



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

RESTRICTED

18839

DP/ID/SER.A/1442
22 February 1991
ORIGINAL: ENGLISH

STRENGTHENING OF PESTICIDE DEVELOPMENT CENTRE

DP/IND/89/128

INDIA

Technical report: Feasibility Studies*

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

Based on the work of Michal Nowak,
Consultant in Feasibility Studies

Backstopping officer: B. Sugavanam, Chemical Industries Branch

United Nations Industrial Development Organization
Vienna

* This document has not been edited.

V.91-21828

C O N T E N T S

	page
Acknowledgements	2
1. FINDINGS	3
2. VISITS	5
3. RECOMMENDATIONS	6
ANNEX 1: " GUIDE FOR TECHNO-ECONOMIC FEASIBILITY STUDY PREPARATION "	10
ANNEX 2: " PRE-FEASIBILITY STUDY FOR CARBOXIN 40 SC FUNGICIDE FORMULATION PLANT "	20
ANNEX 3: " UNIDO'S SUBSTANTIVE COMMENTS "	48

A C K N O W L E D G M E N T S:

I am grateful to Dr. K. Dhari, General Manager of Pesticide Development Centre, and National Project Co-ordinator, for his kindness and assistance during the mission. I wish also to express my gratitude to the kind and willing PDC counterpart Mr. S. Kumar, Dy. Production Manager. Acknowledgment is also due to PDC staff for their co-operation.

I. FINDINGS

- 1.1. The Project Document on "Strengthening of Pesticide Development Centre, Gurgaon - II Phase (IND/89/128)", specifies among others the following targets :

(Development Objective) : " In support of agricultural development and public health programmes in the country, strengthening and improvement of the Indian Pesticide Industry by :

- i) development of newer and safer formulation technologies.
- ii) by offering analytical and consultancy services."

(Immediate Objective 1, Output 1) : "Development of technologies and scale up studies for commercialisation of new generation formulations, earlier developed at the PDPI."

(Immediate Objective 2, Output 2) : "Providing technical and consultancy services to the industry by undertaking sponsored research projects on custom formulations, preparation of feasibility and project reports and offering turnkey plants of pesticide formulations."

(Immediate Objective 3, Output 2) : "Interfacing with regional network on pesticides for training of personnel, development of national facilities in the member countries and undertaking consultancy in the areas of pesticide formulations, R&D and quality control."

- 1.2 After analysis of the present state of development, it was found that the Pesticide Development Centre (PDC) already reached the point enabling marketing its services to industry. Main target of PDC in its R&D activity is to develop the indigenous formulation technologies, and then commercialise them via pre-investment services (pre-feasibility and feasibility techno-economic studies).
- 1.3 The main concern of PDC is to gradually obtain self-sustenance through the variety of services provided on commercial basis to small and medium-scale pesticide industry in India, and also to countries of the Region (Regional Network on Pesticides for Asia and the Pacific-RENAP).
- 1.4 PDC researchers have not got enough expertise on economic, financial and finally profitability analysis of the technologies being prepared by them. That is why talks between the researchers and industrialists meet some gap, making mutual understanding and commercialisation of PDC technologies, difficult at present.

- 1.5 In this situation I decided to undertake the following :
- a) Make recommendations on PDC activity towards its closed linking to industrial needs, and suggest marketable services enabling gathering funds for PDC gradual self-sustenance.
 - b) Prepare a Guide, being the more detailed checklist on techno-economic feasibility studies preparation with adequate references to UNIDO "Manual for the Preparation of Industrial Feasibility Studies". A Guide is to help the PDC researchers in better understanding their contribution of the required data and participation in techno-economic feasibility studies preparation, as this is the multi-disciplinary team work.
 - c) Prepare techno-economic Pre-feasibility Study on Carboxin 40 SC Fungicide Project developed by PDC (Case Study).

2. VISITS

The visits were targeted at :

- survey the existing system of commercialization of R&D projects,
- identifying the existing pre-investment procedures along the way :

Customer (feasibility study ordering) - PDC (feasibility study preparation) - Bank (feasibility study appraisal).

To make this survey, the following plants/organisations were visited:

(1) Two small and medium scale pesticide formulation plants in/around Delhi (potential clients for ordering feasibility studies at PDC), i.e.:

- (a) Unique Farmaid (P) Ltd., Ghaziabad, talks with Dr. P.D. Garg- Director Technical
- (b) Dhanuka Agriculture Research Centre, Gurgaon, talks with Dr. D. Sengupta- General Manager (Tech.)

(2) Two visits to investment banks supporting small and medium scale industries (potential appraising organisations of PDC - made feasibility studies), i.e.:

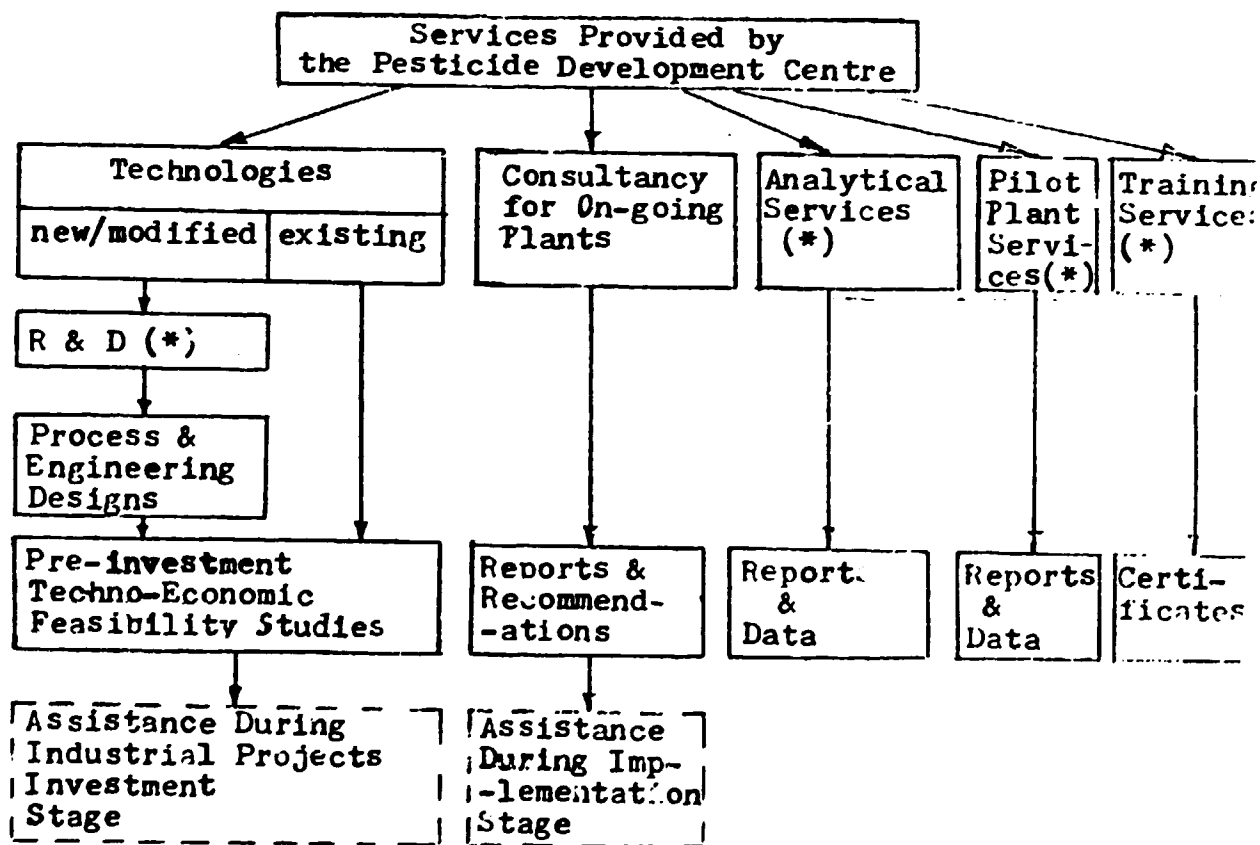
- (a) State Bank of India, New Delhi, Consultancy Bureau, talks with Mr. Rakesh Marwaha.
- (b) Industrial Finance Corporation of India, New Delhi, talks with : Mr. M.M. Sikha, Manager (Tech.),
Mr. P.K. Choudhary - Dy. General Manager (Merchant Banking Division).

Conclusions drawn from the above visits were placed in recommendation part of this report.

3. RECOMMENDATIONS:

3.1. Achieving of self-sustainability is the biggest concern of the Pesticide Development Centre (PDC) at present. To achieve this target, the following commercial services to pesticide industry are recommended :

- a) R&D in pesticide technologies (new or modified), followed by industrial techno-economic feasibility studies,
- b) techno-economic feasibility studies for other industrial projects,
- c) consultancy for on-going plants (trouble-shooting, problem solving, plant rehabilitation),
- d) analytical services,
- e) pilot-plant services,
- f) training of industrial staff.



(*) - services already provided by PDC.

- 3.2 The following steps ought to be undertaken by PDC to implement the above recommendations (items : 3.1. a,b,c,):
- 3.2.1 Employ market analyst, being basically responsible in PDC for collection of data on pesticide market and the market analysis. He/She ought to be also able (if needs arise) to support PDC in the recently acquired knowledge on economic & financial aspects of the feasibility studies preparation.
 - 3.2.2 After recruitment of the above professional by PDC, UNIDO assistance in form of 1 month consultancy in feasibility studies will be required (budget line 11-55). UNIDO assistance ought to concern then with introducing of COMFAR system for computer - aided economic & financial analysis of feasibility studies. Particularly sensitivity analysis will be of use to PDC, as the pesticide formulation industry is based on products-mix. Establishment of computerised data bank on raw materials/semi-products, products, equipment suppliers, etc. required for feasibility studies preparation, ought to be also provided under the above UNIDO assistance.
 - 3.2.3 COMFAR software and manual ought to be purchased from UNIDO Headquarter (charging budget line 40). This ought to be done before the above UNIDO consultancy assistance will be provided.
 - 3.2.4 Nominate Project Coordinators among the PDC senior staff members and assign them with the task of coordination of preparation of techno-economic feasibility studies, concerned with particular industrial projects.
 - 3.2.5 As it is shown on the scheme (item 3.1) apart from the development of new/modified technologies, also the Consultancy for On-going Plants, represents the potential and perspective for PDC self-sustenance. Data available on pesticide industry in India reveal that there is considerable under-utilization of the existing plant capacities in the production/formulation of pesticides. This means that there are some reasons behind it, requiring diagnosis and proposing adequate remedies in every individual case. Technical inefficiencies facing the pesticide formulators, make also the requirements for trouble-shooting assistance. Quality control of pesticides production/ formulation is another field of consultancy assistance to the industry. Also Governmental

requirements for safety operations free from the environmental impact on workers and the surroundings-require direct consultancy assistance to the industry in proposing adequate measures.

The variety of multi-aspect problems facing the existing pesticide industry in India make requirements for their solving i.e. for customer-tailored consultancy services for on-going plants.

The experience I have had from other countries confirm that the consultancy for on-going plants in chemical & allied industries, is the quickest, easiest and cheapest way to collect funds by an industrial R&D organisation.

The consultancy services are aimed at industrial improvements, leading to reduction of production cost and/or increase in sales, and usually involve multi-disciplinary expertise, supported (in limited scope) by a lab /pilot plant tests. The Pesticide Development Centre has got already expertise in production/formulation of pesticides, as well possesses well equipped labs and pilot plant. What is lacking is strengthening of PDC staff in methodology of consulting i.e. in problem identification, diagnosis and development of improved methods/procedures. Therefore UNIDO assistance in form of 1 month assignment in consultancy for on-going plants is recommended (budget line 11-55). The main task of this assignment would be preparation of a Guide for Consulting Engineer i.e. methodology and practical approaches concerned with pesticide industry in India, followed by 1 or 2 practical case studies performed during this mission. The assignment could be extended to cover assistance to PDC in consultancy during project implementation (investment phase). It could cover such areas as :

- methods and procedures of contracting of industrial project, and its organisation,
- methods and procedures of equipment purchasing (invitation to-tenders, tenders evaluation).

3.2.6 Industrial training abroad (2x2 m/m) in consultancy for on-going industrial plants for PDC staff members is also recommended (budget line 31-06). This however ought to be done after completion of the previous recommendation (item 3.2.5).

3.3. Through the establishment of different industry-oriented, commercial services (item 3.1 and 3.2), the PDC income structure will be as follows:

Income Services	in short-term	in medium-term	in long-term
Development of Technologies (R&D)			x
Feasibility Studies for Other Projects	x	x	
Consultancy for On-going Plants	x	x	
Analytical Services	x		
Pilot Plant Services	x		
Training Services	x		

3.4 "Guide for Techno-Economic Feasibility Study Preparation" was written during this mission, as the compilation of data and approaches being used during preparation of a feasibility study. The aim of the Guide was to assist PDC staff members in better understanding of co-relations of data and its processing, during preparation of a feasibility study. The Guide is attached to this report.

3.5 "Pre-feasibility study on Carboxin 40 SC Fungicide Formulation Plant (the case study prepared during the mission) is also attached to this report.

GUIDE FOR TECHNO-ECONOMIC FEASIBILITY STUDY PREPARATION

1. INTRODUCTION

This Guide was prepared for the staff of the Pesticide Development Centre, Gurgaon for better understanding of their contribution for techno-economic feasibility study preparation. This is particularly important as the preparation of feasibility study on industrial projects is the multi-disciplinary team work.

More detailed information on the subject are provided by UNIDO's "Manual for the Preparation of Industrial Feasibility Studies".

2. INDUSTRIAL PROJECT DEVELOPMENT CYCLE

2.1 The project development cycle comprises the following phases :

- pre-investment or feasibility phase,
- investment or implementation phase,
- operation phase.

All three major phases are divisible into stages, some of which constitute important industrial activities. The attached diagram (item 2.4) shows the different phases and stages and the typical activities related to them.

2.2 The pre-investment (feasibility) phase comprises :

- identification of investment opportunities (opportunity study),
- preliminary project selection and definition (pre-feasibility study),
- project formulation stage (feasibility study),
- final evaluation (project appraisal) and investment decision.

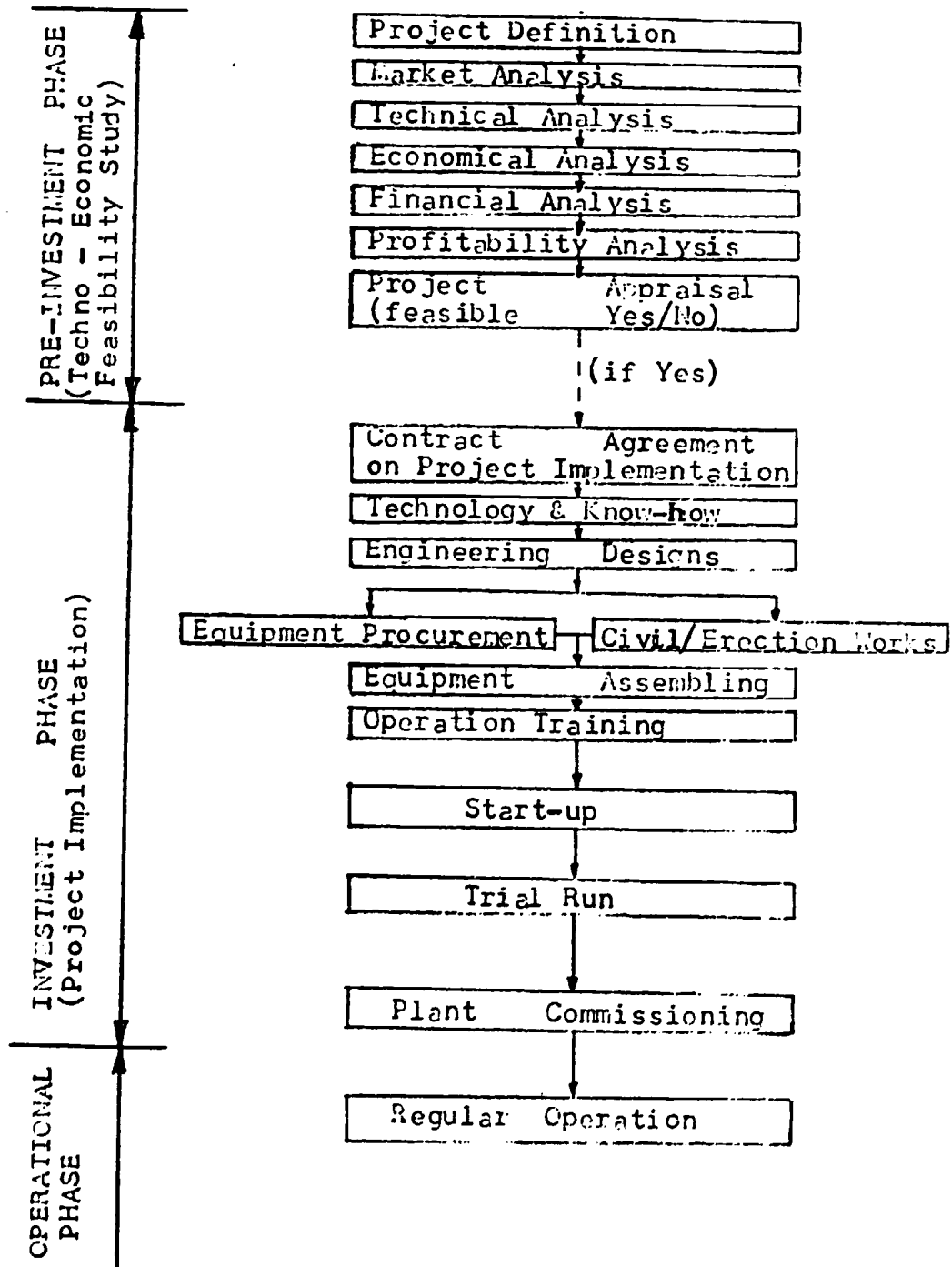
2.3 The consultant's role could extend to cover :

- a) pre-investment phase :
 - opportunity studies,
 - pre-feasibility studies,
 - feasibility studies,
 - projects appraisal.
- b) investment phase :
 - preparation of outline specifications for tender documents,
 - evaluation of tender submissions,
 - supervision of : erection of the plant, supply and installation of equipment, trial-runs and commissioning,
 - selection and training of operational staff and labour.

c) operational phase :

- assistance with the first year's operation

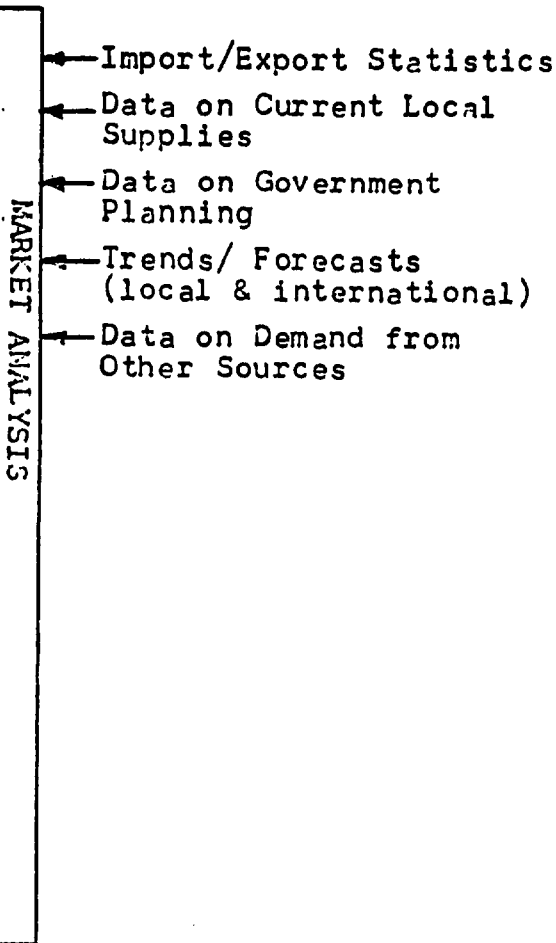
2.4. Project Development Cycle Diagram :



3. REQUIREMENTS OF DATA FOR TECHNICO-ECONOMIC FEASIBILITY STUDY PREPARATION (INPUT / OUTPUT BREAK-DOWN).

3.1 MARKET ANALYSIS :

INPUT :

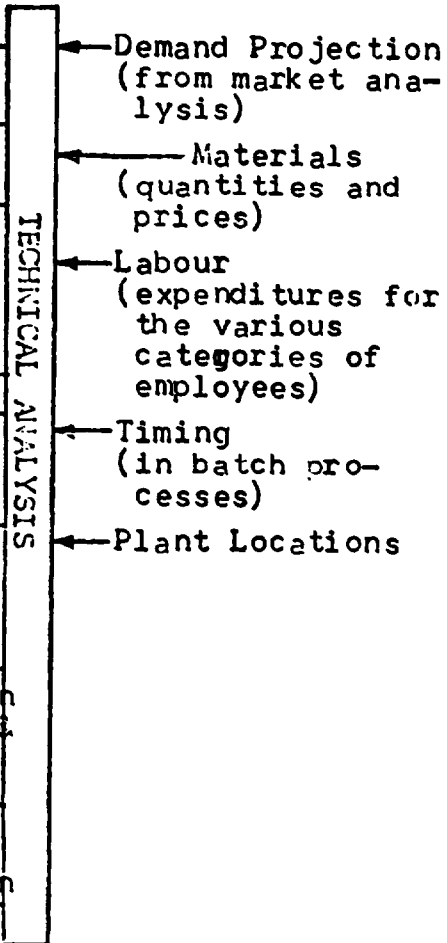


OUTPUT :

Demand Projection
(in a 5-10 years time horizon)

3.2 TECHNICAL ANALYSIS :

INPUT :

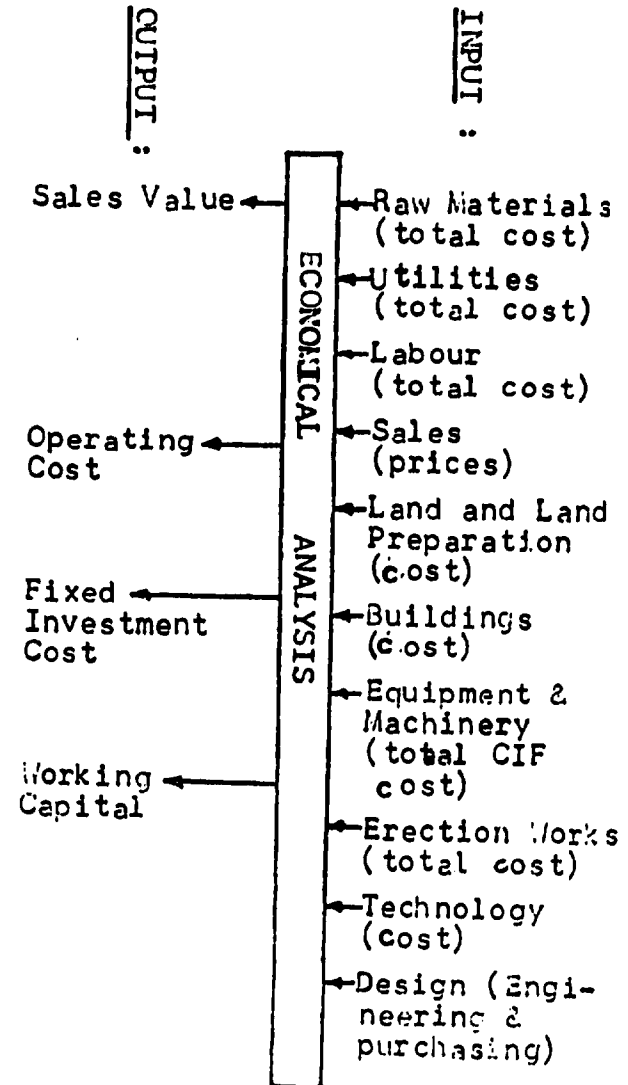


OUTPUT :

Production Programme
Plant Capacity
Process Description & Diagrams
Raw Materials (requirements and costs)
Utilities (requirements and costs)
Labour (requirements and costs)
Equipment & Machinery (Specification of equipment & costs)
Plant Layout
Implementation Scheduling

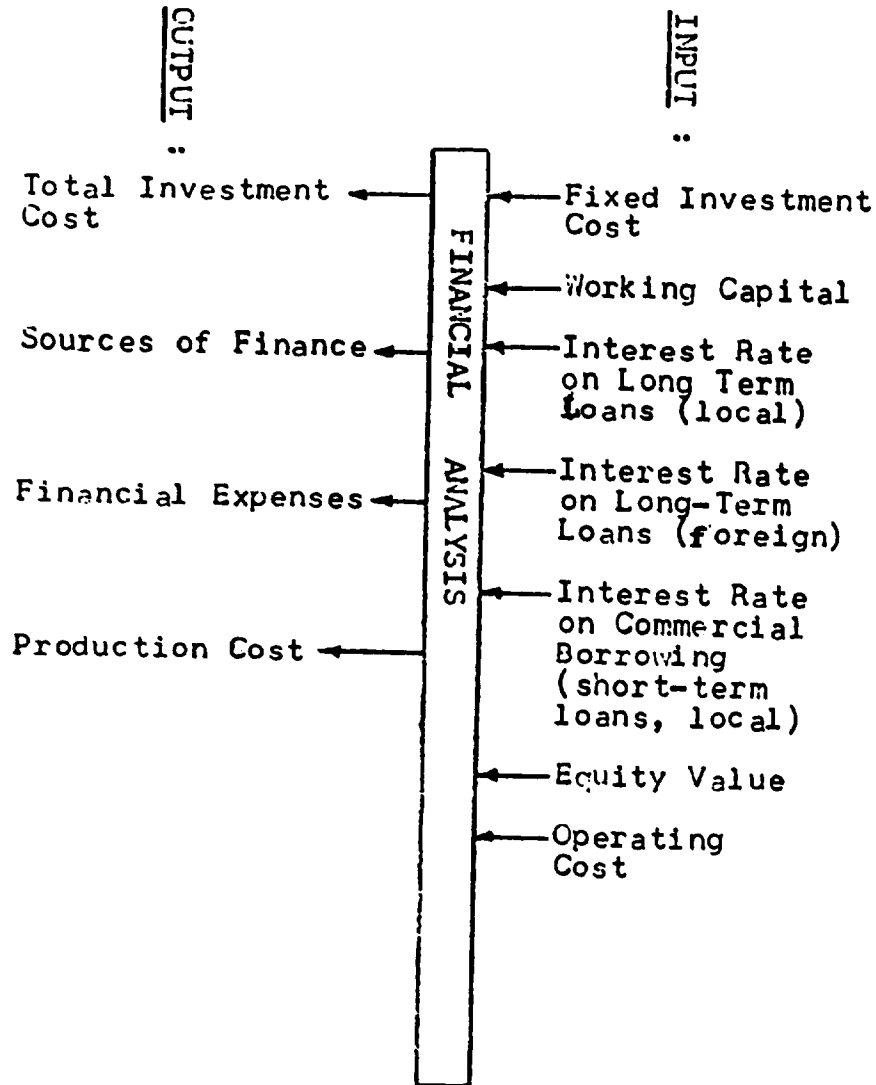
3.3

ECONOMICAL ANALYSIS :



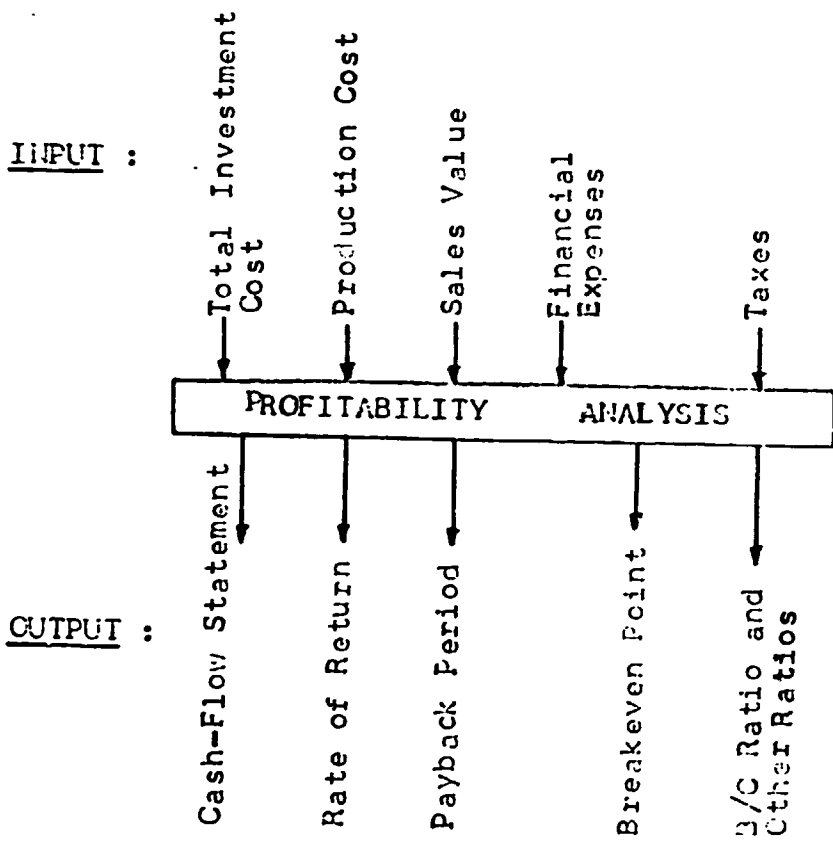
3.4

FINANCIAL ANALYSIS



3.5

PROFITABILITY ANALYSIS



REMARKS :

Economical, financial and finally profitability analysis can be supported by COMFAR i.e. computer software developed by UNIDO.

4. CONTENTS OF A FEASIBILITY STUDY (CHECKLIST)

4.1 A feasibility study can be carried out in many ways. However, UNIDO published a "Manual for the Preparation of Industrial Feasibility Studies" describing techniques that are widely used. The following checklist of a feasibility study is based on UNIDO's Manual :

CHAPTER I - EXECUTIVE SUMMARY

CHAPTER II - PROJECT BACKGROUND AND HISTORY:

- Project background,
- Project promotor(s),
- Project history,
- Feasibility study (ordering party & author),
- Cost of preparatory studies and related investigations.

CHAPTER III - MARKET AND PLANT CAPACITY :

- Demand and market study,
- Sales forecast and marketing of products and by-products,
- Production programme,
- Plant capacity.

CHAPTER IV - MATERIALS AND INPUTS :

- Characteristics of materials and inputs,
- Supply programme.

CHAPTER V - LOCATION AND SITE :

- Location,
- Site,
- Local conditions,
- Environmental impacts.

CHAPTER VI - PROJECT ENGINEERING :

- Project layout,
- Scope of project,
- Technology (ies),
- Equipment,
- Civil engineering works.

CHAPTER VII - PLANT ORGANISATION & OVERHEAD COSTS :

- Cost centres,
- Overhead costs.

CHAPTER VIII - MANPOWER :

- Labour,
- Staff.

CHAPTER IX - IMPLEMENTATION SCHEDULING :

- Data and activities,
- Selection of project implementation programme and time schedule,
- Cost estimate of project implementation.

CHAPTER X - FINANCIAL & ECONOMIC EVALUATION :

- Total investment costs,
- Project financing,
- Total production costs,
- Financial evaluation,
- National economic evaluation.

4.2 The accuracy of estimates of investment and production costs increases as the project progresses from one stage to the next. If compared with the respective ideal average value, which changes from stage to stage, the approximate ranges of accuracy are :

opportunity study	±	30%
pre-feasibility study	±	20%
feasibility study	+ -	10%

These averages are empirical values that may differ from project to project and according to the applied method of cost estimates.

4.3 Cost of pre-investment studies are approximately :

- opportunity study, 0.2-1.0% of project investment costs,
- pre-feasibility study, 0.25-1.5% of project investment costs,
- feasibility study, related to the size of the project, from 1.0-3.0% for small industries to 0.2-1.0% for large industries; percentage figures relate to project investment costs.

The above percentage figures must be treated with caution, as a rough guide, because actual fees charged by a consulting engineering firms vary considerably.

5. BOOKS RECOMMENDED :

The following UNIDO publications on pre-investment studies are recommended :

- a) "Manual for the Preparation of Industrial Feasibility Studies", (ID/206);
- b) "Guidelines for Project Evaluations", (ID/SER. H/2);
- c) "Guide to Practical Project Appraisal", (ID/SER. H/3);
- d) "Manual for Evaluation of Industrial Projects" (ID/244).

ANNEX 2

**PRE-FEASIBILITY STUDY FOR CARBOXIN 40 SC FUNGICIDE
FORMULATION PLANT**

1. EXECUTIVE SUMMARY

1.1 Demand of agricultural sector of India for Carboxin fungicide stands at approx. 100 tons p.a. (as 100% Carboxin) i.e. 250 tons p.a. of Carboxin 40 SC (40% suspension concentrate).

1.2 Basic data on the proposed Carboxin 40 SC Fungicide Formulation Plant :

- | | |
|-----------------------|---|
| - Production Capacity | - 250 tons p.a.
(i.e. 227 K-litres p.a.) |
| - Production Period | - 300 days a year |
| - Operation Time | - 2 shifts of
8 hr. each. |
| - Employment | - 15 persons. |

1.3 Total Investment Cost : Rs.10,411,000

1.4 Project Construction Period : 6 months

1.5 Financial Structure :

- | | |
|---|----------------|
| - Equity | : Rs. 914,000 |
| - Long-term Loans
(term loans) | : Rs.2,279,000 |
| - Short-term Loan
(working capital loan) | : Rs.7,218,000 |

Rs.10,411,000

1.6 Profitability :

- | | |
|------------------|---|
| * Rate of Return | : 299% |
| * Payback Period | : 9 months (including
6 months of
construction) |

* Breakeven Point at 1.6% capacity.

2. INTRODUCTION

2.1 PROJECT BACKGROUND

2.1.1 PURPOSE OF THE STUDY :

The purpose of this study was twofold :

- (a) prepare Pre-feasibility Study for the Establishment of Carboxin 40 SC Formulation Plant,
- (b) provide on-the-job training to PDC counterpart during preparation of techno-economic feasibility study in pesticides formulation field.

2.1.2 HISTORY OF THE PROJECT :

The project for making Carboxin 40SC was conceived in PDPI first phase, as a part of new technology for formulation development.

Carboxin, a seed dressing fungicide was imported from USA, and made as 75% water dispersible powder in India. The trade name is Vitavax.

Based on experience in other countries, a formulation of Carboxin with 40% of active ingredient was prepared. Instead of conventional powder type formulation, the formulation of suspension concentrate is based on finally divided particles suspended in water. Since the method of formulation is different, and particle size is lower, it is conceived to give better results, on application due to superior properties of the formulation.

Earlier the process was developed in laboratory. Later, it was scaled up in the pilot plant scale at 50L/hr (approximately)

Subsequently, field trials conducted on limited scale proved, that the product given better results on application.

These results, justify entering into pre-investment stage of this Project.

2.2 Project Sponsor :

Acting sponsor for the project is :
Pesticide Development Centre, (PDC) ,
Udyog Vihar, Gurgaon-122 016, Haryana, India.

2.3 Authors of the Feasibility Study :

M. Nowak - UNIDO Consultant
S. Kumar - PDC, Deputy Production Manager (counterpart)

3. MARKET ANALYSIS

- 3.1 Carboxin 40 SC (40% suspension concentrate) is the fungicide, ready to use seed treatment product, applicable to wheat and barley seeds. It gives control of various seedling diseases in addition to the control of smut and bunt of wheat and barley.
- 3.2 Market analysis on fungicide CARBOXIN 40 SC was based solely on "Report of the Sub-Group on Methodology and Forecasting (Seventh Five Year Plan) prepared on August, 1981 by the Ministry of Chemicals & Fertilizers of Govt. of India. This was the only document on the pesticide market available at time of this study preparation. In the follow up, further market investigations and up-dating of figures ought to be made, for more precise elaboration of market for CARBOXIN 40 SC (domestic consumption and export potential).
- 3.3 According to available data, Carboxin and also oxycarboxin are not at present produced in India, and the demand is met entirely through the importation. The available data on import of CARBOXIN (technical grade) are as follows :

	Y E A R S		
	1979-80	1980-81	1981-82
Carboxin (Technical grade MT/Y)	24	11	30

- 3.4 Demand for CARBOXIN as submitted for 7th Five Year Plan by Ministry of Agriculture was as follows :

	Y E A R S	
	(1984-85)	(1989-90)(Project)
CARBOXIN (Technical grade MT/Y)	80	86

The system adopted by the Ministry of Agriculture for assessment of the requirements of pesticides (among other CARBOXIN), was based on the targets of the plant protection obtained from each States, Union Territories in India. The States/Union Territories submitted their estimated demand of pesticides itemwise giving due consideration to several factors like the pesticides consumption, inter-substitutability and the targetted area proposed to be brought under intensive/extensive plant protection programmes within the resources available. The demand was finalised

in consultation with the representatives of State Governments, Central Ministries/ Departments and Industry concerned with pesticides at "The All India Plant Protection Conference".

- 3.5 The demand for CARBOXIN estimated the above way, has got reliable background enabling further demand projections. Assuming the same trend of consumption, projections of the demand for coming years will be as follows :

	Y E A R S			
	(1984-85)	(1989-90)	(1994-95)	(2004-05)
CARBOXIN (Tech. Grade MT/Y)	80	96	92	98

Taking into consideration the pesticide demand growth rate over the year 1989-90 assumed in the above "Report" at 2% per annum, projection of the demand will be even higher :

	Y E A R S		
	(1989-90)	(1994-95)	(2004-05)
CARBOXIN (Tech. Grade MT/Y)	86	95	116

The demand for Carboxin (technical) is closely related to demand for Carboxin-based formulations. This was the base for estimation of the demand for Carboxin 40 SC (40% suspension concentrate).

4. PRODUCTION PROGRAMME

- 4.1 Based on the market analysis, the plant production capacity of CARBOXIN 40 SC (40% suspension concentrate) was designed at 250 tons p.a. This capacity will allow to meet local demand for CARBOXIN 40 SC upto approx. 2000 year.
- 4.2 The only product of the above plant will be CARBOXIN 40 SC (40% suspension concentrate) packed in 1 litre HDPE containers.
- 4.3 The production plant was assumed to operate 2 shifts/day (i.e. 12 working hrs. a day + 4 hrs. cleaning a day). Production period 300 days a year was also assumed for this plant.

5. MATERIALS

5.1 RAW MATERIALS :

(basis : 250 tons pa. of Carboxin 40 SC)

	<u>Quantity (tons p.a)</u>	<u>Cost (Rs.)</u>
- Carboxin Technical	103.75	32,370,000
- All Other Adjuvants	42.30	627,000
- Water	103.95	2,500
	<u>Sub-Total:</u>	<u>32,999,500</u>
	Handling losses(5%)	1,650,000
	<u>Total:</u>	<u>34,649,500</u>

Out of the above amount :

- imported raw materials cost is Rs. 32, 370,000

- local raw materials cost is Rs. 2, 279,500

5.2 PACKAGING

(basis : 250 tons p.a. of Carboxin 40 SC)

	<u>Quantity (pcs)</u>	<u>Cost (Rs.)</u>
- 1 litre HDPE bottles	227,270	3,409,050
- cartons (for 10 bottles each)	22,727	340,905
- operating supplies		227,270
	<u>Total:</u>	<u>3,977,225</u>

Packaging materials will be supplied locally.

5.3 UTILITIES

(basis : 250 tons p.a. of Carboxin 40 SC)

	<u>Quantity p.a.</u>	<u>Cost (Rs.)</u>
- Electric Power	84,000 KWH	63,000
- Fuel Oil	6,000 l.	18,000
- Cooling Water	1,500 Kl.	30,000
	<u>Total</u>	<u>111,000</u>

All utilities are locally available.

6. LOCATION

The proposed Carboxin 40 SC is to be located in Bombay region, as Bombay has the advantage of many pesticide formulation plants. Bombay port is one of the most modern ports, where raw materials can be handled easily. Skilled, unskilled labour force is available and good infrastructure is available. Maharashtra State offers lot of incentives to small scale industry.

Location, does not offer much advantage in this case, except for port facility. Hence this factor is not a critical one in this analysis.

7. PROCESS DESCRIPTION

7.1 STEPS (Referred to Process Flow Diagram in Annexure I)

Step 1 Premixing

Here Carboxin in solid form will be mixed with other ingredients such as dispersing agent, water etc., to form a uniform slurry.

Step 2 Doseing:

The mixed slurry will be sent in correct quantity to the dyno mill for correct particle size reduction.

Step 3 Milling :

Here the mixed-dosed slurry will be ground to the correct size.

Step 4 -Post Blending:

The Semi-prepared product, will be mixed with water/dye/thickner and stabiliser to get the product.

Step 5 - Quality control:

The product will be tested for the specification, before packaging at this stage. If passed, it will be packed. If it fails than it will be returned to Step 1.

Step 6 - Packaging:

Here the product will be packed in 1 liter containers. This will be sealed (from cap) and put in outer pack containing 10 lit./pkt. and strapped.

7.2 TIMING

Activities	Hours (Daily Production)															
	Shift 1								Shift 2							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
								9	10	11	12	13	14	15	16	
Batch 1																
Charging	—															
Mixing	—															
Doseing/grinding	—	—	—													
Analysis				—	—	—										
Packaging					—	—	—									
Batch 2																
Charging				—												
Mixing				—												
Doseing/grinding				—	—	—										
Analysis								—	—	—						
Packaging								—	—	—	—					
Batch 3																
Charging								—								
Mixing								—								
Doseing/grinding								—	—	—						
Analysis																
Packaging														—	—	
Batch 4																
Charging												—				
Mixing												—				
Doseing/grinding												—	—	—		
Analysis			—	—												
Packaging		—	—	—	—											

* Next day

8. MAN POWER

8.1 The manpower requirements for the CARBOXIN 40 SC Formulation Plant are estimated as follows :

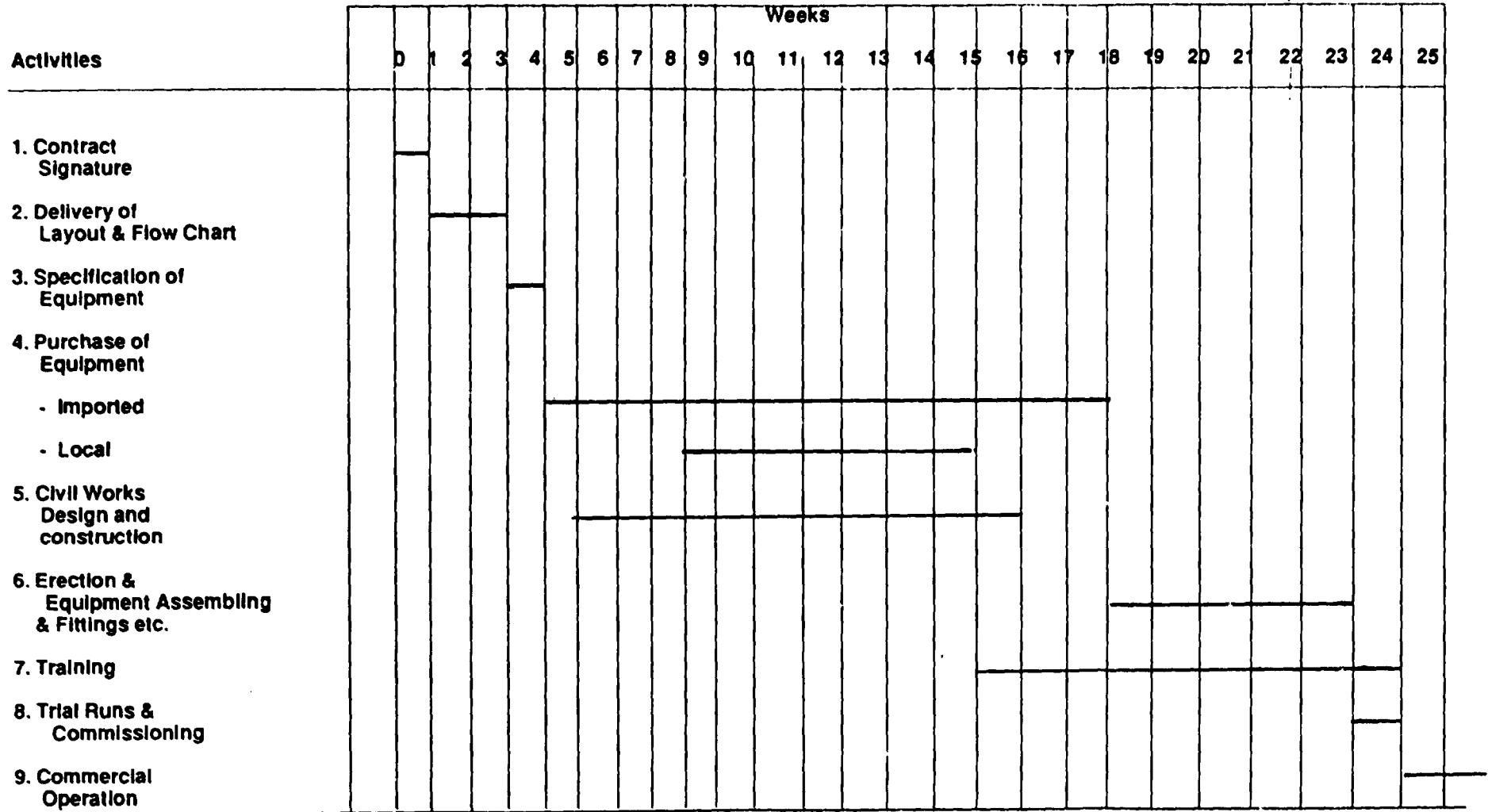
	<u>Number</u>	<u>Average cost</u> <u>Rs. p.a.</u>
Manager	1	40,000
Operators	3	24,000
Other Skilled Workers (Maintenance)	2	18,000
Accountant & Sales & Administration	3	18,000
Unskilled Workers (casual)	6	7,200

8.2 The manpower requirement will be met from local sources.

8.3 The total cost of manpower stands at Rs.245,200 p.a.

9. IMPLEMENTATION SCHEDULING

9.1 Implementation of the Plant, training and start up will take 24 weeks. The project time schedule is as follows:



9.2 The plant is expected to operate at 80% capacity in the first year, at 90% capacity in the second year and at 100% capacity in the third year and thereafter.

10. INVESTMENT COST

The total investment cost of CARBOXIN 40 SC Formulation Plant is estimated at Rs.10,411,000.

	(Rs. 1,000)		
	<u>Local</u> <u>currency</u>	<u>Foreign</u> <u>currency</u>	<u>Total</u>
Land (700 m ²)	200	-	200
Buildings (structures & civil engineering works)	650	-	650
Equipment & Machinery (ex-plant cost)	903	780	1,583
Incorporated Fixed Assets. (technology lump-sum payment, engineering design & purchasing)	281	-	281
Pre-operational Expenses (feasibility studies, travel costs, training, trial run, commissioning)	84	-	84
Contingencies	71	70	141
Working Capital	7,218	-	7,218
Interest during construction.	154	-	154
	<u>9,561</u>	<u>850</u>	<u>10,411</u>

Remarks:

- Construction period assumed for 6 months.
- exchange rate US \$ 1 = Rs.18/-

11. SOURCES OF FINANCE

The Carboxin 40 SC Formulation Plant is expected to be financed as follows :

	<u>(Rs.1,000)</u>		
	<u>Local Currency</u>	<u>Foreign Currency</u>	<u>Total</u>
Equity	914	-	914
Loan	8,647	850	9,497
	<u>9,561</u>	<u>850</u>	<u>10,411</u>

REMARKS :

- (a) The above based on Small Scale Industries Scheme offered by State Bank of India for Industrial Projects (with cost of equipment & machinery not exceeding Rs. 3,5 mln).

The scheme offers :

- term loans upto 75% for acquisition of machinery, land, factory, building, shed; term loans for period 5 to 7 years with reasonable start-up period.
- Working capital loan "need based" (upto 100%), after assessment.

- (b) Local Currency Loan composed of :

Term Loan Rs.1,429,000
Working Capital Loan Rs.7,218,000
Total : Rs.8,647,000

- (c) Foreign Currency Loan :

Term Loan Rs. 850,000

12. COMMERCIAL PROFITABILITY

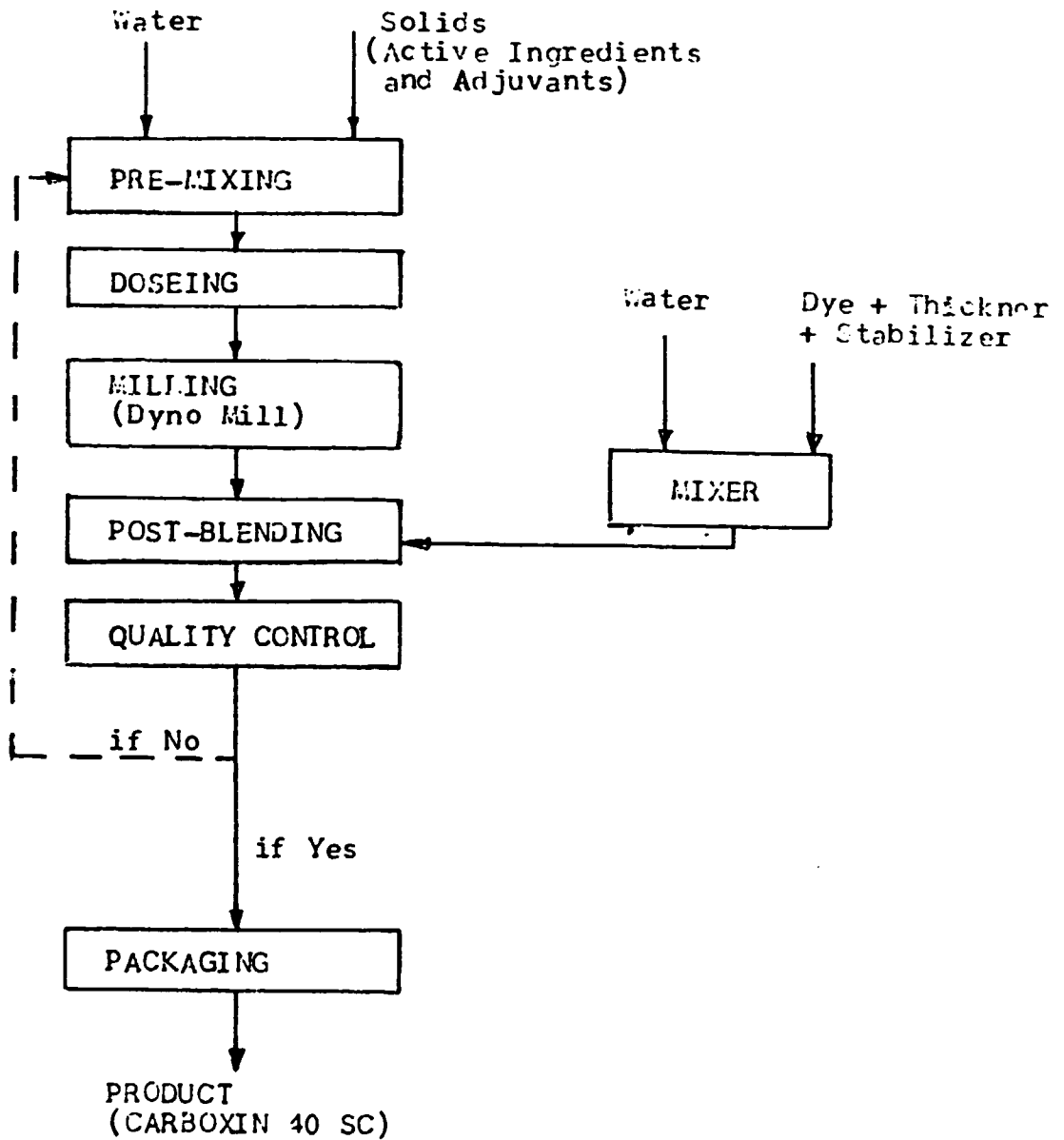
12.1 The following commercial profitability estimates are made for 4th year of operation, i.e. when Carboxin 40 SC Formulation Plant will operate at 100% capacity :

		<u>(Rs.1,000)</u>
	Sales	72,750
	<u>Costs</u>	
	Raw Materials	34,649
	Utilities	111
	Packaging	3,977
	Labour	191
	Maintenance	40
	Spare Parts	34
	Factory Overhead	143
	Sales Cost	2,182
	Administrative Cost	54
	Depreciation	<u>201</u>
		41,583
	Profit before Interest & Taxes	31,167
	Interest	1,469
	Profit before Taxes	29,698
12.2	Profit before Taxes as % of Turnover	40.8%
12.3	Profit before Taxes as % of Investment	285.3%
12.4	Profit before Taxes as % of Equity	325%
12.5	Rate of Return	29.9%
12.6	Payback Period 9 months including 6 months of construction	
12.7	Breakeven Point at 1.6% capacity.	

13. REFERENCES

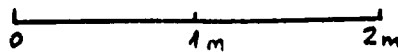
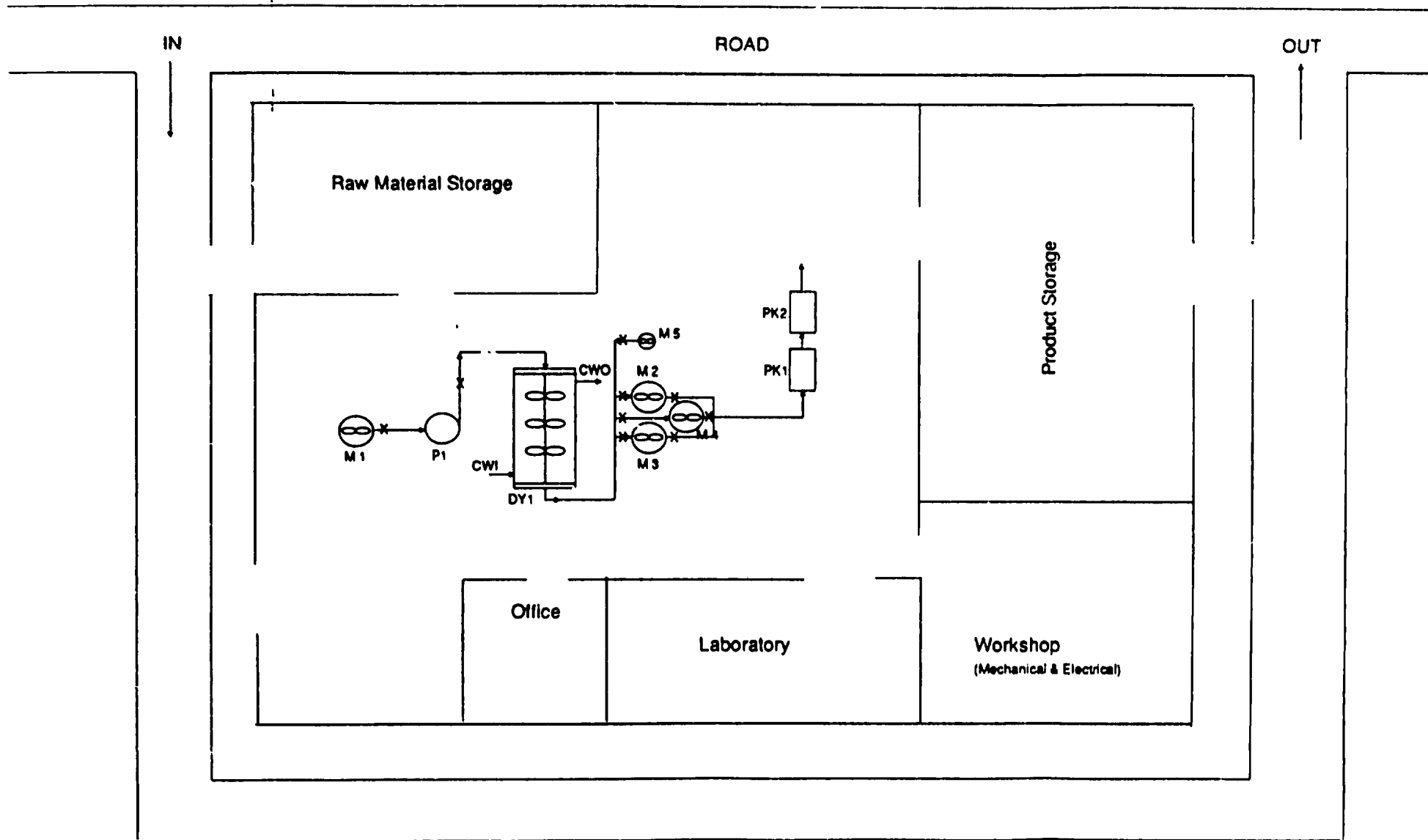
- (1) "Report of the Sub-Group on Methodology and Forecasting (Seventh Five Year Plan)" prepared by the Ministry of Chemicals & Fertilisers of Govt. of India, August 1984.
- (2) Data provided by Pesticides Development Centre, Gurgaon, November/December, 1990.

PROCESS FLOW DIAGRAM
FOR CARBOXIN 40 SC MANUFACTURING



PLANT LAYOUT

Annexure-II



LIST OF EQUIPMENT

<u>Item</u>	<u>Name</u>	<u>Function</u>	<u>M. of construction</u>	<u>Capacity per unit</u>
M 1	Primary Mixer	To mix Carboxin with adjuvants	SS with agitator SS	250 L
M 2 M 3 M 4	Post blenders (Three vessels with common stirrer).	To receive the product and to mix with dye + Stabilizer + Thickner	SS with common agitator	250 L
M 5	Mixer for dye preparation	To prepare dye + Stabilizer + Thickner Solution	SS with agitator	20 L
P 1	Dosing Pump	To pump correct Quantity of Slurry to dyno mill	SS Pump	100 L/hr
DY 1	Dyno mill	To grind the Slurry to required size	SS	100 L/hr
PK-1	Packaging Machine	To dose (Pack Unit Quantity in Unit Pack)	SS	200 L/hr
PK-2	To seal the cap	To seal cap	-	200 Packs/ hr.

COST OF EQUIPMENT

<u>Item</u>	<u>Name</u>	<u>Nos</u>	<u>Total Cost (₹)</u>
Vessel (Stainless Steel)	Vessels of Mixer M1, M2, M3, M4	4	120,000
Agitator	One for M1 One common for M2, M3, M4	2	25,000
Vessel	of mixer M5	1	10,000
Agitator	"	1	5,000
Doseing pump	P1	1	10,000
Dynomill	D1	1	1,200,000
Packaging machine	PK1	1	40,000
Sealing machine	PK2	1	15,000
Sub Total :			1,425,000

Other Items

DG Set	Diesel Gene- rating Set	1	35,000
Electrical Fittings			50,000
Lab Equipments			100,000
Drum unloading pump			5,000
Material handling equipment			10,000
Weight Machine			8,000
Water/Pipe connecting, valves etc.			20,000
Sub total :			228,000

Total : 1,653,000
 Transport Local 30,000

 Grand Total : 1,683,000

Annexure IV

ESTIMATED FINANCIAL EXPENSES

(Rs.1,000)

Item	Year of Operation			
	1st	2nd	3rd	4th
Interest on Term Loans (1) + (2)	308	308	286	242
Interest on Commercial Bank Borrowing (xx) (3)	982	1,104	1,227	1,227
Total :	1,290	1,412	1,513	1,469
1. Foreign Currency Term Loan :				
Principal	850	850	729	608
Instalments (xxx)	-	-	121	121
Interest 13.5% p.a. (x) (on average balance)	115	115	107	90
2. Local Currency Term Loan :				
Principal	1,429	1,429	1,225	1,021
Instalments (xxx)	-	-	204	204
Interest 13.5% p.a. (x) (on average balance)	193	193	172	152
3. Commercial Bank Borrowing (xx)	5,774	6,496	7,218	7,218
Interest 17% p.a.	982	1,104	1,227	1,227

(x) interest for non-backward areas

(xx) working capital loan

(xxx) paid in a period of 7 years after 2 years of payment holiday

ANNUAL PRODUCTION COST ESTIMATION

(Rs.1,000)

Item	Year of Operation			
	1st	2nd	3rd	4th
	80%	90%	100%	100%
I) Manufacturing Cost :				
A) Raw Materials :				
a) Local	1,824	2,052	2,280	2,280
b) Imported	25,896	29,133	32,370	32,370
B) Utilities	89	100	111	111
C) Packaging	3,182	3,579	3,977	3,977
D) Direct Labour	153	172	191	191
E) Maintenance	32	36	40	40
F) Spare Parts	34	34	34	34
G) Factory Overhead	143	143	143	143
Manufacturing Cost (I) Sub total:	31,353	35,249	39,146	39,146
II) Sales & Admn. Costs :				
A) Admin. Overhead Cost	54	54	54	54
B) Sales Cost	1,746	1,964	2,182	2,182
Operating Cost (I+II) Sub total :	33,153	37,267	41,322	41,322
III) Depreciation	201	201	201	201
IV) Financial Costs (interests)	1,290	1,412	1,513	1,466
Production Cost (I+II+III+IV) Total:	34,644	38,880	43,096	43,052

Annexure VI

CALCULATION OF WORKING CAPITAL

(Rs.1,000)

Item	Minimum Days of Coverage	Year of Operation			
		1st 80%	2nd 90%	3rd 100%	4th 100%
I) <u>Current Assets</u> :					
A) Accounts Receivable	15	1,361	1,531	1,701	1,701
B) Inventory :					
a) Raw Materials	30	2,278	2,563	2,848	2,848
b) Spare Parts	180	17	17	17	17
c) Finished Products	15	1,289	1,450	1,611	1,611
C) Cash-in-Hand	5	74	84	92	92
Total (I) :		5,019	5,645	6,269	6,269
II) <u>Current Liabilities</u> :					
A) Accounts Payable	10	759	854	949	949
III) Working Capital (I) + (II) Total :		5,778	6,499	7,218	7,218

Annexure VII

SALES ESTIMATE

(Rs.1,000)

Item	Year of Operation			
	1st	2nd	3rd	4th
	80%	90%	100%	100%
Carboxin 40SC (Suspension concentrate)	58,200	65,475	72,750	72,750

Ex -factory Price : Rs.291/- per kg

(of Carboxin 40SC packed in 1 liter HDPE
Unit containers, overpacked in 10litre
cartons).

Annexure VIII

CASH - FLOW STATEMENT
FOR CARBOXIN 40SC FORMULATION PLANT

(Rs.1,000)

Item	Year of Operation			
	1st	2nd	3rd	4th
	80%	90%	100%	100%
A) <u>CASH INFLOW :</u>	58,200	65,475	72,750	72,750
1) Sales Revenue	58,200	65,475	72,750	72,750
B) <u>CASH OUTFLOW :</u>	34,822	37,745	42,163	41,949
1) Current Assets Increase	1,361	170	170	0
2) Operating Cost	33,153	37,267	41,392	41,392
3) Debt Service :				
a) Repayment of Term Loans	-	-	325	325
b) Payment of Interest on Term Loans	308	308	286	242
C) <u>CASH SURPLUS/DEFICIT</u> (A) - (B)	23,378	27,730	30,614	30,801
D) <u>CUMULATIVE CASH BALANCE</u>	23,378	51,108	81,272	112,073

Annexure IX

FORMULAS USED FOR CALCULATION IN THIS STUDY

- * Incorporated Fixed Assets = 10% of Fixed Investment Cost
(Fixed Investment Cost include cost of = land, buildings, machinery & equipment, incorporated fixed assets).
- * Pre-operational Expenses = 3% of Fixed Investment Cost
- * Contingencies = 5% of Fixed Investment Cost
- * Spare Parts = 2% of Equipment & Machinery
- * Maintenance = 2% of Equipment + 1% of Buildings
- * Factory Overhead = 75% of Labour Cost
- * Sales Cost = 3% of Sales
- * Depreciation : 10% of equipment & machinery
5% of buildings
- * Accounts Receivable = Annual Operating Cost $\times \frac{15 D}{365 D}$
- * Finished Products = (Manufacturing Cost + Admn. Cost) $\times \frac{15 D}{365 D}$
- * Cash-in-Hand = (Annual Operating Cost - Annual Direct Material Cost) $\times \frac{5 D}{365 D}$
- * Accounts Payable = Annual Direct Material Cost $\times \frac{10 D}{365 D}$
- * Raw Materials = $\frac{30 D}{365 D}$ of raw-material (local + imported) annual cost
- * Spare Parts = $\frac{180 D}{365 D}$ of spare parts annual cost
- * Interest during Construction = (Annual Interest Foreign Currency Term Loan + Interest Local Currency Term Loan) x period in years.
- * Interest (on average balance) = $\frac{\text{Principal } n + \text{Principal } n+1}{2}$
x Interest Rate
(n-year of operation)
- * (Simple) Rate of Return = $\frac{\text{net profit}^{(*)} + \text{interest}}{\text{total investment outlay}} \times 100\%$
- * Payback Period = $\frac{\text{total investment outlay}}{\text{net profit}^{(*)} + \text{interest} + \text{depreciation}}$
- * Breakeven Point = $\frac{\text{Fixed Production Costs}}{\text{Sales revenue} - \text{variable prod. costs}} \times 100\%$

(Fixed Production Costs : Spare parts, factory overhead,
administrative cost, depreciation;

Variable Production Costs : Raw-materials, utilities, labour,
packaging, maintenance, sales cost)

(*) = profit before taxes, as the plant is exempted from
taxes upto 5 years of commercial operation.

Annexure X

OTHER FINANCIAL RATIOS (EXAMPLES) :

- * Current ratio = $\frac{\text{Current assets}}{\text{Current liabilities}}$

- * Quick ratio
(Acid test ratio) = $\frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}}$

- * D/E Ratio = $\frac{\text{Long-term debt}}{\text{Equity}}$

- * B/C Ratio
(benefit-cost ratio) = $\frac{\text{Cash inflow}}{\text{Cash outflow}}$

UNIDO'S SUBSTANTIVE COMMENTS

DP/IND/89/128 - Strengthening of Pesticide Development Centre

Introduction

The expert's main assignment was to expose the staff of pesticide development centre to the economic aspects related to developing and taking up new projects in pesticide formulation. In addition, he also carried out one exercise on feasibility studies for the development of a technology invented at the Pesticide Development Centre.

Comments

The expert, Mr. Michal Nowak gave an extensive course on the use of UNIDO's programme on feasibility studies 'COMFAR'. This gives a good background to the staff of PDC, on the techno-economic feasibility studies of developing projects based on the R&D work carried out by the PDC.

Formulation of pesticides is a highly competitive field and if any newer, safer and more effective type of formulations are developed it could demand a high premium price in the market. The PDC personnel in collaboration with the UNIDO expert have made a detailed analysis of a pesticide seed dressing formulation which would be very useful to the Indian market. While the techno-economic feasibility studies are very positive there is no indication whether or not the project authorities have already proven the efficacy of the formulation in the field and obtained registration with the Insecticide Board.

For registration of the formulation, PDC needs to generate data on field trials and some cases even toxicology data. This could be done by carrying out field trials under sub-contract arrangements with organizations outside India for which provision has been made in the project budget. Such an arrangement from outside the organization would prove valuable to register new formulations for commercialization.