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INTERNATIONAL LABOUR ORGANISATION

SECOND CONSULTATION ON THE TRAINING OF INDUSTRIAL MANPOWER

Paris, France, 14–19 September 1987

REPORT

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PREFACE

The Second General Conference of the United Nations Industrial Development Organization (UNIDO), held at Lima, Peru, in March 1975, recommended in paragraph 66 of the Lima Declaration and Plan of Action on Industrial Development and Co-operation 1/ that UNIDO should include among its activities a system of continuing consultations between developed and developing countries with the object of raising the developing countries' share in world industrial output through increased international co-operation. The General Assembly, at its seventh special session in September 1975, endorsed the recommendation and requested UNIDO to implement it under the guidance of the Industrial Development Board.

At its fourteenth session, in May 1980, the Industrial Development Board decided to establish the System of Consultations on a permanent basis. 2/ At its sixteenth session, in May 1982, the Board adopted the rules of procedure, 3/ according to which the System of Consultations was to operate, together with its principles, objectives and characteristics (ID/B/258, annex), notably:

The System of Consultations shall be an instrument through which UNIDO is to serve as a forum for developed and developing countries in their contacts and consultations directed towards the industrialization of developing countries;

The System of Consultations would also permit negotiations among interested parties at their request, at the same time as or after consultations;

Participants of each member country should include representatives of Governments, industry, labour, consumer groups and others, as deemed appropriate by each Government;

Each Consultation meeting shall formulate a report, which shall include conclusions and recommendations agreed upon by consensus and also other significant views expressed during the discussions.

Thirty Consultations have been convened since 1977, covering the following industries and topics: capital goods, agricultural machinery, iron and steel, fertilizers, petrochemicals, pharmaceuticals, leather and leather products, vegetable oils and fats, food-processing, industrial financing, training of industrial manpower, wood and wood products, building materials and fisheries.

1/ See Report of the Second General Conference of the United Nations Industrial Development Organization (ID/CONF.3/31), chap. IV.

2/ Report of the Industrial Development Board on its fourteenth session (Official Records of the General Assembly, Thirty-fifth Session, Supplement No. 16 (A/35/16)), vol. II, chap. XI, para. 153.

3/ Report of the Industrial Development Board on its sixteenth session (Official Records of the General Assembly, Thirty-seventh Session, Supplement No. 16 (A/37/16)), chap. IV, para. 46.

The main benefits emerging from the System of Consultations may be summarized as follows:

- (a) The identification of policy, economic, financial and technical obstacles to industrial development in developing countries;
- (b) The monitoring of trends in world industrial development in order to determine action-oriented measures for increasing the share of developing countries in world industrial production;
- (c) The strengthening of existing, and the establishment of new, forms of industrial co-operation in a North-South and South-South dimension;
- (d) The identification of new areas and concepts for UNIDO technical assistance activities in developing countries;
- (e) The creation of opportunities for the identification and negotiation of technical co-operation and investment projects among participants.

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INTRODUCTION

1. The Second Consultation on the Training of Industrial Manpower was held in Paris, France, from 14 to 19 September 1987. The Consultation was attended by 289 participants from 59 countries and 33 international and other organizations (see annex I).

2. The Consultation was organized by the United Nations Industrial Development Organization (UNIDO) in association with the International Labour Organisation (ILO). It focused on human resources development in industrial maintenance at national and enterprise levels. It was hosted by the Government of France.

Background to the Second Consultation

3. The Industrial Development Board, at its nineteenth session, held in May 1985, discussed the activities of the System of Consultations and approved the holding of the Second Consultation on the Training of Industrial Manpower during the biennium 1986-1987. 1/

4. The First Consultation on the Training of Industrial Manpower, which was held at Stuttgart, Federal Republic of Germany, from 22 to 26 November 1982, recommended inter alia that UNIDO, in collaboration with other United Nations agencies, especially ILO and the United Nations Educational, Scientific and Cultural Organization (UNESCO), should strengthen its capacity and programmes to assist developing countries in building up coherent and comprehensive training systems; continue to develop methodologies to contribute to the determination of industrial manpower and training needs; develop active programmes to assist developing countries in the training of trainers, specialists, managers, supervisors and other cadres on a permanent basis; and assist developing countries in the establishment or strengthening of mechanisms to co-ordinate the collection and dissemination of information relevant to industrial training. It also recommended that UNIDO should assist developing countries in the formulation of national industrial manpower programmes, in strengthening training institutions and in co-ordinating action and mobilizing resources for industrial manpower development in the context of national development plans; and that UNIDO should draw attention to the need to include an industrial training component in all capital projects. 2/

5. UNIDO activities in preparation for the Second Consultation included a global and a regional preparatory meeting.

6. A global preparatory meeting was convened in Paris, France, from 13 to 16 January 1986, to select the issues to be discussed at the Second Consultation. Since the First Consultation had dealt with industrial manpower training from

1/ Report of the Industrial Development Board on the work of its nineteenth session (Official Records of the General Assembly, Fortieth Session, Supplement No. 16 (A/40/16)), para. 89 (3).

2/ Report of the First Consultation Meeting on the Training of Industrial Manpower, Stuttgart, Federal Republic of Germany, 22-26 November 1982 (ID/294), paras. 12 and 20.

a wide perspective, participants considered that it would be desirable to select issues that would provide a sharper focus at the Second Consultation. Discussions therefore centred mainly on human resources development in industrial maintenance and also for the mastery of technological changes in industry. The meeting was co-sponsored by the Government of France. 3/

7. A regional preparatory meeting on human resources development in industrial maintenance in Africa was convened at Nairobi, Kenya, from 23 to 27 June 1986, as a follow-up to the global preparatory meeting. Discussions centred on human resources development in industrial maintenance under six headings: national policy and strategy for industrial maintenance; training policy for maintenance; negotiation and acquisition of capital goods; organization and methods of maintenance; the management and manufacture of spare parts; and technical documentation. An interesting approach was adopted for this meeting in that 12 of the African experts invited to the meeting prepared case-studies on human resources development in industrial maintenance in their respective countries. The case-studies have been synthesized in one report, which was presented as an information document at the Second Consultation. The regional preparatory meeting was co-sponsored by the Government of the United Kingdom of Great Britain and Northern Ireland. 4/

8. Against the background of the First Consultation and the two preparatory expert group meetings, the following issues were discussed at the Second Consultation:

- Issue 1: Human resources development for effective industrial maintenance at the enterprise level;
- Issue 2: National support policies and action for human resources development in industrial maintenance.

3/ See Report of the High-Level Expert Group Meeting in preparation of the Second Consultation on the Training of Industrial Manpower (ID/WG.460/4).

4/ See Report of the Regional Expert Group Meeting on Human Resources Development in Industrial Maintenance in Africa Preparatory to the Second Consultation on the Training of Industrial Manpower (UNIDO/PC.146).

I. AGREED CONCLUSIONS AND RECOMMENDATIONS

Issue 1: Human resources development for effective industrial maintenance at the enterprise level

Policy for maintenance at the enterprise level

Conclusions

9. A clear and explicit maintenance policy with commitment from top management is essential. It should aim at achieving measurable benefits, particularly through increased productivity and profits. Such a policy should include as essential elements:

- (a) Equal status and stronger links between maintenance and production;
- (b) Progress from crisis maintenance towards preventive maintenance;
- (c) Material and other incentives for improvements in maintenance;
- (d) Promotion of a maintenance spirit at all levels of personnel;
- (e) Participation of workers and provision of maintenance information to improve working conditions and safety;
- (f) Training for maintenance.

Recommendations

10. Enterprises and their organizations with the support of national and international organizations should:

- (a) Sensitize managers and policy-makers to the importance and content of maintenance policies, especially by quantified evidence of benefits;
- (b) Organize exchange of experience and publicize examples of successfully implemented policies.

11. Enterprises should ensure that the maintenance function is represented at the top level of management.

Maintenance training at enterprise level

Conclusions

12. Maintenance training by its nature cannot be a once-for-all activity, since constantly changing technology demands rapid development of skills, and affects all levels from top management downwards. The nature of maintenance training must therefore be adapted to the specific training needs of each level, from sensitization training for management (with the focus on attitudes) to broad scientific knowledge and specific technical skills for technicians and skilled workers.

13. All maintenance training for technicians and skilled workers must be designed to provide a wide range of knowledge and skills and to foster an attitude of continuing readiness to learn and willingness to co-operate with all other maintenance workers. Production training needs to pay attention to the importance of correct operation which reduces the costs of maintenance.

14. Maintenance training at colleges and vocational training centres should follow curricula developed in close co-operation with industry.

15. Increasing qualifications of maintenance personnel must go hand in hand with better recognition of their contribution to the objectives of the enterprise.

16. Over the last two decades enterprises in developed countries, together with organizations concerned with training, including UNIDO and ILO, have been developing innovative and flexible methodologies including computer-assisted systems for delivering training. These are becoming available for application in developing countries to assist them in implementing maintenance policies.

Recommendations

17. Top management should be sensitized to the financial and other benefits of improved maintenance for the enterprises.

18. Promotion of training for maintenance should include:

(a) Results-oriented maintenance promoted by ILO together with national organizations to bring maintenance back to acceptable standards;

(b) Training programmes specifically designed, through job analysis in industry, for entrants in the maintenance field, whether through apprenticeships, vocational training, polytechnics or universities, followed by specialized in-service training;

(c) In-service training to keep personnel up to date with changes in technology and to prepare them for the maintenance of equipment based on new technologies.

19. Training and retraining of maintenance staff should be in accordance with the requirements of production.

20. National and international support for maintenance training at the enterprise level should include:

(a) Organization of national and regional round tables and workshops, as well as visits to developed countries, to exchange experience;

(b) Establishment of pilot projects at regional or subregional levels, particularly in the following sectors: water supply and sanitation; electricity generation and distribution; cement; iron and steel; food processing; agricultural equipment; fertilizer; and passenger and freight transport. Such projects should include the involvement of local consultants, with a view to increasing the availability of maintenance advisory services at the national level;

(c) Promotion of organizations of maintenance practitioners.

21. Based on the experience of its previous pilot projects, UNIDO should encourage the application of computer-aided training support systems adapted to local conditions, bearing in mind the costs and benefits of such systems as compared with other methods.

Negotiation and acquisition of capital goods

A. Negotiations

Conclusions

22. In the selection of capital goods choice of technology is extremely important and should take into account the ability of the country's technological base to service and support the technology proposed.

23. Maximum advantage should be taken of standardization, in order to reduce spare parts and maintenance requirements.

24. The design of capital goods should emphasize maintainability, since only at the design stage can maintenance be made less in quantity and simpler in performance.

25. A continuing link should be created between the developing-country user and the developed-country designer, so that necessary modifications to the design can be made in the light of experience to take account of developing country conditions.

Recommendations

26. Training and awareness of maintenance problems should be encouraged by enterprises and their organizations, by workers and their trade unions, and by Governments and international organizations.

27. Consideration should be given by UNIDO to ways and means of providing services for medium- and small-scale manufacturers to keep in touch with developing-country users of their equipment to ensure timely action on potential maintenance problems.

28. Active participation of national and regional design centres should be sought in the selection of technology, with particular emphasis on durability, maintainability and life-cycle cost.

29. UNIDO should support training of negotiators on maintenance aspects in the acquisition of capital goods

30. Regional and international standardization programmes should be developed for the drafting of technical documentation on operations and maintenance.

B. Acquisition of capital goods

Conclusions

31. It is most desirable to include maintenance and training at the very outset of negotiations for the acquisition of capital goods. The negotiating team needs to include engineers who are specialists in maintenance and training.

32. When consultants are used, the selection of independent and experienced experts capable of assuming responsibility and ability to transfer relevant knowledge to enterprises in developing countries is crucial.

Recommendations

33. In the establishment of specifications, maximum use should be made of prototype forms and available guidelines produced by such international organizations as the Fédération internationale des ingénieurs conseils and by UNIDO itself.

34. Negotiations for acquisition of equipment should include initial and recurrent costs of spare parts and initial costs of technical documentation in appropriate languages, of training and of maintenance, either within the contract itself or in separate contracts which should be considered integral parts of the negotiations, and for which distinct budgetary provisions would have to be made.

35. Training of developing-country operating and maintenance personnel should begin early in the project. On no account should maintenance training be delayed until after start-up.

36. Physical facilities for maintenance, such as workshops, should be provided at an early stage of construction.

Technical documentation

Conclusions

37. Technical documentation is a vital part of any technical project. Its absence or inadequacy can cause serious damage, especially in operations and maintenance.

38. The documentation required needs to be specified through consultation between the developing-country purchaser and the supplier at an early stage of negotiations.

39. When specifying the documentation required for a project, every effort should be made to ensure the following:

(a) It should be complete in all technical requirements, including full information concerning plant operations and procedures for maintenance and the ordering and storage of spare parts;

(b) It should be written in the appropriate languages of the user country, and in a manner that is easy to understand by those who will use it, including designs and graphics when necessary.

40. It is important to specify the inclusion of working drawings required for the local reclamation and manufacture of spare parts.

41. Specifications for technical documentation should also be based on internationally standard forms where such exist.

42. Personnel of supplier firms require training in the preparation of technical documentation that is easy to understand by the users, including designs and graphics when needed.

Recommendations

43. Local personnel should be trained in:

(a) Preparation of specifications for technical documentation;

(b) Checking for completeness against specifications;

(c) Updating the documentation and obtaining amendments;

(d) Storage and care of technical documentation;

(e) Providing an efficient technical service to users.

44. Suppliers should be prepared to sell the necessary working drawings and technical documentation against fair payment and in accordance with patent agreements.

Spare parts management, reclamation and manufacture

Conclusions

45. Enterprises have often devoted substantial resources to excessive purchase or storage of spare parts that are not used, while vital spare parts are not always available on time. Among the factors contributing to this situation are lack of management skills, insufficient ability to appraise recommendations of equipment manufacturers, insufficient standardization, lack of generally accepted coding systems and poor information retrieval of spare parts.

46. Spare-parts reclamation and production involve a potential for foreign exchange savings, opportunities for technological advancement, especially for small- and medium-scale enterprises, as well as the need for adaptation to local technological capabilities and considerations of cost-effectiveness.

Recommendations

47. Correct ordering of spare parts is of fundamental importance, and should not be left to suppliers. A correct balance needs to be established between fast-moving parts required in quantity, and slow-moving parts needed only in small numbers. Wherever possible, advantage should be taken of standardization to reduce the number of types of spare parts that need to be stored.

48. Physical care of spare parts - especially protection against climatic conditions and corrosion - should be given greater attention than is at present generally the case, and steps to ensure such care should be planned in advance by the suppliers.

49. Efficient systems of documentation and control of spare parts can reduce both cost and storage space and also improve the supply of spare parts. To facilitate documentation and control, the use of modern computerized methods should be considered. However, it might be a mistake to rely totally on electronic methods, especially in harsh climatic conditions or where maintenance back-up is limited.

50. Enterprises should, through appropriate channels, make adequate foreign-exchange provisions for the import of spare parts that cannot be locally procured or manufactured. Administrative procedures within and outside the enterprises should be speeded up to avoid costly delays.

51. Efforts should be made to encourage the reconditioning and reclamation of spare parts. Full use should be made of special techniques of metallization and welding, and training in these techniques should be provided.

52. The promotion of local spare-parts manufacture should be based on a careful and realistic assessment of quality and of local and foreign costs. Reduction of disincentives, such as taxation of quality raw materials, as well as appropriate incentives for starting operations should be studied in this context.

53. National and regional engineering design centres should be encouraged to contribute actively to local reclamation and production of spare parts.

Special needs of small- and medium-scale enterprises

Conclusions

54. Small- and medium-scale enterprises face particular difficulties in maintenance. They can seldom afford to build up a complete maintenance service, release managers and employees for special maintenance training, or carry the necessary stock of spare parts. They would need assistance in maintenance that is adapted to their needs and possibilities, but assistance is not available in most developing countries. At the same time, small- and medium-scale enterprises have a particular motivation for maintenance and a potential for delivery of maintenance services.

55. Rather than using standard training packages, assistance to small- and medium-scale enterprises needs to combine ad hoc practical advice on specific maintenance problems with training whose results can be immediately applied.

56. It has been noted that owners and managers of small enterprises learn best from each other, particularly through direct exchange of experience. Maintenance training for small- and medium-scale enterprises has to be conceived as a co-operative effort of these enterprises. Trade associations and employers' organizations constitute an excellent institutional basis for this purpose.

57. The development of local units for the production and reclamation of spare parts can be of particular interest to small- and medium-scale enterprises.

Recommendations

58. Associations of small- and medium-scale enterprises and national agencies should, if necessary with international support, strive to achieve the following aims:

(a) Establish, increase or strengthen programmes that provide practical maintenance training and assistance to small- and medium-scale enterprises in developing countries;

(b) Promote the establishment and strengthening of local firms capable of assisting small- and medium-scale enterprises in the field of maintenance;

(c) Disseminate information on successful experiences of small- and medium-scale enterprises in the promotion of spare-parts repair, reclamation and production;

(d) Promote and organize exchanges of experience among small- and medium-scale enterprises and their associations in developing countries;

(e) Promote projects of maintenance improvement through which small- and medium-scale enterprises and their associations in developed countries can assist similar organizations in developing countries.

Maintenance culture

Conclusions

59. It is increasingly recognized that the absence of a culture or spirit of maintenance may be a major obstacle to improving maintenance practices in an industrial enterprise and any other organization. This may have various

causes, such as the lack of an industrial tradition or of pressure for maintaining high productivity levels, insufficient motivation for maintaining plants in perfect condition, poor definition of accountability for maintenance, or the lack of top management support for the maintenance function.

60. These causes, which may be deeply rooted, need to be identified and analysed, and every effort must be made to develop a culture in which maintenance is highly valued by both management and employees. As a rule, this will require efforts to increase accountability, motivation and comprehension, as well as technical and organizational skills needed for maintenance.

61. The experience of organizations that have succeeded in developing a high maintenance culture in an environment with a limited industrial and maintenance tradition is of particular interest.

Recommendations

62. The prominent role of maintenance culture in all enterprises and national efforts for improving maintenance justifies special attention by enterprises, employers' organizations, national and international agencies, the activities of which should include:

(a) Emphasizing the importance of maintenance culture for the efficiency of the enterprise and the implications for both management and workers;

(b) Assisting enterprises in analysing their maintenance performance in order both to improve it and to develop an appropriate maintenance culture;

(c) Promoting exchanges of experience in this field, especially among developing countries.

Issue 2: National support policies and action for human resources development in industrial maintenance

63. The following five issues regarding national support policies and action for human resources development in industrial maintenance were considered:

(a) Objectives of a national maintenance policy;

(b) Policies for training in maintenance;

(c) Role of governments and national institutions in improving maintenance;

(d) Financial implications of national maintenance policies;

(e) International co-operation.

64. These issues were considered singly and jointly in the discussions. A number of conclusions were reached regarding the development of industrial maintenance, and recommendations were prepared for policy action at national, regional and international levels.

Conclusions

65. Efficient strategies, policies and training in maintenance are essential to social and economic development. Although no single set of policies or

strategies can be applied to all countries, there are a number of common elements from which appropriate policies and strategies could be developed.

66. The goal of national policies and strategies should be to enhance the technological capabilities and socio-economic well-being of men and women, to increase cost-effectiveness and to reduce the effects of inadequate maintenance on the production apparatus and the environment. Those effects are measured by the short life of equipment, replacement costs, loss of productive capacity, unemployment, hazardous working conditions and poor product quality. The last-mentioned factor is of particular importance for potential export earnings in an increasingly competitive international economic environment. While precise information is not yet available, the cost would certainly be considerable.

67. The development and implementation of these policies and strategies require full participation and co-operation among government agencies, private and public enterprises and non-governmental organizations, including workers' and employers' organizations, chambers and federations of industry, associations of manufacturers, higher educational and vocational training institutions etc., with appropriate support and assistance from bilateral and multilateral international agencies.

A. Objectives of national maintenance policy and strategy

68. Longer-term development of maintenance capacity. Strategies for the development of maintenance capacity require two approaches:

(a) A structural approach that covers planning, management, organization, policies relating to education and training, including research and development, and institution-building. Planning includes the generation of a data base covering manpower and skill requirements. It should include the development of an economic model for forecasting future demand levels in the various industrial branches and a manpower model for forecasting demand for skilled labour;

(b) An operational approach to cover such activities as:

- (i) Removing obstacles to maintenance, including inadequate provision of technical documentation and counterpart training in the supply of equipment, the lack of recurrent financing, and taxes and regulations that impede the importation of indispensable spare parts;
- (ii) Encouraging local production and reconditioning of spare parts;
- (iii) Enhancing the status of the maintenance profession. Measures could include recognition of knowledge and skills through appropriate certification, better salaries for maintenance engineers, managers and workers, and public recognition of effective maintenance performance by workers, enterprises and agencies.

69. Immediate objectives. There are three main areas of concern:

(a) National awareness. Awareness of the importance of maintenance at all levels of society is a prerequisite for the sustained development of maintenance capacity. In this regard, engineers, managers, workers, and public officials or trainers have special responsibilities and obligations with respect to maintenance. While the nature of these responsibilities vary

across sectors and between public and private enterprises of different size, they have in common the need to increase productivity to conserve scarce economic resources and to avoid the wastage that results from poor maintenance;

(b) Information base. A data base of information regarding maintenance as a management tool for both public and private enterprises and other related institutions is needed;

(c) Rehabilitation. Within the context of industrial rehabilitation, high priority must be given to maintenance of existing infrastructure (water, electricity production and distribution, roads and railways, ports, telecommunications etc.).

70. Small- and medium-scale enterprises. Strengthening the maintenance capacity in small- and medium-scale enterprises should have high priority, given their crucial role in income and employment generation, and the special difficulties they are confronted with.

B. Training policy for maintenance

71. Education and training for maintenance is required at all levels, for engineers, managers, technicians and workers in all sectors. To be effective, training must be integrated within a coherent policy of human resources development.

72. Migrant workers from developing countries employed in developed countries constitute a potential reserve of skills that could eventually assist in the economic development of their countries of origin.

73. Improving the quality of maintenance training. The quality of maintenance training could be improved by the following means:

(a) Developing curricula and training materials based on analysis of the maintenance jobs, which themselves will have been designed according to identified needs at all levels in different sectors;

(b) Recognizing that maintenance requires complex knowledge and multiple skills;

(c) Developing a cadre of qualified trainers and providing salaries adequate to retain them in training roles;

(d) Supporting and developing systems for the training of trainers in maintenance;

(e) Combining supervised on-the-job training with appropriate continuing education programmes;

(f) Developing and applying testing and certification systems based on the skills required for different types of maintenance work.

74. Training maintenance engineers. Universities need to play an important role in designing and developing curricula for engineers and managers.

75. Increasing the availability of training. Both pre-service and in-service training is necessary. Continuing education and training is needed at all levels of employment to enable maintenance personnel to adapt to changing technologies. Consideration should be given to stimulating the provision of

training by public and private institutions and enterprises on a contractual basis. Training by equipment suppliers needs to be systematized and supported by the provision of technical documentation and the training of trainers.

76. Linking training with consultancy services. Advisory services to assist small- and medium-scale enterprises in the design and installation of maintenance systems are needed, and it is desirable to link such services with training and the provision of technical documentation. Consultancy services could be provided through private firms, public or parastatal organizations, universities etc.

C. Role of Governments and national institutions

77. In developing countries, Governments must take the lead, in co-operation with institutions listed in paragraph 67 above, in creating a supportive environment for the development of maintenance capacity by establishing and strengthening institutions and policies. Governments could achieve this goal through legislation or other appropriate policy instruments, by establishing incentives to promote maintenance in public and private enterprises, and by developing co-ordination mechanisms among ministries, parastatal organizations and enterprises involved in maintenance.

D. Financial implications of national maintenance policies

78. Improving maintenance capacity will require investments by both Governments and enterprises in systems, expertise and training. International financial assistance for the development of maintenance capacity is also necessary. Such assistance is more likely to be available where policies are clear and effective, and where analysis demonstrates the longer-term financial returns accruing from higher productivity. Adequate provision of foreign currencies for the importation of spare parts is essential to sustain national production despite the acute balance-of-payments crisis confronting many countries.

E. International co-operation

79. The exchange of successful experience in the development of maintenance capacity is a matter of high priority in international co-operation. The assistance of appropriate international agencies could facilitate the flow of information between developing and developed countries and between developing countries themselves.

80. The possibility also exists for regional co-operation in key areas, such as in the reconditioning or manufacture of spare parts and in highly specialized training, research and development.

Recommendations

81. The policy recommendations presented below are based on the conclusions of the meeting and organized under four headings:

- (a) Measures to be considered by Governments;
- (b) Co-operation between developed and developing countries;
- (c) Technical co-operation among developing countries;
- (d) Co-operation with UNIDO, ILO and other international organizations.

A. Measures to be considered by Governments

82. Governments should strengthen the development of human resources for maintenance by such measures as:

(a) Incorporating maintenance, education and training for engineers, managers, technicians and skilled workers into national education and training programmes;

(b) Improving the quality of training in the field of maintenance, increasing opportunities for training, strengthening existing institutions at the level of formal education and training and at plant level, and establishing a programme of which the production of training materials would be an integral part;

(c) Providing a suitable combination of incentives, subsidies and direct support to training organizations to encourage the provision of both on- and off-the-job training for maintenance. Under certain circumstances, this could include measures to stimulate the growth of private sector training and consulting. Consideration may be given to financing such programmes through fiscal and other incentives;

(d) Encouraging both public and private sector enterprises to provide up-grading training possibly linked with consultancy services for the design of maintenance systems. Such services are particularly important for small- and medium-scale enterprises;

(e) Promoting collaboration between the public and private sectors in the development and provision of training;

(f) Establishing data banks storing information on training materials for maintenance.

83. Taking into account national needs and conditions, in particular national policies and strategies for industrialization and the development of human resources and technology, Governments, in consultation with institutions identified in paragraph 67 above, should establish a supportive environment for maintenance by such measures as:

(a) Ensuring that maintenance is integrated within the context of national development planning in order to reinforce the existing industrial "tissue";

(b) Establishing a national maintenance policy to guide, co-ordinate and encourage the efforts of all the relevant sectors of the economy, both public and private;

(c) Fostering national awareness of the relationship between poor maintenance and the possible negative environmental impact of industrial processes;

(d) Creating a mechanism to promote maintenance through high-level consultations, involving government ministries and authorities and enterprises, workers' organizations, professional associations and non-governmental organizations, leading to advice on policy development and implementation and on the designation of the appropriate authority or authorities to assume responsibility for the latter;

(e) Reviewing policies affecting the importation of spare parts, including import duties, taxes and licensing regulations, in order to eliminate obstacles;

(f) Ensuring that, in the negotiation and acquisition of technologies, provision is made for the supply of technical documentation in the relevant languages and for maintenance training in the production and procurement of equipment;

(g) Promoting local manufacturing and reconditioning of spare parts;

(h) Promoting programmes of awareness of the importance of maintenance through a variety of approaches and methods, including national campaigns;

(i) Encouraging both the active participation of professional associations in promoting maintenance and the creation of such associations where necessary;

(j) Periodically assessing the results of the industrial maintenance policy adopted, and especially its impact on the growth of both the economy in general and the industrial sector in particular.

84. In considering rehabilitation programmes special attention should be devoted to maintenance and its related manpower requirements.

B. Co-operation among developed and developing countries

85. In promoting co-operation among developed and developing countries special emphasis should be placed on:

(a) Human resources development for maintenance activities;

(b) Needed services and other requirements relating to maintenance in the negotiation of supply contracts, including training, clear and easily understandable technical documentation in the relevant languages, spare parts and maintainability;

(c) Fostering exchanges among research institutions;

(d) Sharing experience and information through conferences, expert group meetings, study tours etc.;

(e) Developing local capabilities in the manufacture and reconditioning of spare parts.

C. Technical co-operation among developing countries

86. Developing countries should assist each other in improving industrial maintenance by:

(a) Establishing sectoral network systems among institutions in developing countries to foster exchange of information;

(b) Sharing, where appropriate, maintenance training curricula and materials;

(c) Co-operating in the financing and provision of maintenance training at regional or subregional levels to meet common needs.

D. Co-operation of UNIDO, ILO and other international agencies with developing countries

87. International agencies should improve co-ordination of their efforts to assist developing countries in the development of their maintenance capabilities.
88. UNIDO, ILO and other United Nations agencies should strengthen and harmonize their policies in the field of human resources development for maintenance training.
89. Technical assistance projects with a high equipment component should contain a budgetary provision for maintenance training.
90. UNIDO, ILO and other interested agencies should assist developing countries in developing methodologies to evaluate the cost-effectiveness of maintenance programmes.
91. UNIDO and ILO should examine the possibility of establishing an international clearing-house for information on maintenance training.
92. International agencies and financing institutions should ensure that sufficient attention is given to spare parts, technical documentation and maintenance training in projects that they finance. In project negotiations, the initial provision of recurrent financing should also be considered, especially in priority programmes aimed at the rehabilitation of enterprises in developing countries.

II. ORGANIZATION OF THE CONSULTATION

Opening of the Consultation

Statement by the Minister of Industry, Posts, Telecommunications and Tourism of France

93. The French Minister of Industry, Posts, Telecommunications and Tourism noted that the slow-down in economic growth, the development of increasingly complex technologies and the emergence of a global economy had made it essential to deal with maintenance problems as a matter of urgency. Maintenance required the mobilization of human resources and special emphasis on secondary and higher education as well as on-the-job training. Increasing automation required greater flexibility in the utilization of both machinery and manpower. It also required a special effort to mobilize skills and to make the best use of the expertise and capabilities available at enterprise level.

94. Maintenance offered a vast field of action for international co-operation. To be effective, co-operation should be neither over-extended nor too abstract. To avoid being over-extended, it should be concentrated in sectors to which developing countries attached priority importance, in particular water, electricity, transportation, building materials, agricultural machinery and agro-food production. To avoid being too abstract, it should not be based on general formulas and principles taken out of their proper context, but should focus instead on the efficient use of manpower and resources. It was essential to act with pragmatism, to carry out pilot projects in key sectors and to disseminate the results and techniques in co-operation with UNIDO and ILO.

Statement by the Director-General of ILO

95. The Director-General of ILO drew attention to the two main issues on the agenda of the Consultation, namely the development of human resources for effective maintenance at enterprise level, and national support policies and action to achieve that goal. Improvements in the field of maintenance would help to improve the balance of payments and to make access to loans easier and investments more productive, thereby stimulating both production and employment, the promotion of which was one of the highest priorities of ILO, if not the highest.

96. The International Labour Conference, in a series of international conventions and recommendations, had laid down guidelines and procedures for improving training methods and adapting them to an environment constantly changing under the impact of technological innovation. ILO would try to make the fullest use of its tripartite structure to disseminate the results of the Consultation through the network of close labour relations that it had established in almost all developing countries, where its technical co-operation activities were continually expanding.

Statement by the Director-General of UNIDO

97. The Director-General of UNIDO said that the development of human resources in developing countries had failed to keep pace with the requirements created by rapid industrial change. That held particularly true for the training of manpower in the field of maintenance. Owing to that problem alone, the life-span of equipment in many developing countries was reduced on average by 30 per cent, and the technical availability of equipment for productive use was sometimes barely 32 per cent.

98. To overcome those problems, three factors should be considered: first, creating an awareness among policy-makers at both national and enterprise levels of the need for maintenance; secondly, ensuring a proper understanding of the maintenance function in all its aspects and complexity; and thirdly, providing adequate training so that appropriate maintenance policies could be formulated and implemented at national and enterprise levels.

Statement by the Director of the System of Consultations Division

99. The Director of the UNIDO System of Consultations Division pointed out that one of the objectives of the Consultations was to promote the industrialization of developing countries by looking at specific sectors or topics common to all industrial sectors so as to identify constraints and make recommendations on policies designed to remove those constraints. The System of Consultations was unique in that it offered representatives of Governments, industries, co-operatives and trade unions an opportunity to identify problems that hampered industries and to propose solutions. The Consultations also provided a forum for developing countries to clarify their assistance and technical co-operation requirements and to initiate informal discussions with other developing as well as developed countries, agencies and representatives of industry. In addition to discussion of the problems of industrial maintenance and of training in maintenance, the purpose of the present Consultation was to make recommendations to Governments, national institutions, enterprises and trade unions aimed at mobilizing their forces so as to create an awareness of the importance of the issue and to adopt policies and concrete measures to resolve the problems identified.

100. The Director of the System of Consultations welcomed the excellent co-operation between ILO and UNIDO in the preparation and organization of the current Consultation. He also noted with satisfaction that the current Consultation was being hosted by France. It was, he said, a tribute to France for all its efforts in contributing to the training of cadres from developing countries of Africa, Asia, and Latin America.

Election of officers

101. The following officers were elected:

Chairman: Yves Jacques (France), Minister Plenipotentiary, Chairman of the Interministerial Preparatory Committee, Ministry of Foreign Affairs

Rapporteur and Vice Chairman: Jean-Marie Etoundi (Cameroon), President of the Cameroon Association of Maintenance Engineers

Vice-Chairmen: Marcelo Guillen (Venezuela), Rector of Simon Bolivar University

José Libert (Belgium), Secretary of the Central Council for the Economy

Viktor Novotny (Czechoslovakia), Head of the Department of External Relations, Federal Ministry of Metallurgy and Heavy Industry

Adoption of the agenda

102. The Consultation adopted the following agenda:

1. Opening of the Consultation
2. Election of Chairman, Vice-Chairmen and Rapporteur
3. Adoption of the agenda
4. Presentation of the issues by ILO and UNIDO

Issue 1: Human resources development for effective industrial maintenance at the enterprise level

Issue 2: National support policies and action for human resources development in industrial maintenance

5. Discussion of the issues
6. Conclusions and recommendations
7. Adoption of the report of the Consultation
8. Closure of the Consultation meeting

Adoption of a programme of work and establishment of working groups

103. After adopting its programme of work, the Consultation established two working groups to discuss the different issues and to propose conclusions and recommendations for consideration in the final plenary session. The working group on issue 1 was chaired by Heinrich Dehn (Federal Republic of Germany), and the working group on issue 2 by Marcelo Guillen (Venezuela).

Documentation

104. The documents issued prior to the Consultation are listed in annex II. During the Consultation, a number of papers were distributed, including statements by the delegations of Algeria, Bangladesh, Belgium and France, and technical papers by various participants representing enterprises and organizations. A working document entitled "Offers/Requests for Technical Co-operation" to promote identification and negotiation of potential technical co-operation projects was also distributed.

Adoption of the report

105. The report of the Second Consultation on the Training of Industrial Manpower was adopted by consensus at the closing plenary session on 18 September 1987.

III. REPORT OF THE PLENARY SESSION

Presentation of the issues

106. A member of the ILO secretariat, introducing issue paper 1, identified some of the crucial factors for industrial maintenance at enterprise level. The fact that issue paper 1 focused on problems faced by enterprises and desirable improvements at enterprise level was not accidental. The secretariats had deliberately chosen to address enterprise-level issues first, in order to stress that the future of maintenance in developing countries was primarily in the hands of enterprises and their managers. Governments and national organizations could set up policies and provide all possible support to promote and improve maintenance, but the management of individual enterprises would always have the final say. It was known only too well that, within the same country and the same policies and institutional environment, one often found enterprises whose equipment was perfectly maintained alongside organizations with the poorest maintenance standards; hence the strong emphasis on enterprise-level policies, responsibilities and action.

107. Issue paper 1 presented the issues under the following seven headings to help structure the discussions:

- (a) Policy for organization and methods of maintenance at the enterprise level;
- (b) Training in maintenance at enterprise level;
- (c) Negotiations and acquisition of capital goods;
- (d) Technical documentation;
- (e) Management and manufacture of spare parts;
- (f) Special problems and needs of small- and medium-scale enterprises;
- (g) Developing and maintaining a high maintenance culture in the enterprise.

108. Maintenance was often regarded and treated as a technical issue - a set of norms, prescriptions, technical skills and organizational arrangements. The technical side of maintenance was important, but experience showed that improvement of maintenance practice was a social, cultural and economic issue above all. Changes in values, attitudes and motivations would determine whether maintenance would progress significantly in the years to come. The Consultation could make a distinct contribution by explaining that fact to all the actors in the maintenance scene.

109. A representative of the UNIDO secretariat, introducing issue 2, said that inadequacies in policies at the national level were partly responsible for the inadequacies encountered in several countries in the development of human resources, and that education and training for maintenance should be incorporated and integrated into policies for human resources development. Responsibility for human resources development was generally shared between the public authorities and those responsible for industrial projects. That division of responsibilities often led to neglect of personnel training.

110. Consequently, the identification of requirements in terms of people and training in the maintenance field should be closely linked with industrial planning and technological projections. At the level of enterprises, such

identification should take into account technological changes and the demands of increasingly sophisticated maintenance; hence the importance of establishing data banks as an important management tool.

111. In short, the planning of human resources and training necessitated the following measures:

(a) Evaluation of the level of economic and technological development of the country concerned;

(b) Prediction of future technological trends and consideration of their implications for education and training policies;

(c) Programming of training in the short, medium and long term in the light of needs at the national level and at the level of enterprises;

(d) Establishment of an inventory of manpower resources and needs and assessment of existing possibilities, taking into account the supply of and demand for maintenance personnel.

Maintenance would require substantial human and material resources and should have the benefit of an operational budget to allow it to play its role. Sensitization at all levels was necessary in order to bring about a recognition of the productive character of maintenance and the assignment of equal importance to maintenance as to the manufacturing function.

112. A major organizational effort was required to mobilize the active forces of a country, establish the necessary structures and strengthen educational policies and the existing training institutions, including the training centres belonging to industrial enterprises or dependent on them, and research and development institutions.

Summary of discussions

113. Many participants stressed the importance of maintenance. Among the main obstacles to maintenance, mention should be made of disparities in the equipment used, its obsolescence, the lack of spare parts, difficulties encountered in the understanding of technical manuals on equipment maintenance, and, quite frequently, inadequate training, both of personnel in general and of personnel specialized in maintenance operations.

114. One participant noted that maintenance was certainly not an aim in itself, but that it was an essential condition for industrial activity. Maintenance was a state of mind, geared constantly to the safeguarding of the assets constituted by the equipment at one's disposal, and taking into account the purpose of production goods of all kinds, namely ensuring adequate and permanent economic efficiency. It was clear that if, for lack of maintenance and replacement of parts, the equipment was immobilized, a considerable loss would result. Hence the vital importance of the maintenance of plant and equipment and of preventive maintenance. It was essentially a matter of establishing reflexes in favour of permanent and systematic maintenance, which should play a preventive role, in order to avoid, to the greatest extent possible, belated, ad hoc repair work. It was thus important to devise appropriate training programmes to make all the economic agents aware of the importance of maintenance.

115. Several participants offered, through UNIDO and other international organizations, to make available to all developing countries the whole range of industrial training services at their disposal and all the experience that they had acquired in that field.

116. Recourse to training techniques making use of audio-visual aids and perhaps of data processing, and the development of suitable programmes that could be used in the various countries, seemed likely to accelerate the transfer of know-how in the maintenance field. Pilot operations could be considered, for example using mobile units, and the experience gained by enterprises in developed countries in the training of their own personnel could usefully serve as a model.

117. Many participants drew attention to the crucial importance of trainers in developing countries, noting that their training was not always up to requirements.

118. The point was made that it was wrong to suppose that, in order to establish an enterprise, one only needed, at a particular time, a piece of land, a building, a technology (even a well-tried technology), some raw materials or semi-finished products and a market. The world crisis had revealed the fragility of such ventures, many of which had remained at the industrial project stage without developing into real enterprises with an identity and a life of their own, in a process of perpetual evolution.

119. One participant noted that the training and upgrading of skilled manpower for all categories of industrial maintenance was essential for the effective utilization of the material and financial resources of the countries concerned. There was also a need for more intensive exchange of experience, in particular with regard to the qualifications of those who were responsible for the management, planning and implementation of maintenance activities. The particular economic, political and ideological interests of different groups or persons had an impact on the training and upgrading of maintenance staff. The same was true for suppliers of industrial plants, licences and technologies or for international competitors of industries of developing countries. That fact should be given due consideration when it came to devising measures to be taken by UNIDO to assist developing countries in the maintenance field.

120. The evolution of the UNIDO System of Consultations was also noted with considerable satisfaction. That exercise, original in the United Nations system, in which representatives of industry, Government and workers participated very actively, was an effective instrument for carrying out the mandate of the Organization. With the impetus given recently to this activity, the participants were now the real architects of the results obtained at Consultations. These allowed a real joint analysis of the problems of world industry, thanks to exchanges of views on the experience acquired by the different parties, and an assessment of technical and economic developments in the field considered. These meetings between political decision-makers and industrial practitioners from all countries brought together possible partners, of differing geographical and professional origins, for potential joint operations.

IV. REPORT OF THE WORKING GROUP ON ISSUE 1:

HUMAN RESOURCES DEVELOPMENT FOR EFFECTIVE INDUSTRIAL
MAINTENANCE AT ENTERPRISE LEVEL

121. Issue paper 1 (ID/WG/469/5 (SPEC.)) was introduced by a representative of ILO. Many participants stated that the paper reflected the situation in most developing countries. They also agreed that the concepts for dealing with maintenance and training were comprehensively covered in the paper.

122. Many participants from developing countries, especially from sub-Saharan Africa, stressed that in most cases, maintenance was looked upon as repair after breakdowns, in order to keep production running. Preventive maintenance was sometimes undertaken. But even then one could not talk of a comprehensive maintenance system involving all the departments of the enterprise. They stated that there was a lack of awareness of the full meaning and of the quantifiable benefits arising from proper maintenance in the top and middle management of enterprises. They emphasized that for a maintenance policy within the enterprise, top management must be well sensitized about the benefits, indeed the essentiality, of maintenance. Only then could they feel committed to put in place a systematic maintenance system. Once top management was fully committed, the formulation and implementation of a maintenance policy in the enterprise would follow with the support of all concerned. The maintenance function was therefore above all a management function - formulation of policy, setting up the organizational structure, provision of the necessary budget, purchase of equipment for maintenance, and training of personnel at all levels and in all facets of the maintenance function. This involved the creation of a "maintenance culture" or the "spirit of maintenance" in the enterprise. This was a mental attitude.

123. A participant from a technical assistance institution in a developed country pointed out that the problems of maintenance were not the same in all countries, and that they were also different in large- or small-scale industry, in public and private enterprises and in the various industrial branches. Hence there was no common formula for the formulation and implementation of a maintenance policy in an enterprise. A maintenance system had therefore to be tailor-made for the enterprise, and to this end assistance from outside the firm might be necessary. He also stressed the importance of setting up and using a good information system on the different aspects of maintenance, including spare parts management.

124. Another participant stressed that in order to sensitize decision-makers in Government and in industry on the importance of maintenance, they should be approached in a language they understood well. In other words, politicians, high civil servants and managers would be convinced if it could be proved that maintenance would save foreign exchange and increase production, sales and profits. Pilot projects could be undertaken in a number of firms to quantify the benefits of maintenance, and the results obtained could serve as a motive force to sensitize decision-makers in Government and in enterprises. Maintenance systems should therefore be results-oriented where benefits could be quantified in various terms.

125. While agreeing with the above, one participant pointed out that it was not enough to create an awareness for systematic maintenance; it was also necessary to create the technical capacity to establish and manage the system, especially in small- and medium-scale enterprises, which by far constituted

the great majority of industrial units in developing countries. Therefore small- and medium-scale firms would require assistance from Governments, chambers of industry, associations of manufacturers and labour organizations, as well as from international and bilateral technical assistance institutions.

126. Most participants stressed the need to combine the maintenance function with production to obtain the maximum benefits.

127. All participants agreed that a training policy for maintenance was an essential factor for the installation and running of the maintenance system in an enterprise. They agreed that training started in the educational and training institutions, but that all categories of personnel needed to be retrained and upgraded to perform specialized functions in the enterprise. This would require in-service training involving both theoretical and practical on-the-job instruction in the enterprise. Trainees might have to be sent for further training in specialized institutions or firms. It was therefore extremely important to co-ordinate training between the training institutions and industry. This would help both sides to obtain better results in order to meet the real needs of industry.

128. Most participants stressed that training in maintenance was necessary for all levels and categories of personnel, including managers, engineers, technicians, maintenance personnel and also operatives. Thus maintenance training should be looked upon as an enterprise-wide activity. They also pointed out that an integral part of a training policy should be to ensure that maintenance personnel enjoyed a recognized status in the enterprise and were given incentives and rewards as well as possibilities for career development.

129. Many speakers emphasized the necessity to introduce training in the preparation of preinvestment studies to ensure that the maintenance function was well budgeted for and also in the preparation of specification and tender documents, the negotiation and acquisition of capital goods, the interpretation of technical documentation, the management of spare parts including the possibility of computer-aided inventory control systems, and the maintenance and operation of equipment. One way of training maintenance personnel would be to attach them to technicians of machine suppliers during the installation of machinery and internal services.

130. One participant from a developing country stressed the importance of the provision of specialized training by foreign machine suppliers in order to reduce the time required for the development of human resources and the transfer of technology.

131. Another participant spoke of the importance of the training of trainers who were also foremen of maintenance crews, in order that they could share their experience on the job and help train a large number of workers in a relatively short time. He suggested that such training could also be "results-oriented", whereby activities in maintenance and production could be measured to show improvements resulting from training.

132. A participant from a developed country drew attention to the importance of entrenching the training component in contracts for the acquisition of capital goods, where training in maintenance would be a fundamental aspect. He underlined that while many maintenance activities were common to most equipment, others were much more sophisticated and called for specialized training. This included training of managers and technicians and of operatives on the job. Maintenance personnel must be provided with

maintenance manuals, and safety measures in carrying out maintenance were essential. Finally, good personnel relations in the enterprise would help create the right attitudes to prevent the abuse of equipment and to keep it always in reliable condition.

133. Another participant from a developed country explained that most enterprises in developing countries did not possess sufficient human, technical and financial resources to establish systematic maintenance systems and train the various categories of personnel in all aspects of the maintenance function. They therefore needed support and assistance not only from their own Governments, but also through international co-operation with developed countries, United Nations agencies, especially UNIDO and ILO, and other multilateral and bilateral institutions. Such assistance should especially concentrate on the establishment of adequate maintenance systems in selected enterprises in key economic sectors (water and electricity distribution, agro-food industry, agricultural machinery, transport, steel industry etc.). Enterprises could be helped to train people in condition-monitoring and in fault diagnosis. Maintenance instruction manuals should be prepared by UNIDO and ILO for different industrial branches on specific activities such as greasing, lubrication etc. Small- and medium-scale enterprises called for special assistance and collective training programmes.

134. Several participants spoke about the importance of negotiation and acquisition of capital goods in the maintenance function. They concurred that great attention had first of all to be paid to the choice of technology and the maintainability of the equipment, which should be within the capability of the enterprise and supporting maintenance facilities in the country. In this connection, participants urged the standardization of equipment and components in order to facilitate maintenance and to limit the cost of stocking spare parts. Attention was also to be paid to the identification of the initial stock of spare parts supplied with equipment in order to ensure that no disruption of production took place because of lack of spares and that slow-moving stocks were not oversupplied.

135. Some participants pointed out that enterprises did not always have the capability to draw up detailed specifications and tender documents for the acquisition of equipment, and that outside consultancy services would be required. Such services could perhaps be provided on a collective basis by national associations.

136. One participant from a developing country stated that in many cases the decision to purchase equipment was made without the involvement of engineering specialists. He emphasized the need to include a maintenance engineer in the negotiating team. Often, bidders purposely underestimated the price of spares and training to make the tender price look more favourable - to the detriment of the buyer in the long term. Engineers in the negotiating team would ensure a proper technical appraisal of offers.

137. On the same subject, participants insisted that contractual arrangements for the purchase of equipment should include comprehensive technical documents with detailed specifications of plant to facilitate maintenance and repair of spare parts, after-sales service including continuing supply of spares, and detailed programmes of training for maintenance personnel and operators.

138. Technical documentation was of paramount importance in the establishment of a systematic maintenance system. It should be clear and detailed, and supplied in a language that could be readily understood by the equipment user.

139. Participants agreed that the question of spare parts had to be viewed from three angles, namely, importation, repair and reclamation, and reproduction and manufacture.

140. Most participants from developing countries pointed out the difficulties in importing spare parts because of lack of foreign exchange and administrative delays in obtaining import licences and in customs clearance procedures. They also pointed out that high tariff rates on imported spares was a disincentive for maintenance systems and productivity. Problems also arose on the side of enterprises, which were not always in a good position to order the right spares at the right time owing to lack of precise technical documentation and of inventory management capability.

141. Participants agreed that a number of spare parts had to continue to be imported because of their sophistication and because in many cases suppliers of machinery would withdraw their guarantee if proprietary spares were not used.

142. Many participants insisted on the importance of upgrading the capability of developing countries in the repair and reclamation of spares, since it was easier for them to develop such a capability, and it had a very favourable cost-benefit ratio. Indeed, one participant stated that UNIDO and ILO could not render a better service to developing countries than by providing technical assistance in this field. Reclamation of spare parts by welding, metallization, electrolytic filling and remachining was within easy reach of developing countries from the point of view of existing resources and technologies.

143. A number of participants stated that as an alternative to importation, repair and reclamation, the reproduction and manufacture of spare parts should be encouraged, since this would benefit developing countries by saving foreign exchange, developing human resource capabilities, strengthening the integration of industry and initiating the first steps towards development of a capital goods industry. Yet they also pronounced a word of warning that the manufacture of spare parts should not be embarked upon at all costs. It required detailed technical drawings, availability of materials with precise specifications, technical know-how, as well as supporting manufacturing facilities to ensure that locally made spares conformed to the reliability standards of original spares. They also warned that it might not be economic to undertake the manufacture of spares if the volume of each item to be produced was too low for commercial viability. Studies for the identification of spares amenable for local manufacture would have to be undertaken to ensure success.

144. Many participants recognized that small- and medium-scale industries were well suited for repair, reclamation and manufacture of spare parts because of their flexibility and lower overhead costs, and that they should receive all encouragement in this sphere from Government, national associations and large-scale industry.

145. One participant opined that in the manufacture of spares, one should start in a small way and expand slowly, depending on the development of local expertise and market conditions. The upgrading of capabilities in the enterprises could better be carried out on a collective basis by co-operatives or associations of manufacturers.

146. The question of inventory control was given great importance by most participants. It was recognized that in developing countries experience in stocks management was low, resulting in errors in ordering parts, poor storage and difficult retrieval from stores, leading to the unavailability of parts when most needed. They made a strong plea for technical assistance by UNIDO and ILO in this field, including the preparation of manuals for stock management.

147. Other participants related their experience in inventory management and the improvement they obtained by introducing computer-based stock control. This was encouraged by participants from both developed and developing countries, especially as the cost of hardware and software was decreasing and would be within reach of many medium- and large-scale enterprises.

148. Participants agreed that small- and medium-scale enterprises faced special problems with respect to maintenance and training in maintenance, although they did have a positive attitude towards maintenance. These enterprises could not afford specialized maintenance personnel and could not separate production from maintenance. Thus machine operators had often to maintain their own machines. Also, managers or owners and other key personnel could not afford to take time to leave the factory premises to attend training courses. Problems were aggravated when new machinery incorporating new technologies and demanding more sophisticated maintenance were acquired. A distinction had therefore to be made between maintaining sophisticated equipment and other simpler equipment, where in the former case more in-depth training would be required to master the new technology.

149. It was clear for most participants that small- and medium-scale enterprises needed assistance from outside the firm. They therefore encouraged Governments, associations of manufacturers, labour organizations, large-scale enterprises and international organizations to provide special programmes of assistance to those enterprises. This could be done in several ways, such as the organization of workshops of short duration for managers, the preparation of model contracts for the acquisition of capital goods in various industrial branches and arrangements by large enterprises to accept trainees from small-scale industry.

150. One participant representing a trade union in a North African country gave an example where the union had established a school to upgrade skills for personnel in an electrical industry. These courses ran for two weeks at a time. Another participant proposed the establishment of mobile training and maintenance outfits to reach dispersed small industries, especially in rural areas.

151. Most participants spoke of the importance of creating a maintenance culture within the enterprise by sensitizing all levels of employees from management down to skilled workers. This could be achieved by fostering a favourable environment in the enterprise through good personnel relations and by the allocation of responsibility for maintenance to persons who should be held accountable for the upkeep of maintenance functions and also rewarded if good results were obtained. In this way, workers would know whom to report maintenance problems to.

152. A number of participants spoke of the importance of creating the spirit of maintenance among managers in the first instance. Assistance should be

available for managers to go on study tours abroad in similar more advanced factories, perhaps under technical co-operation arrangements among developing countries in the United Nations system.

153. One participant stated that Governments should encourage the creation of a maintenance culture in the enterprise by reducing tariffs on equipment and spares and providing facilities through national organizations to organize sensitization seminars. Associations of employers and workers could also help in this respect.

154. Another participant stressed that for a maintenance culture to succeed management should work hand in hand with labour representatives, since the right conditions for workers had to be created if the spirit of maintenance was to percolate down to the entire work-force.

V. REPORT OF THE WORKING GROUP ON ISSUE 2:

NATIONAL SUPPORT POLICIES AND ACTION FOR HUMAN RESOURCES DEVELOPMENT
IN INDUSTRIAL MAINTENANCE

155. Several participants stressed repeatedly that the maintenance of machines and equipment had an obvious impact on the economy of developing countries. Poor maintenance could lead to a serious decrease in national production. This impact in fact went beyond the industrial sector and was also felt in all economic sectors using equipment (agriculture, transport, public works, telecommunications, health, education and scientific research).

156. Some participants drew attention to the need to install data banks to provide information on the frequency of breakdowns, the types of incidents and the time required to remedy them, particularly since microprocessing was now an important instrument of management.

157. It was generally recognized that the maintenance function today implied the constant search for a compromise between techno-economic and techno-financial considerations. Much remained to be done, however, before its impact on production could be appreciated in quantitative and qualitative terms; hence the importance of national, subregional, regional and international public awareness policies.

158. It was also recognized that, to attain its objectives, maintenance required considerable, and above all adequate, human and material means. It should have an operating budget allowing it to play its part fully. Planning, organization and methods were necessary for the management of maintenance activities in general and of spare parts in particular. Carefully prepared vocational training and research and development programmes should make it possible for the maintenance function to improve the productivity of work and ensure the constant quality of production. In addition, it was recognized that the maintenance function, in the same way as the manufacturing function, had a productive character.

159. The representatives of a university and of a regional centre, referring to the problem of defining the maintenance function, stressed that, in their experience, enterprises very often received requests for maintenance and maintenance training that in fact masked poor mastery of the technologies used or imported (as in transfers of technology). This lack of mastery might also conceal the fact that the workers had not been associated with the design and installation of the equipment and machines. It would therefore be important to draw up appropriate strategies and policies that would ensure improved mastery of the technologies used.

160. Referring to the action taken by UNIDO on the basis of the Lima Declaration and Plan of Action, the texts setting objectives which were both quantitative (share of the developing countries in world production) and qualitative (creation of a coherent production system), one representative noted that industrialization was more than the mere presence of industries, and might be defined in such a way as to include the existence of links between industries and between enterprises. Training in general and maintenance training in particular could in certain cases improve such links through economies of scale and through the transfer of skills and know-how at national level, thus contributing to industrialization.

161. Some participants considered that, to develop the maintenance function and to avoid discouraging setbacks, particular importance should be given to the socio-economic situation of the country concerned, and especially of the people living in it.

162. Several participants, including African participants, recognized that since the maintenance function had been neglected for so long, few adequate training systems were available in that field. The problem remained serious in developing countries, although some of them had launched training programmes and Governments and industrialists were increasingly coming to realize the importance of maintenance for the national economy, especially at the enterprise level.

163. Several participants expressed their appreciation of the measures taken by UNIDO and ILO with regard to maintenance training in some developing countries, and especially concerning:

(a) Support for training activities aimed at improving technological and administrative capacities;

(b) Suitable development of training possibilities to meet the training needs of specific groups, for example through high-level sensitization seminars for directors of enterprises or factory divisions, maintenance management personnel, technical directors or management personnel of training institutions;

(c) Strengthening of training institutions;

(d) Encouragement for the creation of associations of maintenance engineers;

(e) Drawing up inventories of manpower resources and needs in order to determine existing possibilities, taking into account the supply of and demand for maintenance staff.

164. Some participants observed that an essential stage in the development of human resources was that of arousing awareness about it. In that connection, it was proposed that efforts should be made to bring about a realization, at the national level, of the vital importance of the maintenance function by highlighting the risks incurred through inadequate maintenance of hospital equipment, public transport, purification systems for industrial waste etc. Action could be undertaken using the resources of the mass media, such as posters, newspapers, radio and television. Its impact could be evaluated in the short, medium or long term.

165. One participant expressed the view that, in order to be successful, any national effort in the training field in developing countries should make use of commercial methods. All enterprises, whether large, medium-sized or small, should bring together three elements, namely a set of clear objectives, vigorous management and the necessary resources. Neglect of one aspect would lead to failure. These elements were just as important at the macro-economic level.

166. A participant representing an African trade union federation deplored the absence of representatives of national African trade unions at the present Consultation, which, in his view, was of great importance for the economic development of the African countries. He also observed that industrial restructuring and the impact of technological changes in industrial branches

using immigrant labour were leading to increasing unemployment among migrant workers in general, and in particular among African workers, who were less qualified. However, African workers had been employed in the industries of developed countries, and some had made advances in the areas of training and the development of a spirit of maintenance. Those migrant workers, particularly in the countries of the European Economic Community (EEC), who were interested in returning to their countries of origin would like to obtain assistance, to be negotiated between Governments of the EEC countries and of the countries of origin and African trade unions, with a view to retraining and easier integration in the countries of origin.

167. Some participants proposed that the maintenance function should be included from the start in investment studies.

168. Taking into account the importance of the maintenance function within the national economy, it was suggested that an effort should be made to increase the awareness of suppliers of capital in this regard. This could be achieved through the organization, under the auspices of the World Bank, of seminars to draw the attention of capital suppliers to the need to provide financial resources to cover the maintenance function.

169. Several participants proposed that a directory of sources of financing should be compiled by ILO, UNIDO and other international organizations concerned, in order to provide information to countries wishing to undertake projects for the development of human resources for purposes of industrial maintenance.

170. It was generally recognized that a major effort should be made by Governments and funding agencies to co-ordinate the activities of and contributions to projects designed to develop human resources for maintenance and financed from various sources.

171. Several participants from developed countries described their activities in the area of maintenance, both in their own countries and in developing countries. They proposed bilateral or multilateral assistance for the formulation of strategies, policies, programmes and projects for the development of human resources for purposes of industrial maintenance.

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Annex II

LIST OF DOCUMENTS

Discussion documents

- Issue 1: Human resources development for effective industrial maintenance at the enterprise level ID/WG.469/5(SPEC.)
- Issue 2: National support policies and action for human resources development in industrial maintenance ID/WG.469/6(SPEC.)

Background documents

- Agenda for action in the field of human resource development for industrial maintenance in developing countries ID/WG.469/1(SPEC.)
- Investment in maintenance: economic stakes and possible strategies ID/WG.469/2(SPEC.)
- The role of human resource development in industrial maintenance ID/WG.460/1
- UNIDO training activities in the field of industrial maintenance ID/WG.469/3(SPEC.)

Information documents

- Summary of 12 case-studies on human resources development in industrial maintenance in Africa ID/WG.469/7(SPEC.)
- Liste indicative de clauses pour les contrats de formation industrielle ID/WG.469/8(SPEC.)
- Case-study on in-service training in Zimbabwe ID/WG.469/9(SPEC.)
- Training of manpower in maintenance from the standpoints of equipment design, manufacture and operation ID/WG.469/10(SPEC.)
- Etude de cas sur la formation en cours d'emploi au Burundi ID/WG.469/11(SPEC.)
- La formation en cours d'emploi et la place de la formation à la maintenance; le cas du Cameroun ID/WG.469/12(SPEC.)
- Etude de cas sur la formation en cours d'emploi en Côte d'Ivoire ID/WG.469/13(SPEC.)
- Condition-monitoring techniques in maintenance ID/WG.469/14(SPEC.)

Report of Regional Expert Group Meeting on Human Resources Development in Industrial Maintenance in Africa Preparatory to the Second Consultation on the Training of Industrial Manpower, Nairobi, Kenya, 23-27 June 1986

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Contractual provisions for training in industrial projects in the food-processing sector

IPCT.1

Training for industrial maintenance work in the developing countries

IPCT.13

The use of mixed credits in the United Kingdom for the financing of industrial training and infrastructure

UNIDO/PC.130

Report of the First Consultation on the Training of Industrial Manpower, Stuttgart, Federal Republic of Germany, 22-26 November 1982

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