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UNIDO Contract NO. 85/141

Project No. RP/RAF/85/625

TECHNICAL ASSISTANCE ON THE MANAGEMENT OF THE MAINTENANCE OF REFRIGERATION EQUIPMENT FOR THE ORGANISATIONS AND INDUSTRY IN ETHIOPIA.

PRESENTED TO (UNIDO) THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION, VIENNA, AUSTRIA BY AnCO - THE NATIONAL TRAINING AUTHORITY, DUBLIN, IRELAND.

John Moore

1986

BACKGROUND:

UNIDO in response to a request from the Governments of Ethiopia, Zambia, Tanzania and Malawi, agreed to provide assistance to these Governments in carrying out a project entitled "Group Training in the Management of the Maintenance of Refrigeration Equipment".

AnCO - The National Trairing Authority, Dublin, Ireland was contracted to carry out the project and the mission was undertaken by John Moore of AnCO's Training Advisory Services Division acting as a UNIDO consultant.

The Ethiopian leg of the mission was undertaken from 21st - 28th March 1986.

MISSION BRIEF:

"Identify "Training Activities" requirements at both National Level and Company Level to improve Technical and Managerial competence":

- Locate Centres of Excellence:

  -Identify technical assistance needs
  -Identify potential trainers
  -Recommend trainer development
  -Recommend courses to be run
  -Identify training materials requirements
  -Identify equipment requirements

- Identify training needs of particular group/ categories including:

  -Senior Managers
  -Line Managers
  -Maintenance Personnel
  -Maintenance Managers
  -Training Function Staff

- Identify needs for preparation/adaption of training material for recommended programmes.

- To consider the wider application of maintenance.

- Recommend "Awareness Creating" strategy for Senior Government and Industry Personnel.

SUMMARY OF RECOMMENDATIONS:

- Manpower projections and skills/training needs survey for the Industrial Sector shold be undertaken for the period 1987 - 1992. This exercise should be carried out under the aegis of the Department of Manpower Planning.

- Facilities at the "Ethiopian Productivity Centre" should be developed as the Centre of excellence for both Refrigeration and Air Conditioning technical updating and development of personnel in Maintenance Management and Systems Application.

- An External Consultant, expert in the technical field should be retained for a 3 year period to advise and assist with launch of programmes and provide periodic follow-up.

- Programme Lecturers/Trainers should be drawn jointly from the "Ethiopian Productivity Centre" and Industry.

- Trainer Development Fellowships should be awarded to:
  Mr Nahusenay Desta - Ethiopian Meat Corporation
  Selected candidates from - Dairy Development Enterprise
  - Ethiopian Meat Corporation

- Programme curricula should be developed collectively between the "Ethiopian Productivity Centre" qualified Industry Trainers and other interested parties. The external expert should co-ordinate this exercise.

- Refrigeration and Air Conditioning Training Hardware should be provided to the Centre of Excellence.

- Short duration intensive appreciation sessions should be developed and run for Senior and Line Managers/Supervisors particularly on planned maintenance benfits and concepts and organisational support.

- Modules on training/instructional techniques should be developed and included on Maintenance Management Programmes to enable participating companies strengthen their training function capability.

- Promote the programmes and benefits to industry through Sector/Regional Consciousness Raising Seminars backed by an advertisement campaign using the various media including T.V.

- Programmes in the areas of Maintenance Management and Systems Application should be made widely available to other sectors of industry.

- Special programmes in the areas of "Procurement", "Stores Management/Inventory Control" and Spare Parts Manufacture should be provided at the Centre of Excellence.

- Urgent consideration by the relevant agencies should be given to the introduction of a Formal Apprentice Trainnig Scheme.

METHODOLOGY:

The methodological approach adopted included:-

- Desk research of relevant material.
- Direct observations through tours of the various facilities.
- Meetings and discussions with various personnel including:-

UNDP Office Addis Ababa	Mr Kadress vencentachellum - Senior Industrial Asviser
Herbert Hahn (Refrigeration)	Mr Herbert Hahn - Owner/Manager
Ethiopian Food Corporation Faffa Foods Plant	Mr Belete Beyene - Manager
Ethiopian Meat Corporation State Farm and Processing Plants Awasa (Located 250KM from Addis)	Mr Getachern Demissde - Manager Mr Girma Gudeta - Maintenance Manager
Ethiopian Livestock and Meat Corporation	Mr kejela Gelana - General Manager Mr Esegaye Asmelash - Deputy General Manager Mr Nahusenay Desta - Operation Manager
Ethiopian Livestock and Meat Corporation. Manpower Planning and Training Division	Mr Melaku Benhuu - Head of Department. Mr Noah Estifanos - Department Officer
Horticultural Development Corporation	Mr Girma - Head of Manpower Planning & Training
Horticultural Marketing Enterprise	Head of Maintenance

Technical School	Principal
Dairy Development Enterprise	Dr Assefa Beyene - Manager Mr Beyene - Maintenance Manager
Tana Private Limited Company Enterprise	Mr Raffale Del Gaudio - Technical Manager
Ethiopian Management Institute	Captain Ayele Haile - General manager
Debre-Zeit Management Training Centre (located 45 km from Addis)	Head of Administration
Ethiopian Productivity Centre	Mr Zewde Feleke - Manager Mr Yohannes Tecle - Head of Maintenance Department Mr Negyssie Mehari - Head of Production Department Mr Jerzy Donarski - UNDP/ILO Expert (Adviser to EPC)
Ministry of State Farms Development	Mr Mesfin Mebratu - Head of Planning Department
Department of Manpower (Centre of National Planning)	Mr Getachen Minas - Head of Manpower Planning

MAIN FINDINGS:

Basically an underdeveloped agricultural economy with enormous logistical problems in striving towards self sufficiency in food production, Ethiopia is none the less engaged in a process of limited industrial development designed to meet indigenous requirements and build up a limited export base.

Generally, productivity and prevailing levels of technology were found to be low and there was much evidence of undercapitalisation. These were compounded by a serious shortage of spare parts due to lack of hard currency and a bureaucratic procurement policy.

The level of Maintenance Management was also found to be inadequate with the following consequental effects:

- High ratio of down time to production.
- Inability to cope with high levels of technology (Industrial, Electronics/Instrumentation/Automatic Control Systems etc.).
- Lack of systematic approach towards training and developing staff.
- Inadequate stores management and inventory control which adds to the serious problem of spares shortage.
- Little or no planned approach to maintenance (shortage of spares has delayed the introduction of preventive maintenance in a number of plants).
- Lack of hard data on future manpower and skills requirements.
- Plant out of production for lengthy periods awaiting spares.
- Lack of, and inability to use sophisticated test equipment and specialised tools.

The absence of a formal apprenticeship system is seen as a critical problem. The ad-hoc system currently in operation is both very basic and very limited in scope and significantly falls short of meeting national requirements. Only three craft areas were catered for at the Addis Ababba based Technical School namely:

. Mechanical - which includes basic workshop practice, Metal Fabrication, Welding and Automobile Engineering.

- Civil - which includes Woodwork, Building, Surveying and Drafting.

- Electrical - which includes basic Electricity, Radio and Electronics.

No basic training facility exists for Refrigeration and Air Conditioning. The low throughput figure from the three programmes on offer is augmented by direct intake, for on-the-job training only, with its consequental lowering of standards.

There are no national training facilities for skills updating in Refrigeration and Air Conditioning. Such development is presently catered for at overseas locations mainly with equipment suppliers and is considered expensive and not very satisfactory given the highly specific (usually one machine) nature of the training provided.

The five year "Mechanical Engineering" degree course on offer at the "University of Ethiopia" School of Engineering includes imputs on therodynamics and refrigeration but is largely theoretical.

ETHIOPIAN MANAGEMENT INSTITUTE - (EMI):

To accelerate the process of management development, the Government have recently established the "Ethiopian Management Institute" (EMI) as the national centre for management training, consultancy and applied research to help meet the needs of the economic and public administration sectors of the country.

EMI....Its Purpose:

- To advise the government on matters relating to the management and administration of government establishments.
- To provide traiing in management and related fields.
- To co-ordinate and supervise the activities of management in-service training organisations.
- To conduct applied research in management and based on findings, give consultancy service to government establishments.

EMI....Its Aims:

The Institute has two operational and one support branches: These are

- A Management Education and Training Branch.
- A Research & Consultancy Branch, and
- An Administration and Finance Branch

In addition, it has two Training Centres namely:

- Debre-Zeit Management Training Centre (DMTC) and
- Productivity Improvement Centre (PIC)

Located some 25 km from the capital, the "Debre-Zeit Management Training Centre" (DMTC) offers a range of development programmes for managers in the conventional professional disciplines.

THE OBJECTIVES OF THE CENTRE INCLUDE:

- Encouraging and developing the art and science of professional management.
- Developing a self-sufficient capability in management training.
- Developing indigenous managers adequate in professional competence and in number.
- Designing, developing and conducting training courses based upon and guided by findings of researches required to correlate with the practical reality of the managers' job.
- Development of Instructors/Demonstrators.
- Producing, collecting and disseminating training/learning material.
- Providing facilities for individuals, groups or organisations to meet and discuss managerial practice and problems with a view to improving standards.

The "Productivity Improvement Centre" (PIC) located in Addis Ababba with a staff of 110 offers two levels of programmes:

(1) Production Management and Maintenance Management Development.

(2) Technical Development in the fields of:-
- Industrial Electrical Maintenance.
- Motor Rewinding.
- Automobile Engineering.
- Basic Mechanical Engineering.
- Leatherwork.

The programmes include modules on Instructional Techniques for Managers whose future role will include responsibility for training.

Future manned programmes will include spares, manufacturing and refurbishment - mainly precision engineering for metal parts.

The existing maintenance management programme is "result orientated" and follows the 8 step approach as listed:

1. Problem identification and data collection.
2. Formal course of 1/2 weeks duration run in (PIC) - topics include problem solving and systems design.
3. Work related assignment in selected host company. A report with specific recommendations is produced, endorsed by senior factory management.
4. Live work assignment in own organisation. In-house presentation to management.
5. Two day seminar on "Implementation" run in (PIC).
6. Actual implementation and monitoring incorporating by-weekly meetings to check on progress and exchange ideas. "PIC" staff act as co-ordinators and log results using a weighted monitoring chart.
7. Evaluation of progress of implementation.
8. Evaluation of achieved results.

Steps 7 & 8 are documented in writing. Certificates are awarded for successful completion.

The stated throughput for both programmes is in the region of 3 - 4000 per year. Canditates are selected from the best technical people with a record of achievement. The centre plan to introduce a grading system for practicing maintenance personnel based on formal testing and certification. This they feel would lead to an improved reward system and increase motivation - the present very low level of which is seen as a major problem. Participation is presently confined to the following 5 economic sectors:-

Transport
State Farms
Construction
Mines and Energy
manufacturing Industry

Achievements claimed include "refurbishment of 1,000 tractors for agricultural production" and a "20-30% increase in industrial equipment availability".

UNIVERSITY - SCHOOL OF ENGINEERING:

The School of Engineering offers a five year Primary Degree Engineering Programme which includes imputs on:-

Thermodynomics
Workshop Technology
materials and Equipment Handling
Production Engineering
Maintenance of Machinery

With limited laboratory equipment the imput on Thermodynamics are largely theoritical. There are plans to introduce a post graduate degree programme in 1988 which would include modules on Refrigeration and Air Conditioning and Maintenance Management. The University would be willing to offer these modules separately to industry on a short duration, intensive basis.

DEPARTMENT OF MANPOWER (CENTRE OF NATIONAL PLANNING):

Lack of hard manpower data including future needs projections is seen as a major inhibiting factor on the whole planning front. Preliminary measures are however underway for undertaking a national manpower survey which will include key economic sector projections to the end of the century. Cognisance will be taken of both the Educational and Training Systems.

Much of the present training provided is limited due to bi-lateral aid caveats which channels most assistance towards agricultural development. Lengthy delays are also experienced in processing external course applications by the various government arms. Budgetary and staffing constraints have also negated against progress.

The "Assessment of Training Needs" process has been initiated for many sectors of the economy including industrial plants. A four stage short term plan exists to:

- Increase intake of skilled staff into key sectors.
- Provide overseas training for key staff.
- Undertake in the short term, medium level skills updating programmes.
- Develop key personnel in analyitical and instructional techniques and use as trainers.

SERVICE AND REPAIR INDUSTRY:

The largest such enterprise located in Addis Abadda is owned and managed by an Austrian ex-patriot. Basic fabrication and special one-off-jobs are also undertaken. The limited Service and Repair Industry in the country operates under the severest of limitations. Shortage of spare parts, lack of skilled personnel and prohibitively high local prices for even the most basic of equipment were the major problems identified. The establishment of even the most basic training facilities is seen as a priority.

Another company "Tana Enterprise" was engaged in automobile and other engineering parts reconditioning and rebuilding. Work on large refrigeration compressors was in evidence during my visit. The technology employed is largely Italian based and ranges from casting and welding to precision machining.

PROCESS INDUSTRY AND COLD STORAGE PLANTS:

The age span and range of sophistication of equipment in the plants visited was vast with the earliest dating from 1906, constrasted with recently installed plant incorporating state of the art technology. There was much evidence of plant out of production awaiting spare parts. On the spot analysis also revealed many of the problems experienced where as a direct result of skills shortages, especially refrigeration and ari conditioning mechanics. Industrial electronics and instrumentation also pose maintenance problems and are above the capability of existing levels of technical expertise.

The remoteness of many manufacturing facilities including those located in the fertile heartland of Awasa, acts as a disincentive towards attracting highly skilled people. One key cold storage facility visited with recently installed Russian made plant was still awaiting commissioning and the provision of special training in the Soviet Union for both operational and maintenance staff. Albeit functionally modern in design and construction, this amonia plant is potentially problematic as leaks could contaminate massive quantities of foodstuffs under storage.

Utilities interruptions were also a cause for concern in many facilities. Voltage transients alone, account for much damage to sensitive electronic equipment.

A number of individual plants had developed a planned maintenance system but displayed little evidence of practical application. Without exception lack of spare parts was the most serious problem and highlighted as the factor inhibiting the widespread use of proper preventive maintenance. Few maintenance heads had received any formal develoment in the management of the function.

The major food corporations had independently established the training function and were engaged in undertaking training needs assessments for key staff. Limited indigenous training facilities however, has reduced options and often resulted in expensive overseas development for such staff, sometimes following lengthy delays.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE STRATEGY

CONCLUSIONS:

From the foregoing the major maintenance problems facing Ethiopian Industry can be summarised as follows:

- Serious shortage of technical skills - particularly in the fields of Refrigeration and Air Conditioning. Industrial Electronics and Instrumentation.

- Shortage of Maintenance Management Skills, principally in the areas of Planned Maintenance and Systems Aplication.

- Inadequate local Technical Development facilities.

- Shortage of spare parts - exasperated by currency exchange controls and licencing constraints.

- Lack of specialised tools and equipment.

- Inability to handle the introduction of high level technology in manufacturing and process industry.

- Lack of local specialised manufacturing facilities for spare parts.

- Widespread use of out-of-date plant and equipment - for which major spares are virtually non obtainable.

- Lack of Refrigeration and Air Conditioning Mechanic Apprentice training System.

- Inadequate planned maintenance in many industries.

All of the problems are finance related and significant investment is urgently required in the need areas identified.

It should also be noted that a definite co-relationship exists between planned (preventive) maintenance, and availability of spare parts and that lack of readily available spares has prevented the introduction of much needed effective planned maintenance, thus compounding problems.

RECOMMENDATIONS:

MANPOWER PLANNING:

Given the almost total absence of such vital information, there is an immediate need to undertake a long term "Manpower and Skills Needs Survey" to obtain an "accurate fix" on future requirements.

This exercise should be carried out under the aegis of the Department of Manpower Planning and should ideally form a strategic part of the nations 10 year development plan now in its second year (1986) and which will address areas including "Industry", "Human Resources" and "Development Planning".

It should include the development of an economic model for forecasting future demand levels by market area and a manpower model for forecasting labour demand by skill.

It should:

- Determine the present employment levels in the relevant sectors.
- Determine the employment effects of expected productivity changes in each market area.
- Determine the employment and skill effect of technology changes.
- Determine the level of employment and skills growth for each market area in the period in question.

The study should be undertaken in the context of a definite period of time (1987-1992) and it should establish a basis for the continued review of requirements.

Key skills for the sector under review in this report would include:

- Plant Managers/Supervisors.
- Maintenance Managers/Supervisors.
- Refrigeration and Air Conditioning Mechanics/Technicians.
- Electricians.
- Mechanical and Agricultural Plant Fitters.
- Electronic/Instrumentation Mechanics/Technicians.
- Plant Operatives.

CENTRE OF EXCELLENCE:

There is sufficient evidence of immediate needs to economically and logictically justify the establishment of a Centre of Excellence in Ethiopia.

Given the track record of the "Ethiopian Productivity Centre" in running the results orientated maintenance management programme, which complies with most of the criteria, it was seen as the most suitable centre for development. The programmes currently on offer which have an agricultural bias, should be re-examined and analysed in the light of national generic industrial requirements and modified as appropriate. To meet such requirements, the following range of programmes should be modified/developed and on offer by the end of 1987.

- Awareness - Creating or Appreciation Seminar on Industrial Maintenance for Senior Personnel.
- Appreciation of Industrial Maintenance Programme for Line Managers/Supervisors.
- Maintenance Management Development Programme.
- Maintenance Stores Management Programme.
- Instructional Techniques/Skills Development for Maintenance Staff.
- Technical Development in Refrigeration and Air Conditioning.
- Spare Parts Manufacturing.
- Procurement.

Technical development is an absolute prerequisite to raising the level of key skills in Ethiopian industry, particularly in Refrigeration and Air Conditioning. Consequently the technical course capability of the "EPC" should be expanded to meet this need. This would require major re-equipment of the existing facility and the list of hardware as detailed in Appendix 1 should be provided.

EXTERNAL EXPERT:

An expert in both the technical and management field should be contracted from an agency of international standing to advise, assist and provide impetus with the initial launch.

The experts' role would include course design and evaluation and provide field follow-up with selected maintenance management participants to reinforce the formal course learning. The expert should be retained on an open ended contract for approximately 3 years.

TRAINERS AND TRAINER DEVELOPMENT:

Programme lecturers and trainers should be selected from the Centre of Excellence and industry and used to provide imputs on the variou programmes as appropriate. The industry perspective on such programmes is of crucial importance and their contribution should be through the "part-time" involvement of selected key personnel who would act as trainers. The yearly net time contribution for selected personnel would amount to approximately 2 months.

The following industry personnel were identified as potential trainers:-

Mr Nahusenay Desta	Ethiopian Meat Corporation
Selected Canditate	Dairy Development Enterprise

In addition the Ethiopian Meat Corporation expressed a wish to select a second suitable canditate for development and subsequent involvement.

The selkected personnel should undergo a comprehensive trainer development programme in the management of Industrial and Vocational Training.

The aims of such a programme should provide the participants with:-

- A sound understanding of training and its tole in the development of an economy.
- A detailed knowledge of training at management, supervisory, craft and operative level.
- Analytical consultancy and presentation skills.
- A practical grasp of the use of appropriate training methods and equipment.

On completion of the programme participants should be able to:-

- Carry out an Assessment of Training Needs (ATN) on an organisational or regional basis.
- Evaluate the effectiveness of a wide range of training approaches and methods.
- Provide a report outlining the role of training in the development of their own country's economy.

Deploy newly acquired skills in training at operative; supervisory and management level.

The programme content should include:

Training:

- The learning process.
- Training skills.
- Assessment of training needs.
- Training methodology.

The Trainers Job:

- Presentation skills.
- Interviewing and influencing skills.
- Operator training.
- Role of the instructor.
- Supervisory training.
- Management training

Management of Training:

. General management theory and practice.

. Managing and administering training facilities.

. Control and acccunting procedures.

. Personnel administration.

. Safety and hygiene.

Course Design:

. Training Objectives.

. Curriculum and programme development.

. Test-phase and terminal.

. Evaluation/Validation.

. Training Materials-Manuals.
Graphics.
Audio Visual/Computer
Learner Based.

The Trainee:

. Selecting trainees.

. Aptitude testing.

. Counselling and guidance.

. Skill inventories.

Building and Equipment:

. Training Centre location and design.

. Equipment selection and specification.

. Subcontracting training requirements.

Manpower:

. The labour force.

. Skill categories.

. Manpower planning and forecasting.

. Sectoral studies.

The programme methodology should be highly participative and each participant, with the guidance of an expert tutor should work on an individually prepared practical training assignment. This should involve the secondment of participants to Training Centres or selected specialist organisations. The programme should combine this individual approach with theoretical imput. Learning should be reinforced with case studies, group discussions and practical exercises.

At the end of the programme each participant should have:

- **A thorough working knowledge of all aspects of modern training practice and theory.**
- **Gained valuable practical experience which can be adapted to their own organisations.**
- **Have a comprehensive grasp of industrial and vocational training practice and administration.**

CURRICULUM DESIGN:

An Advisory Committee representative of the Department of Manpower Planning, The Ministry of Education, The Centre of Excellence and Industry, should be established to advise on the content and format of programmes to meet natinal requirements. A key objective should be to aim for the highest international standards on such programmes. Much of the core content will consist of available on-the-shelf material.

Sources to include:

- International Carrier Technical Training Manuals.
- Maintenance Management Training Manual - UNIDO.
- Centre of Excellence Courses.

All relevant material should be extracted, synthesed and re-formatted as appropriate. The External Expert should be used in a consultative capacity for this purpose.

P.R. PROMOTION:

The importance and potential benefits of planned maintenance to Ethiopian Industry should be promulgated through Regional/Industry Sector Seminars backed by an advertisement campaign using the various media.

The economic rationale should form the major thrust of this campaign.

In so far as possible local "succes stories" should be communicated in case study format. Endorsements by "high profile" senior industry and business executives should also feature.

A locally published Maintenance "Newsletter" or "Journal" designed to share and exchange information, and co-ordinate Industrial Maintenance activities at the national level would significantally advance good maintenance practice. A central maintenance library, subscribing to the major international publications, and widely disseminated would do much to also "push the state of the art" of good maintenance practice. This library could be located at the "Productivity Improvement Centre" or alternatively form an adjunct to the existing library housed at the Debre-Zeit Management Training Centre.

APPRENTICE TRAINING:

Special consideration should be given to the introduction of a formal Apprentice Training System, incorporating a co-ordinated Industry/Department of Manpower Planning and Vocational Training involvement. A feasibility study should be undertaken to decide on the most suitable system to meet the national requirements.

A suggested four year model for "Refrigeration and Air Conditioning Mechanics" including a job training profile is outlined hereunder. A prerequisite to its introduction however, would be the upgrading of facilities at the Addis Ababba Technical School which should also constitute part of the feasibility study.

OUTLINE OF 4 YEAR APPRENTICESHIP TRAINING MODEL

YEAR	PROGRAMME	TESTS/CERTIFICATES
1.	Off-The-Job Training and related Theory Education (6 months)	Terminal Test Junior Stage Examination
2.	Off-The-Job related Theory/Training (3 months) On-The-Job Exposure (9 months)	*Junior Stage Examination (repeat option)
3.	Off-The-Job related Theory/Training (3 months) On-The-Job Exposure (9 months)	Senior Stage Examination
4.	On-The-Job Exposure (12 months)	*Senior Stage Examination (repeat option) Completion Certificate

(A special facility should be provided for apprentices to "build-up" a tool kit over the four year period) - See Appendix 2

A recommended job training profile for Refrigeration and Air Conditioning Mechanics is listed overleaf.

Job Training Profile - Refrigeration & Air Conditioning Mechanic

Workshop Practice:

1. Bench Fitting, marking out, cutting, filing, drilling, tapping and fixing to specified tolerances.

2. Pipework
   Select and install annealed copper tubing up to $\frac{3}{4}$" using Flare Fittings.

3. Select and install un-annealed copper tubing over $\frac{3}{4}$" using wrought copper fittings.

4. Form bends and off-sets in annealed tubing using bending springs.

5. Form bends and off-sets in copper tubing using hand and machine benders.

6. Select and install steel tubing using Oxy-Acetelyn and Arc welding equipment.

7. Fabricate bends, off-sets and tees in steel tubing.

8. Repair and maintain Copper and Steel Tubing installations on Commercal and Industrial equipment.

9. Fabricate and install Surge Traps and Oil Traps in Discharge and Suction Lines.

10. Select and install Discharge Line wafflers and Vibration eliminators.

11. Select, install, commission, maintain and repair Suction Pressure Regulators.

12. Handle, store and transfer refrigerants safely between storage vessels.

13. Select refrigerant and charge capilliary systems using graduated charging equipment.

14. Select refrigerants charge and leak test systems using R11.

15. Select refrigerant, charge and leak test systems using R12, R22, R500 or R502.

16. Select refrigerant, charge and leak test Ammonia Systems.

Compressors:

17. Select, install, commission, maintain and repair up to 5HP Hermetic Compressors, Single and 3 phase.

18. Select, install, commission, maintain and repair up to 20 HP Semi-hermetic Compressors Single and three phase.

19. Select, install, commission, maintain and repair Open-type Compressors up to 50 H.P.

20. Commission, maintain and repair Reciprocating Compressors Single and 2 stage.

21. Commission, maintain and repair Centrifugal Compressors Single and Multi-stage.

22. Commission, maintain and repair Helical Rotary Compressors.

23. Align Vee Belt and Directo Drive Compressors.

24. Maintain and Repair Cylinder Off-loading systems and mag-valves.

25. Commission, maintain and test pressure relief valves.

Compressor Lubrication:

26. Select Lubricants for low, medium and high-temperature applications.

27. Test and top-up oil in splash and force lubricated compressors.

28. Maintain, fault-find and repair oil circulation systems.

29. Select, install, commission and repair oil safety switches and controls.

30. Select, install, commission and repair oil Seperators.

Condensers - Receivers:

31. Select, install, commission and maintain Air Coolef Condensers (Close coupled and remote).

32. Select, install, commission and maintain Shell and Tube condensers (Close coupled and remote).

33. Install, commission and maintain Evaporative Condensers.

34. Commission and maintain Water Cooling Towers.

35. Install, commission,maintain and repair condenser water pumps.

36. Install, commission and maintain pneumatic and motorised water valves.

37. Select, install, commission, maintain and repair Head Pressure Control devices.

Evaporators:

38. Select, install, commission, maintain and repair Forced Draft evaporators up to 25 kw.

39. Install, commission, maintain and repair D.X. and flooded chillers.

40. Commission, test and maintain secondary coolant systems.

41. Install, commission, maintain and repair refrigerant re-circulating systems and pumps.

42. Install, commission, maintain and repair Evaporator Defrost Systems.

43. Select, install, commission maintain and repair Evaporator Pressure regulators.

Liquid Flow Metering Devices:

44. Select, install, commission, maintain and repair Thermostatic Expansion Valves.

45. Install, commission, maintain and repair high-Side Float Valves.

46. Install, commission, maintain and repair Low Side Float Valves.

47. Insall, commission, maintain and repair electronic Modulating Valves and sensors.

48. Install, commission, maintain and repair pneumatic modulating valves and controls.

Electrical:

49. Design, select, install, commission, maintain and repair Control Panels Single Phase.

50. Design, select, install, commission, maintain and repair Control Panels Three Phase.

51. Select, install, commission and repair Relays, Contactors, Thermal and Magnetic Over-loads.

52. Select, install, commission, test and Repair Single and 3 phase Motors up to 50 k.w.

53. Select, install, commission and test over-current and short circuit protective devices.

54. Select, install, commission, maintain and repair Pressure Control Safety Stitches.

55. Select, install, commission, maintain and repair Temperature Control and Safety Switches.

56. Select and instll conduits, trunking and Cable Trays for cable and tubing protection.

57. Select, install and terminate Multi-core Cables.

Evacuation and De-hydration:

58. Select, install and maintain Suction and Liquid Line de-hydrators and Filters.

59. Install and test Vacuum Pumps and Vacuum Gauges.

60. Select and install suitable purging and evacuating systems.

61. Select, install, commission, maintain and repair Ice Making Machines.

62. **Select and install water supplies and drains.**

63. Install, commission, maintain and repair domestic and plug-in type Refrigerators and Freezers.

64. Install, commission, maintain and repair plug-in type Commercial Display Units.

65. Select, install, commission, maintain and repair Cold Room equipment and controls to 0 C.

66. Select, install, commission, maintain and repair Low Temp. Holding Room equipment and controls to - 30 C

67. Select, install, commission, maintain and repair Blast Freezer equipment and controls.

68. Select, install, commission, maintain and repair Milk Storage Bulk Tank equipmwent and Controls.

69. Install, commission, maintain and repair High and Low Temperature package units and controls.

70. Install, commission, maintain and repair Package type Liquid Chillers and controls.

71. Install, commission, maintain and repair Air Volume dampers and conrols.

72. Install, commission, maintain and repair Heat Pump and Room Air Conditioners.

73. Install, commission, maintain and repair Heat Reclaim Systems and controls.

74. Commission, maintain and Repair Air Conditioning Systems and Controls.

75. Commission, maintain and repair Humidifying Systems and Controls.

76. Select, install , commission, maintain and repair Air Circulation Fans and Controls.

77. Install, commission, maintain and repair Industrial Ammonia Systems and Controls.

78. Select, install, commission, maintain and repair Beer Chiller equipment, controls and pumps.

79. Install, commission, maintain and repair 2 stage Freib abd Ammonia Systems and Controls.

80. Install, commission, maintain and repair Cascade Systems and Controls.

81. Install, commission, maintain and repair Low and Medium temperature, Transport Refrigeration Systems.

Safety:

82. Review safety procedures.

Appendix I

CENTRE OF EXCELLENCE WORKSHOP

Equipment and Tools

(Based on a Class of 12)

ITEM	DESCRIPTION	QUANTITY
1.	Pillar Drilling Machine (floor mounted) 3 Phase 380V 50 Hz. Speeds 200 - 3,500 R.P.M. T Slotted Drilling Table Drilling capacity to 30 mm Spindle Nose with No. 3 Morse Taper, gear driven, power fed Chuck adaptor and chuck Chuck key etc.	1
2.	Heavy Duty Machine Vice for above m/c. with milled slots for precision mounting Replaceable steel bed plate and graduated swivel base. Jaw width 150 mm Opening 130 mm	1
3.	Lathe	1
4.	Pedestal Grinder, double ended 3 phase 380V 50Hz. 3,000 R.P.M. 200 mm Grinding Wheel Adjustable Tool Rests	1
5.	Portable Electric Drill (heavy duty) 110V 1 phase Variable speed 200 - 3,000 R.P.M. Chuck, key and second handle	1

ITEM	DESCRIPTION	QUANTITY
6.	Impact Electric Drill, portable heavy duty Dual speed 500 and 16,000 R.P.M. Chuck key and second handle 110V 1PH 50Hz.	1
7.	Vacuum Pump : 230V 50 Hz. Self contained and portable Capacity 2 litres/sec. at atm. pressure Final Vacuum 0.6 pa or 50 microns gas ballast valve and non-return valve	2
8.	Graduated Charging Cylinder Scales in c.c. and grammes Compensation for volume fluctuation 5 kg. capacity Suitable for R12, R22, R502 Equipped with pressure relief valve and pressure gauge	2
9.	Portable Charging Station with self contained vacuum pump Graduated charging cylinder in c.c. and grammes Charging cylinder option of 5 kg. capacity Manifold gauge set and thermistor Vacuum Gauge Pressure relief valves etc.	1
10.	System Flushing Apparatus _ 230V 50 Hz. Self contained with acid resistant pump, R11 container, filters and valves. (Used with Hermetic systems only)	1

ITEM	DESCRIPTION	QUANTITY
11.	Oxy/Acetylene Welding and Cutting Set Reducing Valves and Gauges Non-return valves and 5 m each of Red and black hose Gauge readings in KPa Bottle Keys Welding and burner nets for universal use with range of nozzles, taps - cleaners and gas lighter 2 trolleys	2 Sets
12.	Sheet metal cutting/folding and bending machine. Bench type - hand operated Suitable for material 750 mm wide and up to 8 gauge sheet	1
13.	A.C. arc welding set : 380V 50 Hz A.C. Selector switch for 50, 60, 70, 80 amps 2 and 5 m cables Electrode holder and clamp	1 set
14.	Propane/Butane brazing set Complete brazing set with gas cylinder, reduction valve, pressure gauge in KPa Rush-gas stop safety valve, 1.5 m hose Handle, burners and gas lighter	1 set
15.	Portable Service Cylinders Suitable for R12, R22, R502 with pressure relief valve 5 kg liquid capacity	12 off
16.	Platform Scale Heavy duty type 0 - 15 kg. scale	1

ITEM	DESCRIPTION	QUANTITY
17.	Spring Scale 0-10 kg. scale	4
18.	Bench Vices with folding pipe lining 120 mm width	4
19.	Hoisting Pulley Block Manual operation - gear and chain type Capacity 2 tons. Hoisting height up to 6 mm with load holding capacity	
20.	Open end and ring spanners sets 6 mm - 30 mm in 1 mm steps	4 combination
21.	Combination Spanner Sets 1/4" - 1 5/8" A.F.	2
22.	Adjustable Wrenches 2 with 20 mm opening 2 with 30 mm opening 2 with 40 mm opening 2 with 60 mm opening	8
23.	Flexible Box Spanner Set 15 pcs. 6 - 20 mm	1
24.	Socket sets 12 point 1/2" square drive A.F. metric and Whitworth A.F. 1/4" - 1 1/4" Metric 10 - 32 mm Whit 1/8" - 3/4" in metal box with accessories	2

ITEM	DESCRIPTION	QUANTITY
25.	Socket Sets 3/8" Square drive A.F./mm/Whit A.F. 3/16" - 1/2" mm 4 - 13 mm B.A. 10 - 0	2
26.	Allen Key Sets Metric x 2 1.5 - 22 mm Imperial x 2 1/16" - 3/4" in leather cases	4
	Files with plastic handles	
	Flat medium double cut 200 mm	2
	Half-round medium double cut 200 mm	2
	Round medium double cut 200 mm	2
	Flat, fine double cut 120 mm	2
	Half-round, fine double cut 120 mm	2
	Round, fine double cut 120 mm	2
	Centre punches:	
	100 mm	2
27.	Refrigeration special socket sets See Britool catalogue for details	2
28.	Torque Wrenches (1) 5 to 30 Nm. (2) 30 to 150 Nm.	2
29.	Sheet metal shears	2
30.	Pop Rivette - pliers type Nozzle sizes : 2.4; 3.2; and 4 mm	1
31.	Rubber and plastic hammers 500 g and 300 g respectively	2

ITEM	DESCRIPTION	QUANTITY
32.	Pinch-off Pliers for copper pipe 6 - 16 mm	1
33.	Combination Pinch-off and re-rounding tool for copper pipe 6 - 16 mm	1
34.	Scribers	4
35.	Dividers 200 mm span with interchangeable needle tips	2
36.	Chisels flat 150 mm	2
37.	Hole-punch sets 4, 6, 8, 10, 12 and 14 mm diameter	2
38.	Pulley Puller Set	1
39.	Stud Extractor Set 3 to 20 mm sizes	1
40.	Stock and Die Sets 2 - 16 mm in case	1
41.	Stock and Die Sets 1/8" H.N.F. to 5/8" in case	1
42.	Stock and Die Sets 1/8" N.P.T.F. to 5/8" in case	1
43.	Drill and Stand Set	1
44.	Flaring and Swaging Tool Sets 3/16" - 3/4" Copper	2

ITEM	DESCRIPTION	QUANTITY
45.	Flaring Tool Set Double type set 3/16" - 3/4" Copper	1
46.	Re-surfacing tool for 1/4" - 3/4" Flare	1
47.	Lever Type Swaging Tool for 1/2", 5/8", 3/4",7/8", 1", 1 1/8" and 1 1/4" Copper	1
48.	Tee Extractor Kit (Lever type) from 1/2", 5/8", 3/4", 7/8", 1" and 1 1/8"	1
49.	Electric Tee Extractor Kit for above sizes 110V 50 Hz. A.C. supply Oil Charging Pump Manual and suitable for 5 litre cans Capilliary Tube Cleaner Hydraulic and manual operation G. Clamps 2 + 100 mm 2 + 150 mm	1
50.	Pipe Bending Tool Set (Lever type) With degree indicator on the forming wheels For O.D. copper 6, 8, 10, 12, 16, 18 and 22 mm diameter	6 Sets
51.	Pipe Bending Tool Floor mounting with pipe vice Formers and guides for copper pipe 12 to 35 mm O.D.)) diameter 12 to 35 mm I.D.)	1 Set

ITEM	DESCRIPTION	QUANTITY
52.	Pipe Bending Tool Floor mounting with pipe vice and formers for 20 and 25 mm Galv. Conduit	1 Set
53.	Stocks and Dies Suitable for 20 and 25 mm Galv. Conduit	6 Sets
54.	Vernier Caliper 120 mm long and graduated in mm	2 Off
55.	Micrometer For outside measuring 0 - 25 mm range	2 Off
56.	Inside Caliper 150 mm long, locking joint	2 Off
57.	Outside Caliper 150 mm long with locking joint	2 Off
	Soldering Stations	4 Off
58.	Feeler Gauges 0.05 to 1 mm	1 Set
59.	Engineers Square 200 mm long with scale in mm	3 Sets
60.	Spirit Level 600 mm long	1 Off
61.	Spirit Level 150 mm long	1 Off

ITEM	DESCRIPTION	QUANTITY
62.	Charging Manifold Including hoses (red, blue and yellow) valves and pressure gauges in KPa	2 Sets
63.	Vacuum Gauges, Panel Mounting, Clycerine Filled 120 mm diameter 0-100 PA Scale with re-calibration set screw	2
64.	Compound Gauges, Panel Mounting, Clycerine Filled 120 mm diameter 0-700 KPa Scale with re-calibration set screw	1
65.	Pressure Gauges, Glycerine Filled for panel mounting 120 mm diameter 0-3,500 KPa Scale with re-calibration set screw	1
66.	Dead Weight Tester Suitable for re-calibrating to above gauges	1
67.	U Tube Manometer Suitable for vacuum measurement down to 1 mm Hg.	1
68.	Electronic Vacuum Gauge Thermistor controlled. Scale Range in Microns or Pa. Battery operated in carrying case.	1

ITEM	DESCRIPTION	QUANTITY
69.	Recording Pressure Meter Range O - 3,000 KPa Electronic with facility for measurement of 3 pressures and change-over switch 3 sensors and recording charts 230V 50 Hz. A.C.	1
70.	Temperature Recording Meter Range 60^0C to 120^0C Electronic with facility for simultaneous measurement of 6 temps. High and low temperature scales with change-over switch. 6 Sensors with assortment of clamps 220V 50 Hz. A.C.	1
71.	Thermometers Electronic : Dual Scale Range Scale - 60^oC + 60^oC (High and Low) facility for 4 probes Assortment of probes for product, super-heat, room and air temperature measurement. Self contained battery and carrying case.	1 off
72.	Differential Pressure Gauge Measurement of static pressure differential across coils, filters, ducts, fans etc. Scale in Pa.	1 off

ITEM	DESCRIPTION	QUANTITY
73.	Whirling Hygrometer Scale Range 0 - 30°C Robust type in carrying case	2 off
74.	Recording Hygrometer (Dual Scale) Range 20% to 100% Including Sensors and facility for more than 1 sensor. Recording charts - 220V 50 Hz. A.C.	1
75.	Volt/Watt Meter Reading of actual power being consumed. Range 110 - 220V 0 - 300 watts 0 - 1,500 watts 0 - 3,000 watts including test cords and connectors	1
76.	Clip-on Volt/Amp/Ohm Meter Heavy duty type Range (V) 0 - 150 - 300 - 600 volts (I) 0 - 6 - 15 - 30 - 60 - 300 A (R) 0 - 100 including test leads and carrying case.	6 off
77.	A.V.O. Meter for accurate testing of A.C. and D.C. volts Milliamps and Ohms.	1

ITEM	DESCRIPTION	QUANTITY
78.	(Annie) Hermetic Unit Analyser and Tester with facility for measurement of volts, Amps and Ohms Capacitor and potential relay testing Starting and running of Hermetic Units to include test leads, spare fuses, etc.	2 off
79.	Capacitor Tester Dual Scale 0 - 50 mfd. 0 - 200 mfd. Complete with test lead, carrying case and spare fuses.	1 off
80.	Air Velocity Meter to read velocity in M/S Scales range 0 - 0.5 M/S 0 - 2.0 M/S 0 - 5.0 M/S 0 - 10.0 M/S	1 off
81.	Electronic Gas-leak Detector with audio-visual indication of Halogen Gas leaks. Variable sensitivity and 0.5 m flexible sensor lead. Carrying case and spare battery etc.	2 off
82.	Gas Flame Lead Detectors Propane or Butane Gas operated Supplied with spare copper reactors and L.P.G. hose connection.	4

ITEM	DESCRIPTION	QUANTITY
83.	Rev. Counter Electronic Dual Range 0 - 10 R.P.S. 0 - 50 R.P.S. in carrying case with spare battery and sensing lead.	1
84.	Bell Jar Size 200 x 150 x 150 Complete with base plate and vacuum hose connection	1
85.	Storage Cabinets 2,000 mm High 1,000 mm High Adjustable shelves Steel construction and lockable Pull-out shallow drawers suitable for spanners, socket-sets, dies, small tools etc. Pull-out plastic containers on shelves	4 off 4 off
86.	Trainee Personal Bench/Storage Cabinet/Locker Suitable to store personal tools, notes and clothes. Suitable to store small items of consumable/ durable equipment. Suitable as work bench when dismantling and re-building motors and compressors and assembling control panels.	12 off
87.	Cold Rooms Suitable for low/medium and high temperature installations.	1 off

ITEM	DESCRIPTION	QUANTITY
88.	Refrigeration Equipment for Low Temperature Installation (For Cold Room) 3 - 4 KW Capacity Direct drive compressor and motor Electric defrost evaporator Shell and tube condenser Valves/Controls/Tubing etc.	1 set
89.	Refrigeration Equipment of Medium and High Temperature Installation (For Cold Room) 0.75 to 1 KW capacity Semi-lekmetic condensing unit Electric or hot gas defrost evaporator Valves/Controls/Tubing etc.	1
90.	Air Handling Unit with steam heating coil, secondary refrigerant coil, humidifying system, variable air volume motorised valves etc.	1 off
91.	Packaged Liquid Chiller Liquid chilling unit with remote condenser and with shell and tube evaporator for use with above.	1 off
92.	Window Air Conditioning Units Small capacity of 2 KW/hr Electric heating elements and humidity and temperature controls 230 or 380 Hz. A.C.	2 off

ITEM	DESCRIPTION	QUANTITY
	(STOCK ITEMS)	
93.	Refrigerant R12 in 50 kg. cylinders	12 off
	Refrigerant R22 in 50 kg cylinders	2 off
	R 502 in 50 kg cylinders	3 off
	R 11 in 50 kg drums	2 off
	R 13 in 50 kg. cylinders	1 off
	Dry Nitrogen in 50 kg. cylinders	12 off
	Propane or Butane in 25 kg. cylinders.	6 off

APPENDIX 2

REFRIGERATION MECHANIC TOOLKIT

ITEM	DESCRIPTION	QUANTITY
1.	TOOL BOX Steel construction 5 compartment Size 500 X 200 X 200 mm.	1
2.	Brass lock of good quality	1
3.	Ball Pein Hammer: 650 g Hickory Handle	1
4.	Pliers: Insulated 200 mm long nose off-set	1
5.	Pliers: Insulated 200 mm good quality.	1
6.	*Pliers Circlip: for external use 8 - 25 mm Straight Nose	1
7.	Crimping Tool and Wire Stripper: Insulated Handle 200 mm long.	1
8.	*Scissors: Multi purpose for gasket making etc.	1

ITEM	DESCRIPTION	QUANTITY
9.	Screw Drivers with plastic handles: (a)3 mm tip X 100 mm long insulated. 1 off. (b)6 mm tip X 150 mm long insulated. 1 off. (c)8 mm tip X 200 mm long 1 off.	3
10.	Phase Tester: Insulated, of good quality, for 500 volts. 300 mm tip X 150 mm long	1
11.	Screwdrivers Crosshead: (a)3 mm tip X 100 mm long (b)6 mm tip X 150 mm long	2
12.	Hacksaw Tubular Steel: Adjustable up to 300 mm Good quality grip for hand protection.	1
13.	Junior Hacksaw of good quality.	1
14.	File: Half-round, medium double-cut, plastic handle. 200 mm long.	1
15.	File: Flat, fine double-cut, plastic handle. 150 mm long.	1

ITEM	DESCRIPTION	QUANTITY
16.	Scribber: 200 mm long	1
17.	Dividers: 200 mm long with exchangeable needle tips.	1
18.	Centre Punch: 100 mm long	1
19.	Chisel: 150 mm flat.	1
20.	Universal (Stanley) Knife: With retractable blade and 1 set of spare blades.	1
21.	Spanners: Metric O/E 6 - 25 mm.	10
22.	Spanners: A.F. O/E 1" 9" 2 X 16	1
23.	Adjustable Spanner: of good quality 20 mm gap.	1
24.	Adjustable Spanner: of good quality 30 mm gap.	1
25.	Rachet Spanner: 1" 4 square drive, of good quality.	1

ITEM	DESCRIPTION	QUANTITY
26.	*Valve Stem Socket Spanner: 3" 1" 16 X 4	1
27.	External Bending Springs: 3" 1" 5" 3" 8 , 2 , 8 , and 4	4
28.	Charging Manifold: Robust type with charging lines and flare blanks. Compound Gauge OKPa - 700 KPa pressure Gauge 100 KPa - 3,000 KPa	1
29.	Flaring and Swaging Set: of good quality. 3" 3" 16 - 4 O.D. Copper. (4.7 mm)	1
30.	Tube Cutter: with reamer and spare cutting wheel. 3 mm - 30 mm tubing.	1
31.	Pocket Thermometer in Steel Case: Scale - 40^0 C to 50^0 C approx.	1
32.	Steel Tape: of good quality. 3 M (min. length) with scale in mm.	1
33.	Square (Steel): 200 mm long with scale in mm.	1

ITEM	DESCRIPTION	QUANTITY
34.	Level: of robust quality 600 mm long.	1
35.	Plumb Line: 200 g wt. and 10 M of line.	1
36.	Allen Key Set: Metric in plastic case.	1
37.	Small Dust Brush: 50 mm wide X 150 mm.	1
38.	Safety Goggles: with exchangeable lenses.	1
39.	Stillson: of good quality. 400 mm.	1
40.	Vice Grip Pliers: of good quality. 250 mm.	1
41.	B.A. Box Spanners: 2B.A., 3B.A., 4B.A. and 5B.A.	1

E T H I O P I A

ETHIOPIA

Organisations visited and Persons spoken to :

UNDP Office Addis Ababa	Mr Kadress Vencatachellum - Senior Industrial Adviser
Herbert Hahn (Refrigeration)	Mr Herbert Hahn - Owner/Manager
Ethiopian Food Corporation Faffa Foods Plant	Mr Belete Beyenne - Manager
Ethiopian Meat Corporation State Farm and Processing Plants Awasa (Located 250KM from Addis)	Mr Getachern Demissale - Manager Mr Girma Gudeta - Maintenance Manager
Ethiopian Livestock and Meat Corporation	Mr Kejela Gelana - General Manager Mr Esegaye Asmelash - Deputy General Manager Mr Mahusenay Desta - Operation Manager.
Ethiopian Livestock and Meat Corporation. Manpower Planning and Training Division	Mr Melaka Benhuu - Head of Department. Mr Noah Estifanos - Department Officer.
Horticultural Development Corporation	Mr Girma - Head of Manpower Planning & Training.
Horticulture Marketing Enterprise	Head of Maintenance
Technical School	Principal
Dairy Development Enterprise	Dr Assefa Beyene - Manager Mr Beyene - Maintenance Manager.
Tana Private Limited Company	Mr Raffele Del Gaudio - Technical Manager.
University School of Engineering	Mr Getachew [illegible]h - Head of Mechanical Engineering.

Ethiopian Management Institute	**Captain Ayele Haide - General Manager.**
Debre-Zeit Management Training Centre (located 45 Km for Addis)	Head of Administration
Ethiopian Productivity Centre	Mr Sewde Feleke - Manager Mr Yohannes Tecle - Head of Maintenance Dept. Mr Negyssie Mehari - Head of Production Dept. Mr Jerzy Donarski - UNDP/ILO Expert (Adviser to EPC)
Ministry of State Farms Development	Mr Mesfin Mebratu - Head of Planning Department.
Department of Manpower (Centre of National Planning)	Mr Getachen Minas - Head of Manpower Planning.

SUMMARY OF RECOMMENDATIONS :

- Manpower projections and skills/training needs survey for the Industrial Sector should be undertaken for the period 1987 - 1992. This excerise should be carried out under the aegis of the Department of Manpower Planning.

- Facilities at the "Ethiopian Productivity Centre" should be developed as the Centre of Excellence for both Refrigeration and Air Conditioning technical updating and development of personnel in Maintenance Management and Systems Application.

- An External Expert should be appointed to advise and assist with launch of programmes and provide periodic follow-up.

- Programme Lecturers/Trainers should be drawn jointly from the "Ethiopian Productivity Centre" and Industry.

- Trainer Development Fellowships should be awarded to:

  Mr Mahusenay Desta - Ethiopian Meat Corporation
  Selected candidates from - Dairy Development Enterprise
  - Ethiopian Meat Corporation

- Programme curricula should be developed collectively between the "Ethiopian Productivity Centre" qualified Industry Trainers and other interested parties. The external expert should co-ordinate this exercise.

- Refrigeration and Air Conditioning Training Hardware should be provided to the Centre of Excellence.

- Short duration intensive appreciation sessions should be developed and run for Senior and Line Managers/Supervisors particularly on planned maintenance benefits and concepts and organisational support.

- Modules on training/instructional techniques should be developed and included on Maintenance Management Programmes to enable participating companies strengthen their function capability.

- Promote the programmes and benefits to industry through Sector/Regional Consciousness Raising Seminars backed by an advertisement campaign using the various media including T.V.

- Programmes in the areas of Maintenance Management and Systems Application should be made widely available to other sectors of industry.

- Special Programmes in the areas of "Procurement", "Stores Management/Inventory Control" and Spare Parts Manafacture should be provided at the Centre of Excellence.

- Urgent consideration by the relevant agencies should be given to the introduction of a Formal Apprentice Training Scheme.