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ASSISTANCE TO THE ZAMBIA INDUSTRIAL AND MINING CORPORATION LTD. (ZIMCO) RESEARCH, DEVELOPMENT AND INNOVATION (RDI) UNIT DP/ZAM/90/010 REPUBLIC OF ZAMBIA

Terminal report*

Prepared for the Government of Zambia
by the United Nations Industrial Development Organization,
acting as executing agency for the
United Nations Development Programme

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Vienna

* This document has not been edited.

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EXPLANATORY NOTES

Exchange rate of the local currency and an explanation of abbreviations are given below.

A. Local currency

Value of the local currency during the period of the main field mission in terms of United States dollars (US $) was

1 US $ ... ZMK 60.82 (May/June, 1991).

B. Abbreviations

B.1 Technical abbreviations and units of measure

bln	billion (1000 mln)
cubm	meters cube
dia.	diameter
kW	kilowatt
mln	million
m	meter; metric
MW	megawatt
pcs	pieces
sq.m	square meters
tpd	tons per day
tpy	tons per year
y	year

B.2 Acronyms and local abbreviations

ANFO	ammonium nitrate fuel oil explosives
AOSCA	Association of Official Seed Certifying Agencies
BOZ	Bank of Zambia
BP	British Petroleum Co. Ltd.
CAB	Commonwealth Agricultural Bureau
CBD	Coffee Berry Disease
CHL	Contract Haulage Ltd.
CNSL	cashew nut shell liquid
CVRI	Central Veterinary Research Institute
CTA	Chief Technical Adviser
CTS	Consolidated Tyre Services Ltd.
cv.	cultivar
DEC	Digital Equipment Corporation
DPB	Dairy Produce Board
DUS	distinction/uniformity/stability (in crop testing)
D.W.	dressing weight
EBZ	Export Board of Zambia
ECBA	economic & cost/benefit analysis
EEU	Economic Evaluation Unit (INDECO)
ESCO	Engineering Services Corp. Ltd.
ETL	Eagle Travel Ltd.
FAO	Food and Agricultural Organization of the United Nations
FNDP	Fourth National Development Plan
GDP	Gross Domestic Product
GPL	General Pharmaceuticals Ltd.
GRZ	Government of Zambia
HW	hardware
ICI	Imperial Chemical Industries Plc
IDDA	Industrial Development Decade for Africa
IEDC	Indeco Estate Development Company Ltd.
IML	Indeco Milling Ltd.
INDECO	Industrial Development Corp. Ltd.
I/O	input/output
ISIC	International Standard Industrial Classification
ISO	International Standardization Organization
IV	intravenous

KGP	Kapiri Glass Products Ltd.
KIFCO	Kabwe Industrial Fabrics Ltd.
KTC	Kawambwa Tea Company Ltd.
KTZ	Kafue Textiles of Zambia Ltd.
LAC	Lupenga Air Charters
LENCO	Lusaka Engineering Co. Ltd.
LMA	Livingstone Motor Assemblers Ltd.
LPG	liquified petroleum gas
LPRC	Livestock and Pest Research Center
L.W.	live weight
m.c.	moisture content
MCI	Ministry of Commerce and Industry
MDC	Mpongwe Development Company Ltd.
MEMACO	Metal Marketing Corp. of Zambia Ltd.
MINEX	Mineral Exploration Department
MSD	Mechanical Services Division (of ZIMCO)
NAC	National Air Charters
NCDP	National Commission for Development Planning
NCSR	National Council for Scientific Research
NCZ	Nitrogen Chemicals of Zambia Ltd.
NHDC	National Hotels Development Corp. Ltd.
NIEC	National Import and Export Corp. Ltd.
NIECA	NIEC Agencies Ltd.
NIR	near infrared (part of spectrum)
NMC	National Milling Company Ltd.
NPK	nitrogen/phosphorus/potassium fertilizer
ORS	oral rehydration salts
PC	personal computer
PC-AT	personal computer AT
PFP	Policy Framework Paper
PICT	Prague Institute of Chemistry and Technology
PIP	Public Investment Program
PPC	Poultry Processing Co. Ltd.
PTA	Preferential Trade Area for Eastern and Southern African States
PTC	Posts and Telecommunications Corp. Ltd.
PVC	polyvinyl chloride
PVR	plant variety rights
Pvt	Private
R & D	Research and Development
RDI	Research, Development, and Innovations

RDU	Research & Development Liaising & Coordinating Unit; RDI Unit
ROP	R.O.P. (1975) Ltd.
R.S.A.	Republic of South Africa
SADCC	Southern African Development Coordination Conference
SIDA	Swedish International Development Agency
SIDO	Small Scale Industry Development Organization
SITC	Standard International Trade Classification
SME	Self-Management Enterprise
SRTD	scientific research and technology development
SW	software
TAZA	Truckers Association of Zambia
TAZAMA	TAZAMA Pipelines Ltd.
TAZARA	Tanzania-Zambia Railway Authority
TIRC	Tree Improvement Research Center
TNDP	Third National Development Plan
TPM	tripartite meeting
UBZ	United Bus Co. of Zambia Ltd.
UNZA	University of Zambia
UTTA	United Transport and Taxis Association
VIS	Village Industry Service
WHO	World Health Organization
WMRC	Waste Materials Recycling Center
ZA	Zambia Airways Corp. Ltd.
ZADL	Zambia Agricultural Development Ltd.
ZAFFICO	Zambia Forestry and Forest Industries Corp. Ltd.
ZAL	Zambia Appointments Ltd.
ZAM	Zambia Agriculture Management
ZAMEFA	Metal Fabricators of Zambia Ltd.
ZAMOX	Zambia Oxygen Ltd.
ZAP	Zambia Pork Products Ltd.
ZB	Zambia Breweries Ltd.
ZCBC	Consumer Buying Corp. of Zambia Ltd.
ZCC	Zambia Cashew Company Ltd.
ZCCM	Zambia Consolidated Copper Mines Ltd.
ZECCO	Zambia Engineering and Contracting Co. Ltd.
ZES	Zambia Engineering Services Ltd.
ZESCO	Zambia Electricity Supply Corp. Ltd.
ZIM	Zimco Institute of Management
ZIMCO	Zambia Industrial and Mining Corp. Ltd.
ZINCOM	Zambia Industrial and Commercial Association
ZMA	Zambia Manufacturers' Association

ZMK	Zambian Kwacha
ZNBS	Zambia National Building Society
ZNCB	Zambia National Commercial Bank Ltd.
ZNIB	Zambia National Insurance Brokers Ltd.
ZNTR	Zambia National Tourist Board
ZNWMC	Zambia National Wholesale & Marketing Co. Ltd.
ZPL	Zimco Properties Ltd.
ZR	Zambia Railways Ltd.
ZSBS	Zambia Steel and Building Supplies Ltd.
ZSC	Zambia Sugar Co. Ltd.
ZSIC	The Zambia State Insurance Corp. Ltd.

ABSTRACT

Project title: Assistance to ZIMCO RDI (Research, Development, and Innovations)

Project number: DP/ZAM/90/010

Purpose of project:
To strengthen ZIMCO's reliance on domestic raw materials, upgrade its production effectiveness and product quality, and utilize adequate local and acquired technologies through establishing a RDU (Research & Development Unit) to engage in a selective exploration of ZIMCO's development potential in the area of Research, Development, and Innovations (RDI).

Project objectives:
1. To establish an institutional R & D structure within ZIMCO that will promote and coordinate all RDI activities of the ZIMCO Group of companies in the areas of agronomy and food processing, transport and system analysis, and chemical industry and technology.
2. To sustain a process of rapid industrial growth, mobilize domestic and foreign resources and technology for the industrial development of the country via improved and strengthened institutional support in research and development.

Project duration: 6 months, with subsequent extension period planned for project upscaling

Conclusion:
Based on a comprehensive definition of operations and a list of potential RDI projects, the RDU will start its liaising and coordinating activities in four priority subsectors, eventually to expand so as to cover research and development throughout the ZIMCO/INDECO Group, with useful outputs for the Government.

Further assistance by UNDP/UNIDO is envisaged to bring up this institution building project to full-scale operational capability and to include the training and material support (equipment) components.

A total of 62 specific, technology-oriented development projects and/or innovations were outlined and recommended for thorough review and possible implementation.

INTRODUCTION

This is an institution building project aimed at assisting R & D at subsidiary companies of the Zambia Industrial and Mining Corporation (ZIMCO).

The present project, DP/ZAM/90/010 "Assistance to ZIMCO Research, Development, and Innovations (RDI)", is a follow-up to DP/ZAM/88/028 "ZIMCO Technology Audit".

ZIMCO's R & D is being strengthened by establishing a RDI Liaising and Coordinating Unit (RDU).

This US$ 60,000 project represents a scaled-down initiation effort to start up the RDU which for full effectiveness, should be expanded to US$ 660,000 during the next Country Planning Cycle.

The scaled-down RDU will operate in the areas of

- agronomy and food processing,
- transport and systems analysis, and
- chemical industry and technology.

The full-scale RDU should eventually cover R & D in all sectors of ZIMCO, i.e., in nearly all sectors of the national economy.

The present project was planned and implemented in accordance with the Terms of Reference approved by UNDP, UNIDO, and GRZ.

The project represents the Phase I of building the new institution.

Information on Project background and Objectives (shown below) is taken over from the project document without amendment, except for formal editing to take account of the progress of the project.

The other topics covered in this Chapter are the official arrangements concerning the project, Phase I project funding, and basic characterization of recommended training and new equipment intended for a potential Phase II of the project.

A. Project background

The present project DP/ZAM/90/010 "Assistance to ZIMCO RDI Unit" is a follow-up to DP/ZAM/88/028 "ZIMCO Technology Audit" (1989).

In 1989, experts from Prague, Czechoslovakia, working through UNIDO, conducted a technology audit of a number of selected subsidiary companies of the Zambia Industrial and Mining Corporation Limited (ZIMCO). As a result of that audit, which was jointly sponsored by UNIDO and ZIMCO, a recommendation, amongst others, was made to and accepted by both the UNDP and ZIMCO that a Research, Development, and Innovations (RDI) Unit be set up under the ZIMCO Directorate for Research to

- promote and coordinate all RDI activities of the ZIMCO Group of companies
- provide information services supporting the RDI activities
- engage in RDI cooperation and planning in relation to non-ZIMCO entities operating at the Government level, the University level, and the company level
- promote and popularize every success of research and development, and
- motivate the wider technical public towards engaging in RDI.

During the course of the audit, it was discovered that most ZIMCO subsidiaries would welcome assistance from the RDI Liaising and Coordinating Unit and were prepared to consult with the Unit on

- the objectives of their R & D
- the scope of their R & D
- the national, technical, and financial requirements of R & D
- the division of tasks for any specific R & D objectives, and
- the schedule of R & D activities.

This project, aimed at improving the situation in Zambia's RDI, is linked up with the following national and international programs of action:

1. the FNDP
2. the UN program of action for African economic recovery and development
3. the Industrial Development Decade for Africa.

B. Official arrangements

Project approval was secured and the project document was signed by

- Mr. M.M. Liswaniso, P.S., NCDP, Lusaka, on 9 January, 1991 on behalf of the GRZ;
- Mr. Alieu M. Sallah, Resident Representative, UNDP, Lusaka, on 21 January, 1991 on behalf of UNDP; and
- Mr. N.N. Tandon, Director, Area Programmes Division, UNIDO, Vienna, on 21 January, 1991 on behalf of UNIDO.

Project execution was entrusted to a team of UNIDO experts nominated by GRZ (cf. Annex 1).

The proposed starting date of project activities was March, 1991. The actual starting date coincided with the original proposal, and actual project execution (the main field mission) took place during the months of April and May, 1991, with concluding activities in June/July, 1991.

The planned project duration was 6 months. The actual project execution period also covering the field mission was 5 months.

C. Contributions

Total contribution by UNDP:

	committed for 1991
US $	60,000

Government inputs:

GRZ and the counterpart agency, ZIMCO/INDECO (cf. Annex 2), made a substantial contribution by undertaking to cover the international experts' costs and expenses while in Zambia, and were expected to make available local facilities and provide counterpart staff as well as access to technology, production, and RDI data.

D. Objectives of the project

The development objective was to sustain a process of rapid industrial growth, mobilize domestic and foreign resources and technology for the industrial development of the country via improved and strengthened institutional support in research and development.

The immediate objective was to establish an institutional R & D structure within ZIMCO - the RDI Liaising & Coordinating Unit, further called RDU (the R & D Unit) that will promote and coordinate all RDI activities of the ZIMCO Group of companies in the areas of agronomy and food processing, transport and systems analysis, and chemical industry and technology.

It can be seen that the present RDU is to limit itself to four subsectors of the national economy (and of ZIMCO/INDECO), and in this sense the original objectives which naturally encompassed all sectors had to be revised when writing the Project Document for the present project, to suit the revised budget.

The ultimate objective of assisting ZIMCO/INDECO through RDI and technology upgrading, encompassing four out of the 10 or 11 subsectors of ZIMCO where the need to coordinate RDI was identified, cannot be met unless and until the new RDU develops its liaising and coordinating capability, plus a range of supporting services, in all the subsectors.

The basic activities aimed at achieving the objectives are outlined in Chapter II.

All the activities stipulated in the Project Document and in pertinent job descriptions for the experts were performed as planned, and the project objectives were attained.

E. Training

There was no training component under the present project, even though informal training and sharing of experience did take place through day-by-day contacts with the ZIMCO/INDECO subsidiaries

and mainly, the counterpart's chief representatives.

Phase II of the project, aimed at upscaling and integration of the RDU, does require extensive training commensurate with the variegated nature of RDI. It is indispensable that those who are to be involved with corporate and/or company level RDI be given an opportunity to tour similar institutions already operating in other countries, and be exposed to adequate training at home and abroad. The training schemes proposed include

- corporate modeling workshops
- individual fellowships and study tours for RDU and senior staff
- in-service training
- computer and data bank training.

F. Equipment

Based on the diagnostic and technology auditing missions to the ZIMCO/INDECO companies and taking into account the individual ongoing and potential RDI projects, the experts were able to fully specify the computer technology and measuring, control, and auxiliary equipment identified as critical to the success of Phase II of the RDU buildup (cf. Annex 7).

G. Subcontracting

None.

RECOMMENDATIONS

A. Recommendations to GRZ

1. Extend further support to project area companies named hereunder, for them to be able to fully benefit from this study and from the equipment and training to be supplied as Phase II (if approved).

2. Through initiation of and participation in the Phase II follow-up project, intensify efforts to improve nationwide and subregional communication and integration and, particularly, the agriculture - industry links and liaisons.

3. For purposes of subregional cooperation and trade in commodities handled at the ZIMCO/INDECO level, cooperate on the PTA/SADCC-to-Governments and Government-to-Government basis in an effort to enhance subregional liaisons in the area of RDI.

4. Cooperate with UNIDO in implementation of proposed training schemes and workshops.

5. In view of necessary modifications to the time horizons, make use of the RDU to keep on file, monitor, and re-assess available studies on the long-term rehabilitation and development strategies for the sectors and subsectors covered by this project, to furnish quality information on technology and RDI as input to the decision-making process at NCDP and other GRZ bodies (MCI, Ministry of Agriculture, Ministry of Lands, Water & Mineral Resources, etc.).

B. Recommendations to ZIMCO/INDECO

1. Set up the RDU as proposed by the TPM in December, 1989. Refer to this report (mainly, Chapter IV) and to appended Technical Reports "A", "C", "F", and "T" (in separate

volumes) for comprehensive implementation guidelines.

2. Register, examine, and possibly implement suggested potential RDI and investment projects (cf. Chapter IV, Section E) to make full use of available RDI potential.

3. Make efforts to upgrade production and services through improved company-to-company RDI liaisons within the Group; refer to Chapter IV, Section B for a detailed breakdown of links and liaisons to be pursued. Among all these links and liaisons, pay maximum attention to strengthening those at the interface between agriculture and manufacturing which offers the promise of maximum benefit for ZIMCO and the nation. Also, develop cooperative linkages between RDU and ZIMCO/INDECO subsidiaries.

4. Maintain an open attitude toward the private sector and develop cooperative linkage between RDU and non-ZIMCO companies and institutions.

5. Do your best to secure funding for Phase II of RDU's buildup, to scale-up and integrate the RDI efforts throughout ZIMCO/INDECO and nationwide, for maximum results. Bear in mind that the equipment and training components also supposed to be funded under Phase II are really also part of Phase I; the RDU cannot properly operate without them.

6. Participate in, and provide necessary support to, the training schemes outlined in Chapter V.

7. The agronomy subsector should concentrate on

   - land use improvement through establishment of new commercial farms, and expanded irrigation;
   - crop diversification (incl. field crops and cash crops);
   - standardization of inputs and outputs in agro-industries;
   - livestock herd expansion and better utilization of milk

   in line with the 19 specific recommendations contained in Technical Report "A".

8. The chemical technology subsector should concentrate on

   - better/wider use of local raw materials;
   - product upgrading and diversification, and new

products;
- anti-import measures and new exports through new technologies;
- strengthening the link to agriculture; and
- environmental protection and waste processing

in line with the 23 specific recommendations contained in Technical Report "C".

9. The food technology subsector should concentrate on

- product innovation and expansion of exports;
- utilization of wastes as secondary raw materials for stockfeeds, for reprocessing, and for the manufacturing industries;
- new industrial projects in the food industry

in line with the 9 specific recommendations contained in Technical Report "F".

10. The transport and systems sector should concentrate on

- systems analysis of transport problems (passenger, cargo, and crude oil by pipeline);
- computer applications in transport optimization;
- installation of a new RDU computing facility interfaced with EEU facility;
- recovery of wastes (spent oil, wrecks, etc.) from transport sector;
- diversification of liquid fuels and reconnaissance of alternative fuels

in line with the 11 specific recommendations contained in Technical Report "T".

11. Make efforts to equip the RDU with computer facilities, analytical instruments, and auxiliary equipment as outlined herein, to serve the RDU as well as the ZIMCO/INDECO subsidiaries and GRZ.

C. Recommendations to UNIDO

1. Assist GRZ and the ZIMCO/INDECO Group through extending and upscaling the present project so that the RDU can encompass all sectors present in the Group, thus developing its full RDI capability.

2. Assist GRZ by undertaking to organize the training schemes and workshops specified hereunder (cf. Chapter V).

3. Recognizing RDI involvement as an urgent priority of the manufacturing sector as well as of agriculture, intensify assistance to RDI and the ZIMCO/INDECO RDU as far as feasible, to secure adequate funding for the RDU Phase II project thus maximizing the RDI capability of the RDU and ZIMCO/INDECO.

4. Support the RDU idea in the non-ZIMCO sector whenever providing UNIDO assistance to Zambia, and assist ZIMCO/INDECO in extending its nationwide and international RDI liaisons; also liaise with the PTA and SADCC Secretariats promoting the RDU idea in the subregion.

I. PROJECT SCOPE

A. Sectors and companies covered

In accordance with the Terms of reference[1] the sectors covered were as follows:

- agronomy
- chemical technology
- food technology
- transport and systems.

A complete list of ZIMCO/INDECO subsidiary and associate companies can be found in Annex 6.

The companies which ZIMCO/INDECO wanted to have covered preferentially in the scaled-down program of the present project were

(i) Premium Oil Industries Limited
(ii) Zambia Maltings Limited
(iii) National Milling Company Limited
(iv) Lusaka Engineering Company Limited
(v) Consolidated Tyre Services Limited
(vi) Kafue Textiles of Zambia Limited
(vii) Zambia Sugar Company Limited
(viii) General Pharmaceuticals Limited
(ix) Poultry Processing Company Limited

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[1]The Terms of reference for the upscaled, comprehensive RDI project (i.e., incl. Phase II) should also cover the following sectors:

- agriculture (broader than just agronomy)
- power, mining & metallurgy
- mechanical engineering (can be combined with transport)
- building trade and materials/construction industry
- corporate/strategic planning (can be supported by the EEU)
- ECBA (likewise).

(x) Supa Baking Company Limited
(xi) Zambia Coffee Company Limited.

INDECO companies were in the focus of attention but because of the potential of RDI for the future of the national economy, the project also addressed selected priority problems of other ZIMCO companies and of Zambia in general.

The companies actually covered are dealt with in Chapter III, Section B and Chapter IV, Section E but mainly in the four Technical Reports attached to this Terminal Report.

B. Professions covered

The professions covered were

- project manager (industrial engineer/chemical technologist & metallurgist)
- agronomist
- chemical engineer - RDI technologist
- food processing specialist
- transport & systems specialist conversant with computers and data bases.

In line with the general orientation of the project, attention was also focused on all inter-sectorial links and liaisons.

II. PROJECT ACTIVITIES

This Chapter presents an analytical account of activities. The method of work and the work phases including the two main field missions are outlined.

A. Method of work

The method of work involved

- a general approach shared by all team experts, incorporating a systems analytical approach applied in the main field mission
- profession-specific approaches for the four expert areas
- other substantive aspects (mainly, equipment and training).

A.1 General approach

A multidisciplinary team was formed so as to match the project requirements. The experience of the team members derived not solely from R & D but also from field experience and industrial operations. The international staff are listed in Annex 1.

Cooperation with local staff was generally very good. In fact, the cooperation of ZIMCO/INDECO subsidiaries and associate companies as well as of the various institutions in the country which are active in or can benefit from RDI was a necessary prerequisite, and the senior counterpart staff (Annex 2) were extremely helpful. The selected companies and institutions were contacted and their managements' reaction to issues mentioned below was sought by the UNIDO experts in order to help them to properly orient the future activities of the RDI Unit's staff:

1 RDI priorities

2 suggestions for RDI coordination & liaising by the RDI Unit

3 participation in ad hoc teams

4 company-to-company input-output links; specifically, data on the nature, quantity, destination, potential use, and environmental impact of specific by-products and/or wastes

5 funding of potential RDI

6 potential RDI projects to be launched; steps to be taken; benefits to be derived therefrom

7 desirable RDI-related information, inputs, and feedbacks from other companies and/or institutions.

All this information was considered by the UNIDO team when defining the RDI Unit's specific activities. The list of persons met is appended as Annex 3.

A.2 Agronomy

Staple crops as well as special agricultural products were considered, cf. Technical Report "A". Issues of technology, yield, plant protection, and organization in agriculture were also addressed.

A.3. Chemical technology

INDECO as well as ZIMCO subsidiaries were analyzed; the chemical aspects of food processing and some other industries (e.g., glass and ceramics) were also considered; pharmaceuticals were included in the analysis; and attention was paid to environmental considerations (cf. Technical Report "C").

A.4 Food technology

Some preference was given to meat processing but all major branches of the food industry were analyzed (cf. Technical Report "F"). Issues of food imports and exports and of minimizing wastage were also addressed.

A.5 Transport and systems

All kinds of passenger and freight transport were tackled, as was the transportation of media (crude oil) by pipelines. Special attention was paid to a systems approach to building the RDU and designing its operations, incl. computer technology (cf. Technical Report "T").

A.6 Other substantive aspects

Cross-sectorial aspects were tackled jointly by all team members. These concerned primarily

- the problem of properly specifying the computer technology and scientific apparatus required for the RDU,
- the general problem of identifying cross-sectorial and other important links to establish RDU supported liaisons
- the general problem of RDU formulation and operation
- the general problem of activating the RDU to assist
    - efforts to raise capacity utilization at subsidiaries
    - process & product quality improvements, and
    - utilization of byproducts and intermediates, waste management, and ecology
- the problem of upgrading the professional qualities of local staff through appropriate training.

B. Work phases

There are to be two phases in the buildup of ZIMCO's RDI capability.

Phase I activities were exhausted by the present project and probed into all aspects of RDI in the four professional areas (plus informatics, data bases, and computer HW and SW). They included

- formulation of the RDU
- outline of RDU startup and routine operations
- definition of project scale-up
- identification of critical equipment and training.

Phase II activities, if approved, will include

- final, detailed specification of equipment and training
- procurement of computer equipment, its initialization at the experts' startup station, and eventual delivery to project area
- consolidation of RDI practices and procedures at the RDU
- upscaling the RDU to full inter-sectorial capability.

Equipment to be provided for Phase II of the RDU (which however is already needed for routine operation during Phase I) is listed in Annex 7. Revised Phase II budget is appended as Annex 8.

III. ANALYSIS OF PRESENT SITUATION

A. Zambia

In addition to the exclusive position of ZIMCO in the country's economy, the over-all status of industry and agriculture in Zambia is determined to a considerable degree by the following features:

- there is a great, largely untapped reservoir of raw materials; abundant workforce and energy; considerable talent; and many attractive resources, but
- the economy operates under many constraints, reflecting on the living standard of the people and scope of new investment;
- so Zambia is a seller's market for many agricultural and manufactured commodities, and
- much research, development, and innovative effort is needed to alleviate the constraints and to upgrade agriculture and industry.

There is a number of common features but different levels of economy, raw material availability, plant and technology standard, and logistic aspects have to be considered individually for each subsector and, indeed, for each subsidiary or associate company.

One feature which applies to all the subsectors covered by this project is that much can be done by improving the liaisons within and between the subsectors.

The country is rich in raw materials outside the mainstay of copper mining. Nevertheless, most of the raw materials which could properly supply the manufacturing industries are yet to be exploited at a reasonable rate.

The energy potential required to turn these raw materials into finished goods is available and is far from being fully utilized.

Advancement is hampered by a number of factors, with logistics

ranking in a prominent position. The locations of raw materials, energy sources, and selling outlets are widely scattered.

The years 1989 and 1990 may be considered as an important turning point in the recent economic strategy of Zambia. The country has entered the 1990s with new hopes and facing new challenges, as it embarked upon a package of radical reforms. These have been endorsed by the World Bank and the International Monetary Fund and have received considerable financial support from international community. Despite a difficult economic situation and hardships of the transition period the country has proved its commitment to a successful implementation of basic economic reforms.

The over-all FNDP strategy for regional development is aimed at reducing the existing intra-regional and inter-regional disparities and giving highest priority to rural development so as to create a strong rural economy and to promote and an equitable regional pattern of development.

The reforms launched in 1989 in the PIP were aimed at improving the parastatal sector's financial and economic viability. These measures were targeted at eliminating the Government's budgetary support for the sector, increasing the parastatals' contribution to Government revenues, and strengthening their ability to compete in foreign and domestic markets. These reforms complemented the Public Enterprise Restructuring Programme undertaken earlier.

The general measures undertaken include the charging of market prices by the companies that reflect costs of production and investment, restructuring of nonviable parastatal companies, and the removal of favorable tax treatment.

The specifics of the professional areas covered, i.e.,

- agronomy subsector,
- chemical technology subsector,
- food technology subsector, and
- transport and systems sector

are dealt with in respective Technical Reports.

B. ZIMCO and INDECO

There are 149 subsidiary and associate companies under the umbrella of the Zambia Industrial and Mining Corporation Limited. These companies, ranging from small-scale workshops to large industrial complexes, are located in Lusaka, the Copperbelt, and numerous other locations throughout the country.

The performance of parastatals under ZIMCO can be characterized as follows:

(a) Major contributions to the Group profits were made by ZCCM, INDECO, ZNCB, BP (Z) Ltd., PTC, and ZSIC (in that order, with ZCCM profits higher by an order of magnitude as compared to all others).

(b) The loss making companies included ZESCO, MINDECO Small Mines, Indeni Refinery, Crushed Stone Sales, Mwinilunga Cannery, Drum and Can, National Milling, Norgroup Plastics, Supa Baking, Zambezi Saw Mills, Zambia Coffee, Cold Storage Corp., Zambia Cashew, National Air Charters, Engineering Services, and Kawambwa Tea.

(c) The reasons for losses included uneconomical tariffs (ZESCO), rundown equipment (Mindeco), low throughput (Indeni), production constraints (Crushed Stone, Zambezi Saw Mills), poor condition of the plant (Mwinilunga), inadequate forex allocation (Drum and Can), uneconomical prices on wheat production etc. (National Milling), low availability of wheat flour (Supa), low international prices (coffee), disproportionately high overhead (Cold Storage), immature plantations (cashew), low turnover (NAC, Engineering Services), low seasonal output (Kawambwa).

B.1 List of companies

A comprehensive list of ZIMCO subsidiaries and associate companies can be found in Annex 6. This Annex is intended as a quick reference; in fact, it includes two alphabetic lists:

- listing with indication of sectors (subsectors) and principal products (services), and
- listing with indication of company location.

In the former of these two lists, the sector indicators used refer to the type of actual company operations and need not coincide with the formal sector designator.

B.2 Analysis of technology & RDI audits

The data on audits dating from 1989 were reviewed and expanded by data gathered during the 1991 mission. Both were used to formulate the final recommendations. It should be noted that there was little actual change in technology and RDI between 1989 and 1991.

C. Companies and institutions outside ZIMCO

These were analyzed less systematically but in considerable detail, to allow for an increased ZIMCO/non-ZIMCO interaction and to respect the growing importance of the private sector which should also be able to benefit from the RDU's activities. Again, the data on

- agronomy,
- chemical industry,
- food industry, and
- transport

can be found in the appended Technical Reports.

D. Performance trends

These were analyzed for
- subsectors
- selected companies.

General outlook for 1991 is that the new policies on prices, forex allocation etc. should show their positive effects but ZMK depreciation and high interest rates make new investments less viable. Over-all financial and operations performance of ZIMCO may be expected to improve. The corporation would be well advised to invest in RDI.

E. Research, Development, and Innovations

While the over-all responsibility for guiding the activities of scientific research and technology development in the country rests with the NCSR, a significant contribution can be made by the companies associated in the parastatals (mainly, ZIMCO and INDECO) and the private sector in both agriculture and manufacturing.

The over-all policies and strategies for scientific research and technology development, as elaborated in the FNDP, are aimed at strengthening the role of this sector in national development efforts aimed at building a sound and progressive national economy. The objectives of the scientific research and technology development (SRTD) sector were stipulated in the FNDP as follows (abridged):

(a) To enhance the role of NCSR in the promotion and coordination of SRTD
(b) To review and strengthen SRTD and to ensure adequate financial allocations and spending on priority research
(c) To encourage industry and commerce, parastatal and private, to invest in local R & D in preference to imported technology
(d) To increase the number of indigenous scientists
(e) To pursue R & D relevant to Zambia's development needs

(f) To improve the national institutional framework for tapping talents
(g) to indigenize technological know-how and to rationalize technology imports
(h) To provide better R & D related information
(i) To better inform the public on the application of SRTD
(j) To support professional societies in science and technology
(k) To participate in international SRTD programs.

Areas of research:

- animal research — livestock, pests; numerous projects
- fisheries research — Itezhi-tezhi lake limnology; limited research
- environmental research — monitoring of Kafue river pollution, Copperbelt atmospheric pollution, toxic chemicals and solid wastes; Environmental and Pollution Control Act
- forestry research — tree improvement research, indigenous trees (musuku, ipiko)
- water resources research — a number of projects; mainly, Kafue river basin inventory
- human and natural resources research — cartographic analyses
- medical research — Tropical Diseases Research and Training Center; NCSR; limited research of local plants
- radiation research — projects in analytical techniques, irradiation, and radioactivity
- industrial research
  - industrial minerals and clays
  - cement and concrete
  - food and biotechnology (microorganisms; baby foods; composite flours in the preparation of bread; development of food products from "Chikanda" tuber; malting studies on millet and sorghum for beer and baby food)
  - natural products (to eradicate snails - schistosomiasis;

acaricide properties of plants)
- technical services (in food technology, industrial minerals, textiles, nuclear chemistry, water testing, environment monitoring, use of natural products in industry)

R & D sector development:

- GRZ allocations for R & D show a steady increase over the years
- costs of R & D are also increasing
- availability of scientists is declining (at the NCSR)
- training programs for R & D are increasing in number.

IV. FINDINGS AND OUTPUTS

Detailed findings and outputs are presented in an essentially sector-by-sector arrangement in the Technical Reports attached hereto. In this Terminal Report, however, the major accent is on

- defining links and liaisons,
- formulating the RDU's functional and operating capabilities, and
- outlining RDU scale-up and integration.

A. Sectorial input/output flows

Existing and potential I/O flows (to be monitored by the RDU in priority subsectors, i.e., during Phase I) are defined by recording

- major inputs by subsector in
  - agronomy,
  - chemical industry,
  - food industry, and
  - transport;
- major outputs by subsector, again in
  - agronomy,
  - chemical industry,
  - food industry, and
  - transport;
- the links of various types (cf. Section B); and
- the characteristics (qualitative or quantitative descriptors) of these links

making them more or less suitable for establishing liaisons (cf. Subsection B.2).

B. Links

The links existing within ZIMCO/INDECO (and within Zambia's economy outside ZIMCO/INDECO) belong to various types and comprise an open network which should be explored for the purposes of RDI.

B.1 Types of links

The following types of links can be distinguished from the point of view of the RDU and ZIMCO/INDECO management:

- process flow and other in-house links
- company-to-company input-output links
- links between sub-sectors
- links to other sectors of national economy
- links to GRZ and non-ZIMCO institutions.

Clearly, all these are "horizontal" links mainly providing for the flow of goods and services. This does not include the "vertical" links transmitting information and commands.

B.2 General system of links and liaisons

This general representation is an attempt to systematically encompass all kinds of liaisons, existing and potential, within an economy. At different levels, this can be

- a technological system such as an industrial works, a farm, or a trading company;
- a Group of companies within a sector or subsector;
- a holding company or Group transgressing the sectorial boundaries and providing an umbrella for a range of subsidiary and associate companies;

- a national economy;
- an international business community.

At each level, the management concerned with the system's efficiency, effectiveness of operations, and future developments can greatly benefit from a

- reasonably detailed,
- reasonably complete, and
- reasonably accurate

knowledge of the internal and external links connecting the system elements with one another and with the outside environment. The benefits include

- an increased RDI potential;
- streamlining of operations, communication, and decision making;
- opportunity for well-founded system restructuring;
- improved allocation of resources; and
- additional data on the feasibility of investment projects.

The holding company level is the nearest representation of the ZIMCO or INDECO situation.

The links to be considered first can be termed "horizontal", describing the flows of

- inputs such as raw materials (but also utilities, manpower, passengers/freight, or any other inputs);
- intermediates;
- products; and
- wastes

throughout the system, from one system element to another. Immaterial (information) transmissions on the horizontal links can also exist.

Vertical or structured links must also be considered. Essentially, they transmit information, commands, and instructions, including those on RDI. Rarely they transmit material flows.

SYSTEM ELEMENTS

On the horizontal plane, let the system comprise i discrete

elements E representing the companies (manufacturers, traders) participating in an open economic and business system. The system is open because links to outside the system also exist.

The number of descriptors (indices, subscripts) of an element can be selected so as to best suit the system specifics.

INPUTS AND OUTPUTS

An input to an element is either consumed within that element or converted into an output.

The possible outputs of an element include

- the products;
- the intermediates;
- the wastes.

Each of these outputs can be

- either inputted in some other element of the system,
- or consumed outside the system.

The source of an input to an element is

- either an output of some other element,
- or some "undefined" source outside the system.

SYSTEM LINKS

A link is defined by the existence of flow between

- two elements of the system, or
- a system element and outside environment.

Any two elements can have multiple links. The following types of links can exist:

- element-to-element links, i.e.,
  - product of one element becomes input to another element;
  - intermediate of one element becomes input to another element;

- waste of one element becomes input to another element;

- element-to-outside links, i.e.,

  - input from the outside enters one element;
  - product of one element exits the system;
  - intermediate of one element exits the system;
  - waste of one element exits the system.

Each of the seven different types of links has its significance for the system management.

The links are vectors, always implying direction of flow. Important characteristics of the system structure are

- the intensity of links, i.e., link power
- the number of links issuing from (or entering) any one element, i.e., link density
- the length of links (in terms of geographic distance or time)
- the types of links present ("color")
- the flow rate.

These characteristics vary over the system surface, and can be used collectively or separately to examine system complexity and performance.

Likewise, the links crossing the system boundaries are indicators of the degree of loading of outside environment. They allow to measure the system's general and partial reactions to environment.

POPULATING THE SYSTEM

The only prerequisite to ascertaining and examining the links is to define (populate) the system.

The system elements are defined by allocation and characterized by their descriptors. The outside environment is defined by setting the system boundaries.

The inputs and outputs of the system elements can be defined using a data bank approach. The links existing (or, vice versa, lacking) within a system are defined as soon as the

- elements,
- inputs, and
- outputs

are known.

The links connecting the system with outside environment are defined as soon as the system boundaries are set.

Above general, formalized representation of the system of links and liaisons can basically be applied to the description of any business community. As such it provides a generalized guideline for Links and liaisons data bank layout.

C. Formulation of RDU in priority subsectors

The functions and services to be performed by the RDI Unit upon completion of the project include

- promotion of RDI activities to help solve the most urgent problems of the national economy, taking into consideration Government priorities, utilization of local resources, and environmental protection

- setting up ad hoc teams to solve specific problems in the field of RDI, with the participation of specialists from the subsidiaries

- establishing and maintaining linkage between the R & D activities at the Government level, the ZIMCO/INDECO level, the university level, and the company level

- gathering, sorting, analyzing, and disseminating information on ZIMCO's

    - RDI activities (results)
    - products and their properties
    - wastes
    - technical and scientific instruments

- advising on the choice of technology.

C.1 RDU objectives

These include

- substitution of raw materials
- improvement of products
- utilization of wastes
- applicability of special products or wastes for specific use
- sharing of laboratory and testing equipment
- sharing of know-how, etc.

C.2 RDU activities

Specific activities to be performed/considered during Phase I in the priority subsectors (agronomy, food, chemical, and transport) and which are to expand to eventually cover all major subsectors under Phase II include

- RDI consulting
- mediation of intra-sectorial and inter-sectorial contacts and links
- collection and dissemination of scientific and RDI information
- technology auditing (of subsidiaries not covered by the ZIMCO Technology Audit)
- organization of training
- data logging and analysis
- regular RDI project screening.

C.3 RDU outputs

These partly coincide with the "functions and services" listed:

- RDI promotion
- RDI coordination within the Group
- RDI cooperation and planning nationwide
- RDI conducted by the RDU
- RDU information services
- data acquisition
    - data acquisition techniques
    - information on RDI
    - information on technology upgrading
    - information on the transfer of know-how
- RDI surveying
    - general
    - identification of production constraints
    - identification of technology related losses
- RDI related training
- data dissemination
    - data dissemination techniques
    - identification of recipients of information.

In fact, it is sometimes difficult to clearly distinguish what is an "activity", a "function/service", or an "output" - the important thing is that all of them are valid RDI constituents.

D. RDU operation in priority subsectors

RDU project phases, RDU staffing, RDI methodology, RDU facilities, and RDU management and financing are outlined.

D.1 Schedule of operations

Phase 0 (Definition) is accomplished by presenting this report to ZIMCO/INDECO.

Phase I (Startup and Routine) can begin as soon as staff, premises, basic facilities, and financing to cover operating costs are available.

Phase II (Upscaling and Integration) is dependent on securing adequate funding (cf. Annex 8) for the upscaling, and financing to cover integrated RDU operations.

D.2 RDU staff

- RDU Head
- Agronomy specialist
- Chemical technology specialist
- Food technology specialist
- Transport & systems specialist
- Secretarial support.

Job descriptions for the four specialists can be found in respective Technical Reports ("A" for agronomy, "C" for chemical, "F" for food, and "T" for transport and systems).

The problem of filling the RDU Head's post is most delicate and writing a job description would only confuse the issue. This should be a talented person with adequate education and experience, capable of providing leadership and always anxious to explore new horizons. His background is of secondary importance but he should be able to assess for himself not only the theoretical and technological but also the practical business aspects of RDI. He should be trusted by ZIMCO/INDECO management, and well paid.

D.3 RDU methodology

Guidelines for national staff for the Phases 0, I, and II of RDU's buildup are given in the Technical Reports. Standard good R & D practice should be followed throughout. However, the RDU is not a research institute so the R & D component should not be allowed to override the liaising function which, in the light of present experience, is regarded as crucial.

Detailed recipes to be followed are given in the Technical Reports.

Phase II should involve participation by international as well as national experts; this would give opportunity for redefining methodology, should this become necessary, on the basis of Phase I experience.

D.4 RDU premises and facilities

The obvious phase 0 requirements are quite modest (office desk for each RDU appointee, and access to computer) and can be covered by the resources of ZIMCO/INDECO Headquarters. For all other requirements, see Section F.4 below.

D.5 RDU management and financing

As originally envisaged, the RDU should operate under the ZIMCO Directorate for Research and Development. Alternative arrangements are possible though. Inasmuch as the RDU should also provide inputs to GRZ, the RDU's relations to GRZ Ministries (during Phase I, mainly to MCI and Ministry of Agriculture) should be clearly defined.

An organizational arrangement such that will bring the RDU and

the EEU close together is desirable.

Principal sources of financing to be considered include

- ZIMCO/INDECO HQ;
- ZIMCO/INDECO subsidiaries;
- target oriented GRZ subsidies;
- contracts with non-ZIMCO sector;
- fees for services (instruments/analyzes, computing, literature, arbitration, etc.).

Also cf. Section F.5 below.

E. RDI POTENTIAL

An in-depth analysis can be found in the four Technical Reports appended with this Terminal Report. Only a few prominent problems and projects are highlighted here, while major attention is focused on a systematic approach to analyzing RDI potential.

E.1 RDI problems to be analyzed

These are addressed in the Technical Reports and include

- potential new projects
- potential technology transfers
- subsectorial specifics
- R & D priorities.

E.2 R & D priorities

To be considered are

- GRZ priorities
- ZIMCO priorities
- RDU priorities.

These differ from sector to sector. Consequently, they are treated in the four (appended) Technical Reports and reflected in the ranking of the specific recommendations made.

Obviously, in case of conflict, GRZ priorities should override ZIMCO's, and the RDU should implement both. The RDU will have no executive powers to decide on priorities; its status should be consultative.

It is worth noting how important it is to take great care to allow the RDU an unimpeded operation, so that no RDU operational priorities infringe on the real strategic and tactical priorities of GRZ and ZIMCO.

F. RDU scale-up and integration

Scale-up is justified by the need to integrate. The sectors covered should eventually reflect Zambia's major sectors. RDU staff is defined for Phases I and II. Premises and facilities must be planned to allow for unimpeded operation. Financing of scale-up and routine operations is also defined in this Chapter.

F.1 Justification

The need to integrate RDI over all subsectors (among other things, because of strong inter-sectorial ties) and to develop a full operational capability of the RDU provides ample justification for the upscaling project.

F.2 Sectors/subsectors covered

As originally envisaged, setting up the RDI Unit was to have involved US$ 660,000 in foreign exchange and to have covered the following areas:

- agriculture, forestry, and production of foodstuffs
- transport engineering and mechanical engineering
- building materials and construction
- chemical technology
- power and electronics
- economics, marketing, and market research.

But due to the current funding constraints, the RDI Unit will initially operate only in the areas of

- agronomy and food processing,
- transport and systems analysis, and
- chemical industry and technology,

with the understanding that, for full effectiveness, it would eventually expand its activities so as to cover all sectors of ZIMCO while also providing useful integrated outputs for GRZ.

The accent on the various sectors now has shifted slightly, due to a deeper understanding of the problems at corporate level. For sectors to be covered during Phase II (after scale-up), refer to the next Section and also to Footnote in Annex 8.

F.3 Staff and organization

1 - RDU Head
2 - Agriculture specialist (Phases I and II)
3 - Food technology specialist (I and II)
4 - Chemical technology specialist (I and II)
5 - Power/mining/metallurgy specialist (II)
6 - Transport & systems specialist (I)
7 - Mechanical engineering & transport specialist (II)
8 - Building/construction specialist (Phase II)
9 - Corporate planning specialist (II)
10 - ECBA/computer specialist (II)
11 - Secretary (II).

This breakdown of professions however should never be regarded as a bible: ZIMCO/INDECO management should exercise maximum flexibility depending on what quality people can be hired for these jobs, even if the internal divisions should become displaced from what is shown above. Example: If a Mechanical engineer cannot be combined with a Transport specialist in one person, these two jobs can either be separated (while saving by striking a combination elsewhere), or the man with excellent references in either Mechanical Engineering or Transport Engineering (in absence of the other of the two) should be given preference over one who is "just good" at both.

Yet another important point is how to fill the jobs no. 9 and 10. At INDECO HQ, the UNIDO mission was able to observe the setup and some activities of EEU the Economic Evaluation Unit. It certainly appears that the activities of the RDU and the EEU are complementary to say the least, because an important activity of the former is to be evaluations of potential RDI projects while the primary activity of the latter is evaluations of investment projects.

Thus the preferred solution would be to bring the two Units organizationally as close to one another as possible, or even to think of an integrated solution (in which case the RDU would be the umbrella for both technological and economic activities, i.e., for both the "technical" professions and the EEU). In any case, the two economics related posts can be filled using EEU staff.

F.4 Premises and facilities

An office desk for each staff member is all that is necessary for startup.

A test room/laboratory, storeroom, and computer room are needed for Phase II.

Access to computing facilities is needed at startup. Well developed computing facility (as per Technical Report "T") is needed not only for Phase II but even for Phase I routine; the difference between Phase I and Phase II is not the techniques used but rather, the scope covered (and benefit obtained).

Scientific/testing apparatus (as per appended Technical Reports "A", "C", and "T" and also Annex 7 of this report) are needed for Phase II.

Independent, ready-to-use transportation is imperative for Phase II, to be used by the international experts, the RDU staff, senior management of ZIMCO/INDECO concerned with RDI, and members of ad hoc teams from subsidiaries etc.

F.5 Financing

This includes

- scale-up costs (recommended to be partly covered by UNDP assistance), and
- operating costs of the RDU.

F.5.1 Scale-up costs

Proposed project scaleup contribution by UNDP:

	committed for 1991	planned for 1992-1993	revised for 1992-1993	total for 1991-1993
US $	60,000	600,000	437,000	497,000

As concerns the Phase II budget, considerably reduced as against the original 1989 estimate, it is now recommended that the preferred mode should be an extensive involvement of national experts during this upscaling phase. Together with reduced requirements on the duration of the international experts' missions (made possible by the existence of specific local expertise), this will cut the project costs by almost 20% and will be conducive to a further upgrading of the local professional capability already developed during the present (downscaled) phase of the project and also during the previous project the "ZIMCO Technology Audit".

It is worth noting that a factor greatly contributing to this potential saving has been the continuity of involvement by ZIMCO/INDECO as well as by international experts, plus the determined effort by UNDP which raised the funding that was necessary for Phase I of this Project to take off.

F.5.2 Operating costs

ZIMCO/INDECO must cover Phase I operation from the corporate budget. Phase II activities should however be co-financed by subsidiaries, combining a preset rate with fees determined individually on a project-by-project basis.

On the other hand, the revenues eventually raised by the RDU from successful projects or from loans of equipment, diffusion of information, consulting etc., should be split into corporate, subsidiary, and RDU components.

V. PROPOSED TRAINING

The UNIDO team had an opportunity to examine the status of manpower at the subsidiaries, and make observations regarding staff qualifications. Many discussions with management focused on training. Without exception, it has been found by the team (and confirmed by counterpart) that on the one hand, personnel with advanced training and RDI capability is available both at ZIMCO/INDECO HQ and at subsidiaries but, on the other hand, these people are isolated and, on the whole, there is no doubt that in order to raise the effectiveness and productivity at most of the plants visited, it is of great importance to upgrade the professional level of personnel in managerial as well as supervisory positions.

Managerial capability tends to be high while advanced RDI capability tends to be sporadic.

A. Identification of training requirements

Training requirements were ascertained by analyzing existing R & D, potential RDI projects, (cf. appended Technical Reports), and the available level of specialized training.

B. Formulation of training projects

A brief formulation of the five training projects envisaged is given overleaf.

B.1. Computer/data bank training

This will be training in Czechoslovakia, Germany, or Austria (preferably in the country of residence of the international Industrial information expert, cf. Annex 8) where the computer equipment purchased at the onset of Phase II would be temporarily installed for debugging and initialization of data bank and modeling software. This training should be attended by one or two RDU staff. See Technical Report "T".

B.2 Workshop on corporate modeling

A workshop on building and using corporate models at the RDU and in companies of the manufacturing sector is a logical extension to the UNIDO technical assistance and institution building projects. Specifically, the workshop will address cost, production, and financial models as applicable to existing industrial plant and new investment projects. This is a workshop which can best be organized by arrangement with W. S. Atkins Management Consultants, England.

The workshop, preferably to take place in Lusaka, will assemble a multi-disciplinary group of RDU specialists together with senior Group and plant managers for the purpose of undertaking corporate planning within their respective companies.

This is a training workshop extending over 1-2 weeks where the multi-disciplinary group alluded to above would be composed of individuals representing a cross-section from management to technology to accounting and financing. Consequently, several subsidiaries would each send out as trainee either an engineer or a sales oriented manager. This will eventually create a pool for the RDU to choose from when nominating ad hoc RDI teams.

The provision of this World Bank approved corporate modeling software goes hand in hand with the training component and amounts to acquiring the software application licenses together with the training.

B.3. Strategic planning & modeling workshop

Training in the implementation of the "FORECASTER" technique already applied at the MCI could be handled as follow-up to a UNIDO project for MCI now completed; would also take care of continuity of thought and compatibility of data bank formats between ZIMCO/INDECO and MCI.

B.4 Plant rehabilitation workshop

There are over 40 entities within ZIMCO which can be characterized as industrial plants. As confirmed by the missions, many of them suffer from poor capacity utilization and are in need of rehabilitation. Isolated efforts to enhance capacity utilization were often fruitless and rehabilitation plans face difficulties at implementation. Rehabilitation is also thwarted by the general condition of the national economy and by the shortage of foreign exchange, making it increasingly necessary to rely on foreign aid. The optimal rehabilitation technologies are yet to be defined for some of the plants.

The principal issues that need to be addressed at the RDU level include plant rehabilitation, upgrading of technology, maintenance of equipment, and potentially even subregional cooperation within the industry.

All this information is needed by the RDU to keep up to date the ZIMCO/INDECO management, for them to reformulate their Group policies.

This should be a workshop taking the form of in-service training, addressing technological, methodological, and economic issues of rehabilitation common to most subsidiaries. It could be organized to involve the private sector as well, possibly even at a subregional (i.e., international) level. This could be discussed with PTA Secretariat where staff experienced in organizing rehabilitation workshops is available.

B.5 RDI study tours and fellowships

These are based on the principle of exchange of experience, providing for later partnership oriented cooperation.

Recognizing that considerable experience can be gained through personal contacts among professionals of similar orientation and having ascertained that each of the RDU specialists and others concerned with RDI has a lot to gain through visits to foreign establishments of similar orientation in the way of technology, innovation, and/or organization, a program of study tours for senior management and fellowships for RDU staff is proposed.

VI. ACHIEVEMENT OF IMMEDIATE OBJECTIVES

Actual results are compared with schedules, targets, and objectives.

A. Comparison of results with schedules and targets

The planned project duration was six months. Project execution started in March, 1991 by CTA's briefing at UNIDO. Full adherence to schedules and targets is documented by Annex 5.

Detailed schedule of field work was updated in April, 1991 (Annex 4) and can be confronted with the general schedule of activities (Annex 5).

Equipment specification for Phase II "RDU scale-up and integration" (Annex 7) was compiled from the Technical Reports.

The targets of the project were met in full. The issue of training was addressed to an extent considerably wider than required by the project document, but commensurate with the needs of the RDU and of ZIMCO/INDECO.

B. Comparison of results with objectives

Efforts were made by the UNIDO team to meet the project objectives in spirit as well as by the letter of the formal terms of reference.

The field team probed into questions of production, technology, maintenance, general business environment and prices, and RDI.

The team drew a list of equipment and instrumentation to be purchased by UNIDO and supplied to the RDU within this institution building project.

The mission and subsequent analysis yielded a number of suggestions for the RDU and many of the ZIMCO/INDECO subsidiaries. These actually are recommendations to the management and are either potential RDI projects, investment projects requiring RDI, or RDI related problems to be monitored and analyzed.

The objectives are best classified as

(i) establishing or upgrading RDI
(ii) plant personnel training
(iii) improvement in capacity utilization, productivity/production, and product quality; and
(iv) well-substantiated expansion and rehabilitation.

The immediate objective of formulating the RDU and its operations has been achieved. The RDU can start operations as soon as its staff is available.

In summary, the objectives of the project were attained. In some cases more was attained than envisaged by the project document and the work plan (identification of constraints and of a broad range of potential industrial projects extending beyond the scope of R & D), in other cases the results are more modest (due to difficulties in finding proper personnel for staffing the new RDU). However, the results are at least satisfactory in all fields and can serve as a solid basis for further development. Specifically, the RDU is now fully defined and can start operations as soon as the constraints of staffing and operational funding are overcome.

VII. UTILIZATION OF PROJECT RESULTS

The immediate benefit has been that ZIMCO/INDECO management have been thoroughly acquainted with the project results during the project presentation and review meeting held in the last days of the field mission. Particularly, the general strategy toward up-scaling the RDU has been explained in the context of specific development projects and innovative suggestions. Transfer of experience would have benefited if ZIMCO/INDECO already had appointed the RDU staff, as envisaged in the Project Document for DP/ZAM/90/010.

Utilization proper can start as soon as ZIMCO/INDECO receive the UNIDO report. Once the RDU will settle into a routine, and especially after scale-up, utilization is expected to comprise three major elements:

A. Implementation by ZIMCO/INDECO
B. Utilization by GRZ
C. Liaisons to non-ZIMCO institutions.

The project produced many specific modes of results and suggestions. Obviously, it will take time to explore them, and the RDU will have to tackle these results in a succession, not simultaneously. In the area of medium term development (Phase II), the most important item will be the instrumentation and equipment to be provided to the RDU to serve the subsidiaries' R & D needs; this will alleviate a number of bottlenecks identified by the field mission.

The short and medium term development should be well advised to follow the recommendations and to implement the suggested improvements as spelled out in the Chapters above.

Both medium and long term development are bound to benefit from follow-up training and workshops.

It has been ascertained by the field mission that an important factor which affects the level of utilization of RDI results is the necessity to enhance company-to-company communication for the purpose of exchange of data and experience. This factor should be stressed in all subsequent activities of the RDU, in the interest of ZIMCO/INDECO and of Zambia in general.

VIII. CONCLUSIONS

A total of 62 potential R & D and technology oriented projects and innovations were identified in the four subsectors covered by the mission. The feasibility of these projects is to be examined by ZIMCO/INDECO, individual ZIMCO/INDECO subsidiaries, and possibly by GRZ, making use of the R & D liaising and coordination capability of the new Research & Development Unit.

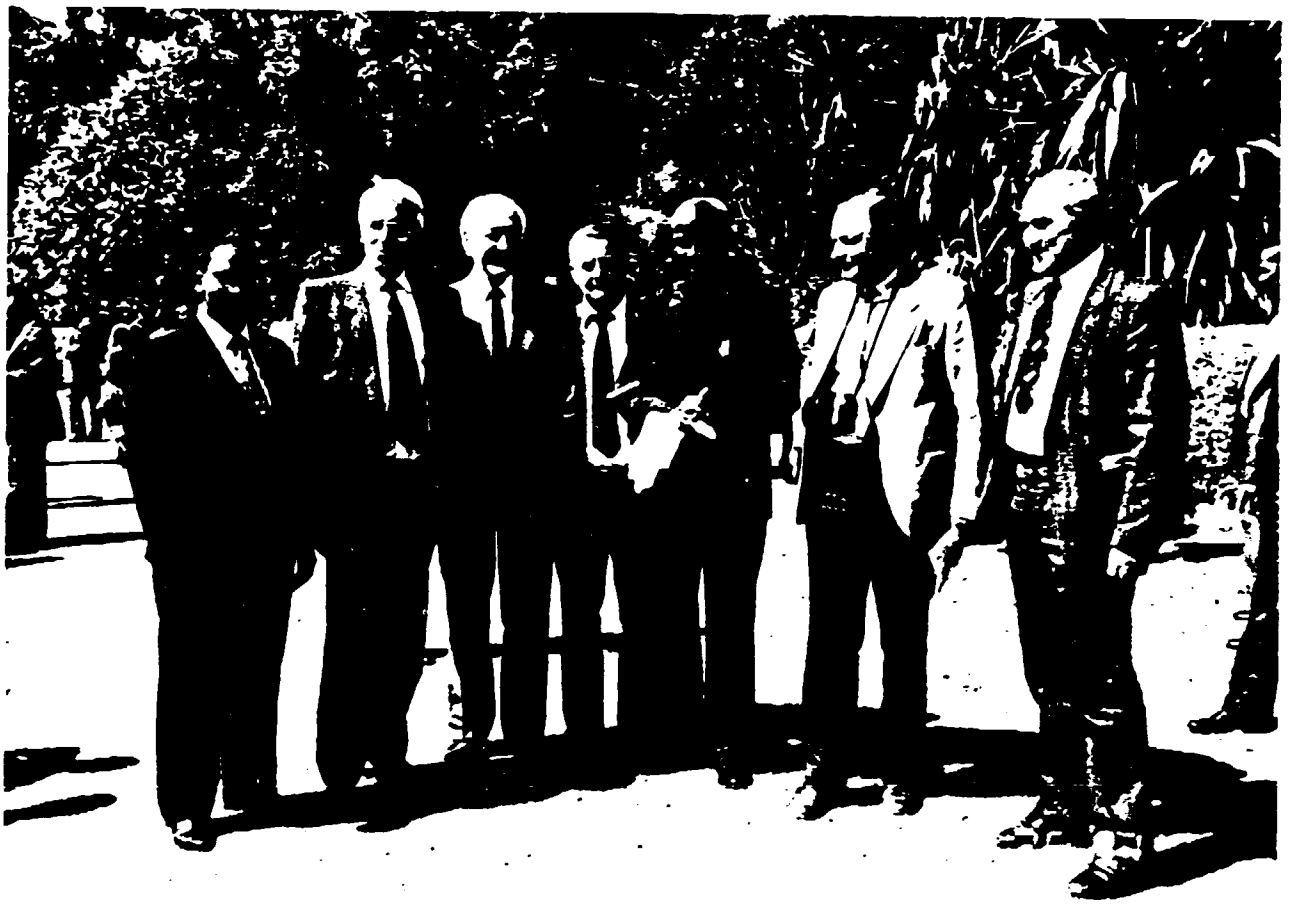
During the rather brief space of time available for the field mission, the team collected a large amount of information. The profile of the company interviews and plant visits was designed bearing in mind both RDI and sound company operation as the ultimate objectives.

The present document is the result of an analysis of the collected data, aimed at developing RDI potential within ZIMCO/INDECO in order to better satisfy the needs of the country in priority subsectors.

The objectives of the project were attained in compliance with the Project Document. As evidenced by this report and its annexures, this is the result of a full involvement of the experts' team and also of the very good cooperation with the management of INDECO and the ZIMCO/INDECO subsidiaries.

The support of GRZ and INDECO is gratefully appreciated. The Zambian counterpart, INDECO/ZIMCO, provided an excellent environment for the experts' work on the project and mediated contacts with individual subsidiaries and other pertinent institutions.

The guidance of the Industrial Infrastructure Branch of UNIDO in Vienna and the cooperation of the UNIDO Country Director in Zambia is gratefully acknowledged.



Toward the close of the field mission, the team had the honor of having a photograph taken with His Excellency Dr. K.D. Kaunda, President of the Republic of Zambia.

ANNEX 1. International staff

PROJECT PROGRESS REPORT	FORM E-1	United Nations Development Programme		
		Project number	Agency	Reporting Period
		DP/ZAM/90/010	UNIDO	March/June 1991

No.	Post description[2]	Name of expert
01	CTA (Project Manager)	Rudolf STEFEC[3]
02	Agronomy Expert	Vladimir TABORSKY[4]
03	Food Processing Expert	Zdenek GALICEK[5]
04	Transport and Systems Expert	Jaroslav DEDEK[6]
05	Chemical Technology Expert	Ludek VODICKA[7]

[2]Field & home work

[3]independent consultant, Prague/Kladno, Czechoslovakia

[4]Prague Agriculture University, Czechoslovakia

[5]Ostrava-Martinov Meat Company, Czechoslovakia

[6]Plynoprojekt Corporation, Prague, Czechoslovakia

[7]Prague Institute of Chemistry & Technology, Czechoslovakia

ANNEX 2. Senior counterpart staff

Zambia

BWALYA R.L.	Executive Director, Industrial Development Corporation Ltd. (INDECO), Lusaka
CHACKO C.A.	Director (Stockfeeds), Industrial Development Corporation Ltd. (INDECO), Lusaka
TAYLOR E.A.S.	UNIDO Country Director, Lusaka

UNIDO Headquarters, Vienna

PAVLIK J.	IO/IIS/INFR, Project Backstopping Officer
WINKELMANN C.	IO/PPR, Senior Project Personnel Officer

ANNEX 3. List of persons met

ALEXANDER Z.	General Manager, Comark Limited, Lusaka
BANDA L.F.C.	Deputy Director, Ministry of Commerce and Industry, Lusaka
BORSOTTI A.	Deputy Resident Representative, UNDP, Lusaka
BOWMAN P.I.	Operations Advisor, Technical Operations & Corporate Engineering Services, Johnson & Johnson, New Brunswick, N.J.
BUSHE M.	Commercial Manager, AMI Zambia Ltd., Lusaka
BWALYA R.L.	Executive Director, Industrial Development Corporation Ltd. (INDECO), Lusaka
CHACKO C.A.	Director (Stockfeeds), Industrial Development Corporation Ltd. (INDECO), Lusaka
CHADZINGWA J. (Ms)	Energy expert, PTA Secretariat, Lusaka
CHANGUFU F.	Executive Director, Kingstons Ltd., Ndola
CHIBASA W.M.	General Manager, Zamseed Co. Ltd., Lusaka
CHIKWESE A.N.	Manager, Management Information System, Kafue Textiles of Zambia, Kafue
CHILABI T.C.	Executive Officer (Air), Ministry of Power, Transport and Communications, Lusaka
CHISUTA H.M.	Acting Deputy Permanent Secretary, Ministry of Tourism, Lusaka
CHITAH B.M.	Executive Assistant, Zambia National Holdings Limited, Lusaka
DAKA M.E.	General Manager, Consolidated Tyre Services Ltd., Kitwe
DAVEY F.	Production consultant, Zambia Coffee Co., Kasama
DUKA R.	Managing Director, PRAGO Ltd., Lusaka
GRAY E. (Ms)	Public Relations Officer, INDECO
HALL G.J.	Group Sales & Marketing Manager, Toyota Nippon Motor Sales (Z) Ltd., Lusaka
INDOPO S.	Booking Officer, Zambia Airways, Lusaka
JORGENSEN K.D.	JPO, UNIDO, Lusaka
KABAMBA C.S.	Projects Engineer, Industrial Development Corporation Ltd. (INDECO), Lusaka
KABIKA F.M.	Zambia Information Services, Lusaka
KALANDE K.	Administrative Officer, Ministry of Water, Lands & Natural Resources, Lusaka
KALULU S.	Chairman, Zambia National Tourist Board, Lusaka
KAMANGA I. (Ms)	Permanent Secretary, Ministry of Commerce and Industry, Lusaka
KAMBOBO M.F.	Managing Director, NCZ Kafue
KASONGO C.	Assistant Manager, Nkumba Piggery, ZADL, Lusaka

KOPOLO D.	Sales Executive, AMI Zambia Ltd., Lusaka
LACEY A.P.G.	Technical Manager, Consolidated Tyre Services Limited, Kitwe
LIUWA M.	Assistant Secretary, Ministry of Power, Transport and Communications, Lusaka
MacKAIL I.	Project Engineer (Operations), ZSC, Nakambala
MAKONNEN A.	CTA, UNIDO/PTA Secretariat, Lusaka
MASSAWE J.J.	Commercial Information Advisor, PTA Secretariat, Lusaka
MATE O.	Officer, General Services, UNDP, Lusaka
MATHER K.	Managing Director, Wellcome Zambia Ltd., Lusaka
MAUZU D.M.	Economist, Ministry of Commerce and Industry, Lusaka
MBIKUSITA-LEWANIKA M.W.	Dean, School of Business, Copperbelt University, Kitwe
MITTAL A.	Managing Director, ICI Zambia Ltd., Lusaka
MONEY N.J.	Director, Geological Survey Department, Ministry of Mines, Lusaka
MUBITA K.C.	Manager, Economic Evaluation Unit, INDECO, Lusaka
MULALA B.A.	Cotton Development Manager, Lint Company of Zambia Ltd., Lusaka
MULENGA C.	Deputy Permanent Secretary, Ministry of Water, Lands and Natural Resources, Lusaka
MULUBE E.W.S.	Deputy Permanent Secretary, Ministry of Agriculture, Lusaka
MUNYINDA K.	Assistant Director for Agriculture (Research), Ministry of Agriculture, Lusaka
MUTANUKA M.	General Manager, National MIlling Co. Ltd., Lusaka
MWALE S. (Ms)	Travel Care Ltd., Lusaka
MWANZA N.	Assistant Secretary (Power), Ministry of Power, Transport and Communications, Lusaka
MWENCHA J.E.O.	Director of Industry & Energy, PTA Secretariat, Lusaka
MWASE H.	General Manager, Lusaka Engineering Co. Ltd. (LENCO)
MWASE N.R.L.	Regional Transport Advisor, PTA Secretariat, Lusaka
MWENCHA J.E.O.	Director of Industry, PTA Secretariat, Lusaka
MWUNGA E.M. (Ms)	General Manager, Supa Baking Co. Ltd., Lusaka
NAGARZETH A.	Managing Director, Volvo (Zambia) Ltd.
NAKALONGA J.	Senior Economist, Ministry of Commerce and Industry, Lusaka
NAMBAO C.M. (Ms)	General Manager, International Catering Service, Lusaka

NAMBWE P.	Factory Manager, Poultry Processing Co. Ltd., Lusaka
NASIR A.S.	Chief Industrial Planning/Technical Advisor (UNIDO) with the Ministry of Commerce and Industry, Lusaka
NGUVU M.B.N. (Ms)	Permanent Secretary, Ministry of Higher Education, Science and Technology, Lusaka
NJOLOMBA J.K.	Managing Director, J.M.J. Resource Management Ltd., Lusaka
NKANDELA A.S.	Hotel Standards Inspector, Ministry of Tourism, Lusaka
NKANZA P.	National Expert/Industrial Engineer, NCDP, Lusaka
NTASANO O.	Transport Expert, PTA Secretariat, Lusaka
NUNN R.P.	Assistant General Manager (Industrial), ZSC, Nakambala
OPIO J.A.A.	Senior Industrial Expert, PTA Secretariat, Lusaka
PARVANOV V.R.	Director of Strategic Planning, Resource, Market and Investment Policy Division, Industry Development Institute, Sofia; UNIDO expert with the Ministry of Commerce and Industry, Lusaka
PHIRI P.P.	Area Manager, Kingstons Ltd., Lusaka
POPOPO R.	Managing Director, Zambia Pork Products Limited, Lusaka
RANCHHOD K.P.	Managing Director, Polypackers Ltd., Lusaka
SAIDANE A.	Industrial Information Expert (UNIDO) with the PTA Secretariat, Lusaka
TAYLOR E.A.S.	UNIDO Country Director, Lusaka
SAIDANE A.	Industrial Information Expert, UNIDO, Vienna
SAMBONO T. (Ms)	Secretary, Lint Company of Zambia Ltd., Lusaka
SANDALA B.M.	General Manager, Dairy Produce Board
SCHUBER K.	Processing Manager, Buccaneer Ltd., Lusaka
SILWAMBA G.B.	Manager - Medical Services, Medical and Education Trust, Kitwe
SINGOGO L.P.	National Coordinator, Adaptive Research Team, Mt. Makulu, Chilanga
STROUGER P.M.	Assistant General Manager (Agricultural), ZSC, Nakambala
WALMSLEY B.L.	Technical Manager, Zambia Pork Products SME, Lusaka
WERNER W.A.	Representative, Health Systems Management (HSM), Switzerland
ZULU L.	Assistant Secretary (Transport), Ministry of Power, Transport and Communications, Lusaka

ANNEX 4. Revised field mission schedule

	experts	a/m	p/m	o/n
WED 10 April	RJLVZ		arrival Lusaka	Lusaka
THU 11 April	RJLVZ	INDECO	UNIDO	Lusaka
FRI 12 April	RJLVZ	UNDP/UNIDO	ZIMCO/INDECO	Lusaka
SAT 13 April	RJLVZ			Lusaka
SUN 14 April	RJLVZ			Lusaka
MON 15 April	RJLVZ	consultations		Lusaka
TUE 16 April	RJL	Min.Power,Transport&Comm.		Lusaka
	VZ	consultations		Lusaka
WED 17 April	RJL		Min.Comm.&Ind.	Lusaka
	VZ	Zambia Malting		Lusaka
THU 18 April	RVZ	National Milling		Lusaka
	JL	LENCO	Premium Oil	Lusaka
FRI 19 April	RJLVZ	UNZA (cancelled)		Lusaka
SAT 20 April	RJLVZ			Lusaka
SUN 21 April	RJLVZ			Lusaka
MON 22 April	RJLVZ		NCSR	Lusaka
TUE 23 April	RJLVZ	Min.Tourism		Lusaka
WED 24 April	RJLVZ	Min.Agriculture; Min.Water Lands&Nat.Res.		Lusaka
THU 25 April	RJL	EEU (INDECO)		Lusaka
	RL	Min.Comm.&Industry		
	VZ	report writing		Lusaka
FRI 26 April	RJLVZ	Kafue Textiles		Lusaka
SAT 27 April	RJLVZ			Lusaka
SUN 28 April	RJLVZ			Lusaka
MON 29 April	R	dep. from Lusaka		
	JL	NCDP		Lusaka
	VZ	Z.Pork Products (ZAP)		Lusaka
TUE 30 April	JL	CTS (meet GM fm Kitwe in L.)		Lusaka
	VZ	Cold Storage	Dairy Produce	Lusaka
WED 1 May	JLVZ	Labor Day		Lusaka
THU 2 May	JL	Kafue Textiles		Lusaka
	VZ	Nakambala Estate Mazabuka		Lusaka
FRI 3 May	JL	Gen.Pharmaceuticals Kabwe		Lusaka
	VZ	Poultry Processing		Lusaka
SAT 4 May	JLVZ			Lusaka
SUN 5 May	JLVZ			Lusaka

	experts	a/m	p/m	o/n
MON 6 May	JL	consultations		Lusaka
	VZ	ZADL (Z.Agri.Developments)		Lusaka
TUE 7 May	JL	Min.Comm.&Industry		Lusaka
	VZ	Supa Baking		Lusaka
WED 8 May	JLVZ	Min.Higher Ed.Sci.&Tech.		Lusaka
THU 9 May	JL	Min.Water Lands&Nat.Res.		Lusaka
	VZ	consultations		Lusaka
FRI 10 May	JL	Geol.Survey of Zambia		Lusaka
	VZ	Z.Seed		Lusaka
SAT 11 May	JLVZ			Lusaka
SUN 12 May	JLVZ			Lusaka
MON 13 May	JL	report writing		Lusaka
	VZ	ICS (Int.Catering Service)		Lusaka
TUE 14 May	JL	report writing		Lusaka
	VZ	Mt.Makulu		Lusaka
WED 15 May	JLVZ	report writing		Lusaka
THU 16 May	JLVZ	report writing		Lusaka
FRI 17 May	JLVZ	report writing		Lusaka
	R	arrival Lusaka		Lusaka
SAT 18 May	RJLVZ			Lusaka
SUN 19 May	RJLVZ			Lusaka
MON 20 May	RJLVZ	report writing & consult.		Lusaka
TUE 21 May	RJLVZ	INDECO & consultations		Lusaka
WED 22 May	RJLVZ	consult. & report writing		Lusaka
THU 23 May	RJLVZ	consult. & report writing		Lusaka
FRI 24 May	RJLVZ	project presentation & review meeting		Lusaka
SAT 25 May	RJLVZ			Lusaka
SUN 26 May	RJLVZ			Lusaka
MON 27 May	RJLVZ	consult. & report writing		Lusaka
TUE 28 May	RJLVZ	UNDP/UNIDO	ZIMCO HQ	Lusaka
WED 29 May	RVZ	dep. from Lusaka		
	JL	consult. & report writing		Lusaka
THU 30 May	JL	consult. & report writing		Lusaka
FRI 31 May	JL	dep. from Lusaka		

ANNEX 5. Adherence to schedules and targets

PROJECT PROGRESS REPORT	FORM C PROJECT ACTIVITIES	United Nations Development Programme		
		Project number DP/ZAM/90/010	Agency UNIDO	Reporting Period March/June 1991

No.	Activity	Started	Completed	Location
1	CTA's briefing	March 1991	March 1991	Vienna
2	PD analysis	March 1991	April 1991	Prague
3	Preparation of field mission	March 1991	April 1991	Prague/ Vienna/ Lusaka
4	Interview scenario	April 1991	April 1991	Prague/ Lusaka
5	Main field mission	April 1991	May 1991	Lusaka & other locations
6	CTA's mid-mission trip & debriefing	April 1991	May 1991	Prague/ Vienna
7	Technical reports	April 1991	June 1991	Lusaka/ Prague
8	CTA's mission to UNIDO	June 1991	July 1991	Vienna
9	Terminal report	May 1991	July 1991	Lusaka/ Prague/ Vienna

ANNEX 6..List of ZIMCO/INDECO companies

ZIMCO subsidiaries and associate companies: sector classification and principal products/services

Company	Sector	Principal products/services
AFE Ltd.	O,A	agricultural machinery & equipment (retail)
Africa Bound Ltd.	O,T	travel services
Agip (Zambia) Ltd.	C,T	gasoline & petroleum products (retail)
Amalgamated Millers Zambia Ltd. (incl. E C Milling, Robin Hood, Ghirardi Milling)	A	mealie meal & stockfeeds
Anros Industries Ltd.		
Auto Care Ltd.	O,T	automobile care
Avondale Housing Project Ltd.	O	housing
BP (Zambia) Ltd.	C,T	gasoline & petroleum products (retail)
Chilanga Cement Ltd.	O	cement
Choma Milling Co. Ltd.	A	mealie meal
Circuit Construction Ltd.	O	
Circuit Engineering and Tooling Ltd.	O	
Circuit Safaris Ltd.	O,T	travel services
Circuit Saw Milling and Joinery Ltd.	O	timber & products
City Radio and Refrigeration Supplies (1975) Ltd.	O	refrigeration & electronic equipment (retail)
Coffee Industry Services	F	food processing
Consolidated Tyre Services Ltd.	T,C	tyre retreading
Consumer Buying Corp. of Zambia Ltd.	F	food & consumer goods (retail)
Contract Haulage Ltd.	T	transport of cargo
Copper Industry Services Bureau Ltd.	O	industry services
Crushed Stone Sales Ltd.	O	building material (stone aggregates)

Dairy Produce Board	F	milk & products
Duncan, Gilbey and Matheson Ltd.	F	liquors
Dunlop Zambia Ltd.	T	tyres
Eagle Travel Ltd.	0,T	travel services
Engineering Services Corp. Ltd. (ESCO; former MSD)	0,T	engrg. & transport services
General Pharmaceuticals Ltd.	C	intravenous fluids, oral rehydration salts
Hotel Intercontinental Lusaka	0	hotel services
Hotel Intercontinental L/stone	0	hotel services
Hyperion Properties (Jersey) Ltd.	0	
Indeco Estate Development Co. Ltd.	0	estate development & rentals
Indeco Milling Co. Ltd.	A	mealie meal & stockfeeds
Indeni Petroleum Refinery Co. Ltd.	C	fuels & petroleum products
Indo-Zambia Bank Ltd.	0	banking services
Industrial Development Corp. Ltd.	A,C,F,T	mixed
Kabwe Industrial Fabrics Ltd.	0,A	mealie meal bags
Kafironda Explosives Ltd.	C	mining explosives
Kafue Textiles of Zambia Ltd.	0,C	textiles; also coating of tires
Kagem Mining Ltd.	0	mining (precious stones)
Kapiri Glass Products Ltd.	C	glass bottles
Kawambwa Tea Co. Ltd.	A	tea
Livingstone Motor Assemblers Ltd.	0,T	motor vehicles
Luangwa Industries Ltd.	0,T	bicycles, motorcycles & three-wheelers
Lublend Ltd.	C	lubricating oils
Lukanga Investments and Development Co. Ltd.	0	
Lusaka Engineering Co. Ltd.	0,T,A	metal products (window & door frames, bus bodies, nails & bolts, furniture, agricultural implements)
Maamba Collieries Ltd.	0,C	stone coal
Mansa Batteries Ltd.	0,C	dry cell batteries
Memaco Farms Ltd.	F	livestock, pigs, poultry
Memaco Services Ltd.	0	marketing of minerals (Cu, Pb, Zn etc.)
Memaco Trading Ltd.	0	metal trading
Memaco Trading Inc.	0	metal trading

Metal Fabricators of Zambia Ltd.	0	cables & Cu/Al products
Metal Marketing Corp. of Zambia Ltd.	0	metal trading
Mindeco Lumwana Ltd.	0	mining (not operational)
Mindeco Noranda Ltd.	0	mining (not operational)
Mindeco Small Mines Ltd.	0	limestone, feldspar, fluorite, amethyst, tourmaline
Mineral Exploration Dept.	0	exploration services
Mokambo Development Co. Ltd.	0	mining
Monarch Zambia Ltd.	0	containers & hardware (household & industrial); geysers etc.
Mpelembe Drilling Co. Ltd.	0	provision of services to ZCCM
Mpelembe Properties Ltd.	0	service department
Mpongwe Development Co. Ltd.	A	farm crops, gladioli, coffee
Mpulungu Harbour Corp. Ltd.	T	transport of cargo
Mukuba Hotel	0	hotel services
Mulungushi Investments Ltd.	A,F,T	mixed (bus services; farms; milling & stock-feeds; poultry)
Mwaiseni Stores Ltd.	F	food & consumer goods (retail)
Mwinilunga Cannery Ltd.	F	canned pineapples
Nakambala Estate Ltd.	A	sugar cane
National Air Charters Zambia Ltd.	T	air transport of cargo
National Airports Corp. Ltd.	T	air transport services
National Breweries Ltd.	F	opaque beer
National Drug Co. Ltd.	C	pharmaceuticals (retail & manufacture)
National Drum & Can Co. Ltd.	0	drums & cans
National Engineering Services Co. Ltd.	0,T	transport engineering
National Hotels Development Corp. Ltd.	0	hotel services
National Import and Export Corp. Ltd.	F,T	international trading
National Milling Co. Ltd.	A	mealie meal & stockfeeds
National Shipping Line Ltd.	T	transport of cargo
Nchanga Farms Ltd.	A,F	crops & livestock
Ndola Lime Co.	0,A,C	lime
NIEC Agencies Ltd.	F,C	food, consumer goods & pharmaceuticals (wholesale)

NIEC Overseas Services (Zambia) Ltd.	O	international trading
NIEC Stores Ltd.	F	food & consumer goods (retail)
Nitrogen Chemicals of Zambia Ltd.	C	fertilizers & sulfuric acid
Nkwazi Manufacturing Co. Ltd.	O	threads, fishing & mosquito nets
Norgroup Plastics Ltd.	C	plastic containers
Posts and Telecommunications Corp. Ltd.	O	communication services
Poultry Processing Co. Ltd.	F	processed broilers
Premium Oil Industries Ltd.	C,F	hard soaps & detergents, edible oils & fats
Redirection Placement Ltd.	O	recruitment
Reserved Minerals Corp. Ltd.	O	marketing of semi-precious stones
Roan Air Services Ltd. (formerly Mines Air Services)	T	air transport
ROP (1975) Ltd.	C,F	hard soaps & detergents, edible oils & fats
RST Management Services Ltd.	O	mining (ZCCM)
Rucom Industries Ltd.	F	food processing (no longer operational)
Scaw Ltd.	O	engineering services
Supa Baking Co. Ltd.	F	baker's products
Tazama Pipelines Ltd.	T,C	transport of crude petroleum
Technical Management Services of Zambia	O	services
The Zambia State Insurance Corp. Ltd.	O	insurance services
United Bus Co. of Zambia Ltd.	T	passenger transport
United Milling Co. Ltd.	A	mealie meal
ZAL Holdings Ltd. (Zambia Appointments Ltd.)	O,T	travel, transport & technical services (lifts, laundry, ...)
Zambezi Saw Mills (1968) Ltd.	O	timber
Zambia Agricultural Development Ltd.	F	cattle & milk
Zambia Airways Corp. Ltd.	T	air transport
Zambia Breweries Ltd.	F	beer
Zambia National Broadcasting Corp. Ltd.	O	communication services
Zambia Cashew Co. Ltd.	A	cashew nuts
Zambia Ceramics Ltd.	O,C	ceramic products
Zambia Clay Industries Ltd.	O,C	bricks (no longer operational)

Zambia Cold Storage Corp.Ltd.	F	beef
Zambia Coffee Co. Ltd.	A	coffee
Zambia Concrete Ltd.	0,T	railway slippers
Zambia Consolidated Copper Mines Ltd.	0	copper & other metals
Zambia Electricity Supply Corp. Ltd.	0	electric power
Zambia Engineering and Contracting Co. Ltd.	0	engineering services
Zambia Engineering Services Ltd.	0	consulting engrg.services
Zambia Forestry and Forest Industries Corp. Ltd.	0,A	timber & wood products
Zambia Horticultural Products Ltd.	F	processed rice; canned foods; jams; vegetables (retail)
Zambia Hotel Properties Ltd.	0	hotel services
Zambia International Insurance Services Ltd.	0	insurance services
Zambia Maltings Ltd.	A	malt
Zambia National Building Society	0	real estate
Zambia National Commercial Bank Ltd.	0	banking services
Zambia National Insurance Brokers Ltd.	0	insurance services
Zambia National Shipping Co. Ltd.	T	transport
Zambia National Wholesale & Marketing Co. Ltd.	F	food & consumer goods (wholesale)
Zambia Oxygen Ltd.	C	industrial gases
Zambia Pork Products Ltd.	F	pork & meat products
Zambia Procurement Services (Pvt) Ltd.	0	purchasing for ZCCM
Zambia Railways Ltd.	T	railroad transport
Zambia Seed Co. Ltd.	A	seeds
Zambia State Insurance Corp. Ltd.	0	insurance services
Zambia Steel and Building Supplies Ltd.	0	building materials & equipment (retail)
Zambia Sugar Co. Ltd.	A	sugar
Zamcargo Ltd.	T	transport of cargo
Zamlube Refiners Ltd.	C	lubricating oils
ZCCM Kabwe Division	0	lead/zinc
ZCCM Power Division	0	power distribution
ZCCM Luanshya Division	0	copper
ZCCM Mufulira Division	0	copper
ZCCM Nchanga Division	0	copper

ZCCM Nkana Division	0	copper
Zimco Institute of Management	0,A,C,F,T	training
Zimco Properties Ltd.	0	real estate
ZIMOIL	T,C	import of crude

Note: A = agronomy sector
C = chemical industry sector
F = food processing sector
T = transport sector
0 = other sectors not covered by present project

ZIMCO subsidiaries/associate companies and their location:

	Zambia Industrial and Mining Corp. Ltd.	ZIMCO	Lusaka
	AFE Ltd.		Lusaka
	Africa Bound Ltd.		Lusaka
	Agip (Zambia) Ltd.		Lusaka
	Amalgamated Millers Zambia Ltd. (incl. E C Milling, Robin Hood, Ghirardi Milling)		Lusaka
	Anros Industries Ltd.		
	Auto Care Ltd.		Lusaka
	Avondale Housing Project Ltd.		Lusaka
	BP (Zambia) Ltd.		Lusaka
A	Chilanga Cement Ltd.		Chilanga
	Choma Milling Co. Ltd.		Choma
	Circuit Construction Ltd.		Kitwe
	Circuit Engineering and Tooling Ltd.		Kitwe
	Circuit Safaris Ltd.		Kitwe
	Circuit Saw Milling and Joinery Ltd.		Kitwe
	City Radio and Refrigeration Supplies (1975) Ltd.		Lusaka
	Consolidated Tyre Services Ltd.	CTS	Kitwe
A	Consumer Buying Corp. of Zambia Ltd.	ZCBC	Ndola
A	Contract Haulage Ltd.	CH	Lusaka
	Copper Industry Services Bureau Ltd.		Kitwe
	Crushed Stone Sales Ltd.		Lusaka
A	Dairy Produce Board		Lusaka
	Duncan, Gilbey and Matheson Ltd.		Lusaka
	Dunlop Zambia Ltd.		Ndola
	Eagle Travel Ltd.	ETL	Lusaka
A	Engineering Services Corp. Ltd. (former MSD)	ESCO	Lusaka
A	General Pharmaceuticals Ltd.	GPL	Kabwe
A	Hotel Intercontinental		L/stone
A	Hotel Intencontinental		Lusaka
	Hyperion Properties (Jersey) Ltd.		London
A	Indeco Estate Development Co. Ltd.		Lusaka
A	Indeco Milling Co. Ltd.		Ndola
	Indeni Petroleum Refinery Co. Ltd.		Ndola
	Indo-Zambia Bank Ltd.		Lusaka
	Industrial Development Corp. Ltd.	INDECO	Lusaka
A	Kabwe Industrial Fabrics Ltd.		Kabwe
A	Kafironda Explosives Ltd.		Mufulira
	Kafue Textiles of Zambia Ltd.	KTZ	Kafue
	Kagem Mining Ltd.		Kitwe

A	Kapiri Glass Products Ltd.	KGP	Kapiri-Mposhi
A	Kawambwa Tea Co. Ltd.		Kawambwa
	Livingstone Motor Assemblers Ltd.	LMA	L/stone
	Luangwa Industries Ltd.		Chipata
	Lublend Ltd.		Ndola
	Lukanga Investments and Development Co. Ltd.		Lusaka
	Lusaka Engineering Co. Ltd.	LENCO	Lusaka
A	Maamba Collieries Ltd.		Choma
	Mansa Batteries Ltd.		Mansa
	Memaco Farms Ltd.		Kabwe
	Memaco Services Ltd.		UK
	Memaco Trading Ltd.		London
	Memaco Trading Inc.		USA
	Metal Fabricators of Zambia Ltd.	ZAMEFA	Luanshya
	Metal Marketing Corp. of Zambia Ltd.	MEMACO	Lusaka
	Mindeco Lumwana Ltd.		Lusaka
	Mindeco Noranda Ltd.		Lusaka
A	Mindeco Small Mines Ltd.		Lusaka
A	Mineral Exploration Department	Minex	Lusaka
	Mokambo Development Co. Ltd.		Lusaka
	Monarch Zambia Ltd.		Kitwe
	Mpelembe Drilling Co. Ltd.		Luanshya
	Mpelembe Properties Ltd.		Ndola
A	Mpongwe Development Co. Ltd.		Luanshya
	Mpulungu Harbour Corp. Ltd.		
	Mukuba Hotel		Ndola
	Mulungushi Investments Ltd.		Kitwe
A	Mwaiseni Stores Ltd.		Lusaka
	Mwinilunga Cannery Ltd.		Mwinilunga
	Nakambala Estate Ltd.		Mazabuka
	National Air Charters Zambia Ltd.		Lusaka
A	National Airports Corp. Ltd.		Lusaka
A	National Breweries Ltd.		Kitwe
	National Drug Co. Ltd.		Lusaka
	National Drum and Can Co. Ltd.		Ndola
A	National Hotels Development Corp. Ltd.	NHDC	Lusaka
	National Import and Export Corp. Ltd.	NIEC	Lusaka
A	National Milling Co. Ltd.		Lusaka
	National Shipping Line Ltd.		London
	Nchanga Farms Ltd.		Kitwe
	Ndola Lime Co.		Ndola
A	NIEC Agencies Ltd.		Lusaka
	NIEC Overseas Services (Zambia) Ltd.		Lusaka
A	NIEC Stores Ltd.		Lusaka
A	Nitrogen Chemicals of Zambia Ltd.	NCZ	Kafue
	Nkwazi Manufacturing Co. Ltd.		Kafue

A	Norgroup Plastics Ltd.		Ndola
A	Posts and Telecommunications Corp. Ltd.	PTC	Ndola
	Poultry Processing Co. Ltd.		Lusaka
A	Premium Oil Industries Ltd.		Lusaka
	Redirection Placement Ltd.		London
	Reserved Minerals Corp. Ltd.		Lusaka
	Roan Air Services Ltd. (formerly Mines Air Services)		Kitwe
A	ROP (1975) Ltd.		Ndola
	RST Management Services Ltd.		Johannesbg
	Rucom Industries Ltd.		Lusaka
	Scaw Ltd.		Kitwe
	Supa Baking Co. Ltd.		Lusaka
A	Tazama Pipelines Ltd.		Ndola
	Technical Management Services of Zambia Ltd.		Lusaka
	The Zambia State Insurance Corp. Ltd.	ZSIC	Lusaka
A	United Bus Co. of Zambia Ltd.	UBZ	Lusaka
	United Milling Co. Ltd.		Chingola
	ZAL Holdings Ltd. (Zambia Appointments)	ZAL	London
A	Zambezi Saw Mills (1968) Ltd.		L/stone
A	Zambia Agricultural Development Ltd.		Lusaka
A	Zambia Airways Corporation Ltd.		Lusaka
A	Zambia Breweries Ltd.		Lusaka
A	Zambia National Broadcasting Corp. Ltd.		Lusaka
A	Zambia Cashew Co. Ltd.		Mongu
A	Zambia Ceramics Ltd.		Kitwe
	Zambia Clay Industries Ltd.		Kitwe
A	Zambia Cold Storage Corp. Ltd.		Lusaka
	Zambia Coffee Co. Ltd.		Kasama
A	Zambia Concrete Ltd.		Kafue
	Zambia Consolidated Copper Mines Ltd.	ZCCM	Kalulushi
A	Zambia Electricity Supply Corp. Ltd.	ZESCO	Lusaka
	Zambia Engineering and Contracting Co. Ltd.	ZECCO	Lusaka
	Zambia Engineering Services Ltd.	ZES	Ashford
A	Zambia Forestry and Forest Industries Corp. Ltd.	ZAFFICO	Ndola
	Zambia Horticultural Products Ltd.		Lusaka
	Zambia Hotel Properties Ltd.		Lusaka
	Zambia International Insurance Services Ltd.		London
	Zambia Maltings Ltd.		Lusaka
A	Zambia National Building Society	ZNBS	Lusaka
A	Zambia National Commercial Bank Ltd.	ZNCB	Lusaka
	Zambia National Insurance Brokers Ltd.	ZNIB	Lusaka
	Zambia National Shipping Co. Ltd.		

A	Zambia National Wholesale & Marketing Co. Ltd.	ZNWMC	Lusaka
	Zambia Oxygen Ltd.	ZAMOX	Ndola
	Zambia Pork Products Ltd.	ZAP	Lusaka
	Zambia Procurement Services (Pvt) Ltd.		Harare
	Zambia Railways Ltd.	ZR	Kabwe
	Zambia Seed Co. Ltd.		Lusaka
A	Zambia State Insurance Corp. Ltd.		Lusaka
A	Zambia Steel and Building Supplies Ltd.	ZSBS	Lusaka
	Zambia Sugar Co. Ltd.	ZSC	Lusaka
	Zamcargo Ltd.		London
	Zamlube Refiners Ltd.		Kitwe
	ZCCM Kabwe Division		Kabwe
	ZCCM Power Division		Kitwe
	ZCCM Luanshya Division		Luanshya
	ZCCM Mufulira Division		Mufulira
	ZCCM Nchanga Division		Chingola
	ZCCM Nkana Division		Kitwe
	Zimco Institute of Management	ZIM	Lusaka
A	Zimco Properties Ltd.		Lusaka
	ZIMOIL	ZIMOIL	Lusaka

Note: A = Technology Audit performed under DP/ZAM/88/028 (1989)

ANNEX 7. Equipment to be provided on upscaling

Critical nonexpendable equipment to be supplied under the proposed UNIDO technical assistance project:

-	computer hardware and software (see Technical Report "T")	US$ 74,000
-	project service vehicle (see Technical Report "T")	US$ 17,000
-	corporate modeling package (see Chapter V, Section B.2)	US$ 12,000
-	agro-food analytical equipment (see Technical Report "A")	US$ 22,000
-	analytical instrumentation - chemistry (see Technical Report "C")	US$ 24,000
TOTAL		US$ 149,000

Equipment to be acquired for the RDU by ZIMCO/INDECO:

-	agro-food analytical equipment	US$ 8,000
-	analytical instrumentation (chemistry)	US$ 45,000
TOTAL		US$ 53,000

GRAND TOTAL, EQUIPMENT US$ 202,000

ANNEX 8. Budget revision

Assistance to ZIMCO RDI
Phase II - Project Upscaling

Buli	Description	TOTAL m/m	TOTAL US$
	INTERNATIONAL EXPERTS		
11-01	Project manager[8]	3.0	44,000
11-02	Industrial information expert[9]	3.0	39,000
11-50	Short term consultants[10]	10.0	100,000
11-99	SUB-TOTAL, INT. EXPERTS	16.0	183,000
15-00	Project travel		3,000
16-00	UNIDO staff mission		5,000

[8]Approx. 1.5 m/m project area in 3 split missions, plus 1.5 m/m home office.

[9]Approx. 1.5 m/m project area in 2 split missions, plus 1.5 m/m home office.

[10]Approx. 6-8 experts in priority areas; the team composition envisaged at this stage is

11-51	Agriculture expert	2.0	20,000
11-52	Food technology expert	2.0	20,000
11-53	Chemical technology expert	2.0	20,000
11-54	Power/mining/metal. expert	2.0	20,000
11-55	Mech./transport expert	0.5	5,000
11-57	Corporate planning expert	0.5	5,000
11-56	Building/construction expert	0.5	5,000
11-58	ECBA/Computer Expert	0.5	5,000
SUBTOTAL		10.0	100,000

Buli	Description		TOTAL US$
	NATIONAL EXPERTS		
17-01	Systems analyst	3.0	4,500
17-02	Agriculture/food expert	3.0	4,500
17-03	Chemical technology expert	1.0	1,500
17-04	Economist/planning expert	1.0	1,500
17-04	Transport/mech. expert	1.0	1,500
17-05	Power/Mining/Metallurgy expert	1.0	1,500
17-99	SUB-TOTAL, NAT. EXPERTS	10.0	15,000
19-99	TOTAL, PERSONNEL COMPONENT	26.0	206,000
	TRAINING		
31-00	Individual fellowships		37,000
32-00	Study tours		25,000
33-00	In-service training		8,000
39-99	TOTAL, TRAINING COMPONENT		70,000
	EQUIPMENT		
41-00	Expendable equipment		2,000
42-00	Non-expendable equipment:		
	Computer systems (HW & SW)[11]		74,000
	Corporate modeling package		12,000
	Scientific instrumentation and apparatus		46,000
	Vehicle for RDU & international staff[12]		17,000
49-99	TOTAL, EQUIPMENT COMPONENT		151,000
51	MISCELLANEOUS		
59-99	TOTAL, MISCELLANEOUS		10,000
99-99	PROJECT TOTAL		437,000

[11] Including shipping, re-shipping, and handling.

[12] Preferably, landrover or station wagon type capable of carrying loads (instruments & apparatus).

ANNEX 9. Bibliography

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2. Towards an Agro-Industrial Future. Proc. int. symp. RASE, U.K. (1988)

3. Selection of ZIMCO Annual Reports, 1984-1989

4. INDECO Annual Report, 1990

5. ZIMCO TECHNOLOGY Audit: Terminal Report (1989). UNIDO DP/ZAM/88/028

6. Regional centers for the promotion of technologies and methods on the minimization, recovery, and recycling of waste residues (W.M.R.C.). UNIDO project document, 1989

7. New Economic Recovery Programme, FNDP 1989-1993, Volumes I and II, January, 1989 (786 pp.)

8. Economic Report 1990. NCDP, Lusaka (264 pp.)

9. Public Investment Program (PIP), Consultative Group for Zambia, April 1990 (227 pp.)

10. Company papers and reports of ZIMCO/INDECO subsidiaries (1989-1991).

ANNEX 10. Summary of project implementation

PROJECT PROGRESS REPORT	FORM A SUMMARY	United Nations Development Programme		
		Project number DP/ZAM/90/010	Agency UNIDO	Reporting Period March/June 1991
Country and project title ZAMBIA - "Assistance to ZIMCO RDI"			Duration 6 months	Budget US$ 60,000

Date project document approved	Start of field work		Completion of field work		Project review date
	scheduled	actual	scheduled	actual	
January 1991	March 1991	March 1991	July 1991		May 1991

Summary of project implementation

This project progress report worked out in compliance with relevant UNIDO rules describes the activities undertaken by the experts from the start of the project in March 1991 up to the submission of this Terminal Report in July 1991.

The activities covered by the report include:

- CTA's briefing at UNIDO HQ (March)
- main field mission to Zambia by five experts (April/May)
- formulation of the ZIMCO RDU (Research and Development Liaising and Coordinating Unit)
- list of R & D data to be gathered/analyzed by the RDU
- outline of R & D activities to be pursued or monitored
- list and analysis of potential R & D projects to be launched by the ZIMCO/INDECO Group.

A general account of project implementation is attached as Form B and a schedule of project activities is attached as Form C. All field team members are listed in Form E1.

Name of CTA	Date	Forms submitted
Rudolf STEFEC	15 June 1991	A, B, C, E-1

ANNEX 11. Summary of project implementation

PROJECT PROGRESS REPORT	FORM B GENERAL ACCOUNT	United Nations Development Programme		
		Project number DP/ZAM/90/010	Agency UNIDO	Reporting Period March/June 1991

General account of project implementation

1. CTA's briefing at UNIDO HQ.

2. Analysis of project document. This focused mainly on job description breakdown into individual tasks for the CTA and the other experts.

3. Preparation of the main field mission and the tentative field mission schedule.

4. Preparation of the company interview scenario. This was reflected in the feedback received from the ZIMCO subsidiary companies' managements.

5. The main field mission. This started as planned, on 9 April, 1991 and took 8 weeks. The following major activities were involved:

   5 (a) Company visits where the ZIMCO/INDECO companies' reactions to a standardized range of R & D issues were sought (cf. Appendix 4, Revised field mission schedule).
   5 (b) Consulting Zambia's R & D issues with Zambian Government, National Council for Scientific Research, research stations, private companies.
   5 (c) Interview data processing.
   5 (d) Reviewing technology audit data.
   5 (e) Writing the interim report.
   5 (f) Formulation of the RDI Liaising & Coordinating Unit. Writing the technical reports for the four professional areas; writing the terminal report.
   5 (g) Project presentation and review meeting. This took place in Lusaka on 24 May, 1991.

6. CTA's debriefing at UNIDO HQ, final data analysis, and writing the terminal report.

ANNEX 12. Related UNIDO projects now underway in Zambia

DP/RAF/89/850	Manufacture of equipment for road, rail, maritime and inland water transport in Africa; T.L. T. Malinowski + 5 experts; launched by ECA (Economic Council of Africa) and UNIDO
TF/RAF/90/092	Assistance to Chilanga cement; tripartite review in 1991
DP/ZAM/88/026	Investment Promotion Tour/Sugar-Cane Bagasse
DP/ZAM/88/027	Pharmaceutical Manufacturing (GPL = General Pharmaceuticals Limited); includes expansion (intended) to production of veterinary medicines
DU/RAF/87/117	Development of plantation based forest industries.