects. More often the best solution will be for continuing education to be provided by

(1) Final Report, Third International Conference on Adult Education, Tokyo, 25 July - 7 August 1972.

Final Report, Meeting of Unesco Working Group on the Continuing Education of Engineers, Paris, 4 - 7 June 1972.

"The School and Continuing Education; Four Studies", Unesco, Paris, 1972.

educational institutions, according to the expressed wishes of industry and with its assistance in such forms as financial support and provision of part-time teaching staff.

33. In the engineering fields, especially at technician level, one key area for training of personnel in the developing countries is material technology. It is all too frequently found that excellent construction materials are badly used, resulting in poor performance, risk of failure and often the need to compensate by expensive over-design. Concrete and finishing work in buildings, water retaining structures, and highways are common examples. Another area of great economic importance is that of the maintenance of mechanical equipment, where much needs to be done to improve qualitatively and quantitatively the training of personnel for the construction industry in developing countries.

34. The solutions to the training problems in these and similar areas may lie in the wider development of in-service training courses within industry, short term training provided in technical schools on the basis of the expressed needs of industry, or longer term apprenticeships or technician programmes. Availability of competent instructors is usually a critical factor in such training programmes, often because comparatively low salary scales exist for such posts in education and because within industry inadequate interest is taken in systematic in-service training. Taxation benefits and other incentives may also be an important factor.

The Future

35. In all countries, there will be an incessant challenge to keep education and training relevant to the continuing progress of the industry itself. On the side of education and government there will need to be appreciation of the importance and special nature of the manpower needs of the industry. On the side of industry, the federations, labour unions and other interested bodies will need to strengthen their interest and involvement in education. This will also help to improve the public image of the industry and to attract better quality recruits.

36. In the developing countries, education and training for the construction industry is but one aspect of their struggle to achieve, first of all,

universal literacy and reduce the present disparities in living standards. Reform of primary and secondary education will inevitably improve the quality of recruits to the industry, especially if substantial science and technology components are included in these levels of education. The strengthening of secondary technical education is a high priority in many developing countries.

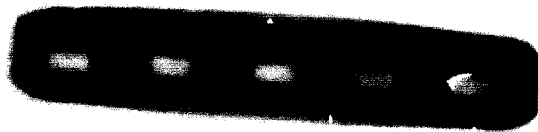
37. Similarly, at post-secondary levels, the construction industry stands to benefit from qualitative and quantitative improvements in higher technician training and degree level education in engineering and allied fields. International and regional cooperation can play an important role in helping to improve education at these levels.

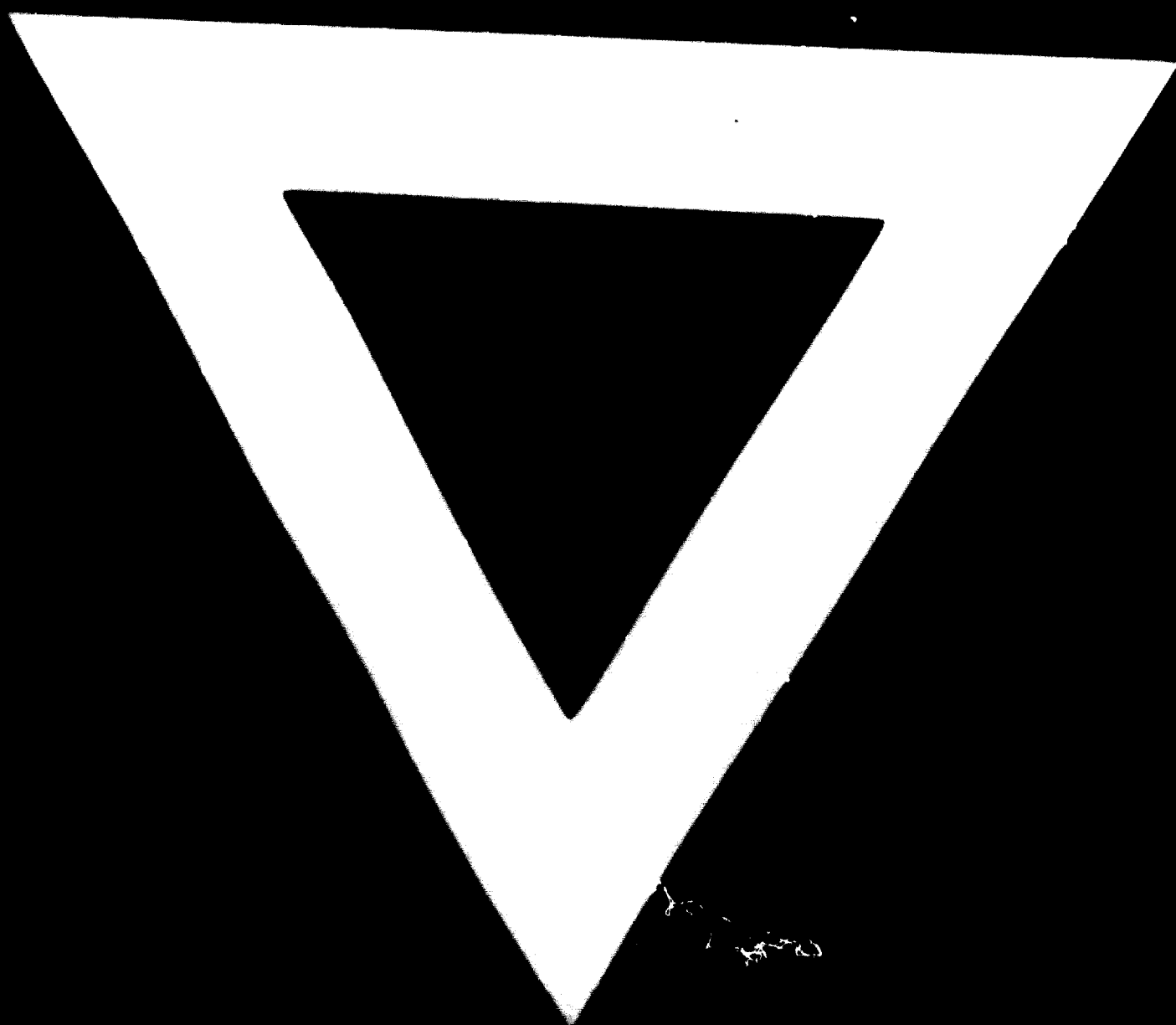
38. In developing countries there usually exists a need to establish or strengthen bodies concerned with industrial training whose role is to advise Government on necessary measures to be taken to improve industrial training of staff at various levels. In the engineering areas such bodies may include representatives from Government, industry, education, labour unions, and professional organizations.

39. For the construction industry in developing countries, such bodies, supported by federations of the industry, can play a key part in establishing workable training schemes, both within the industry and in educational institutions. The economic feasibility of such training schemes is a key criteria, as is the motivation of those for whom the training is designed.

40. Where major foreign organizations are working in a developing country it may be advisable for them to be required by law or contract to include in their operations a defined degree of effective participation of national staff in all posts, including those at higher level, with training programmes mounted as necessary to ensure that this participation is fully effective.

41. It may also be necessary for Government to establish special means whereby smaller national construction organizations in developing countries receive special assistance with the in-service training of their staff. This may be part of a wider programme of continuing education in technical fields, carried out as a cooperative task of educational institutions, Government, the construction industry, and other interested bodies.





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