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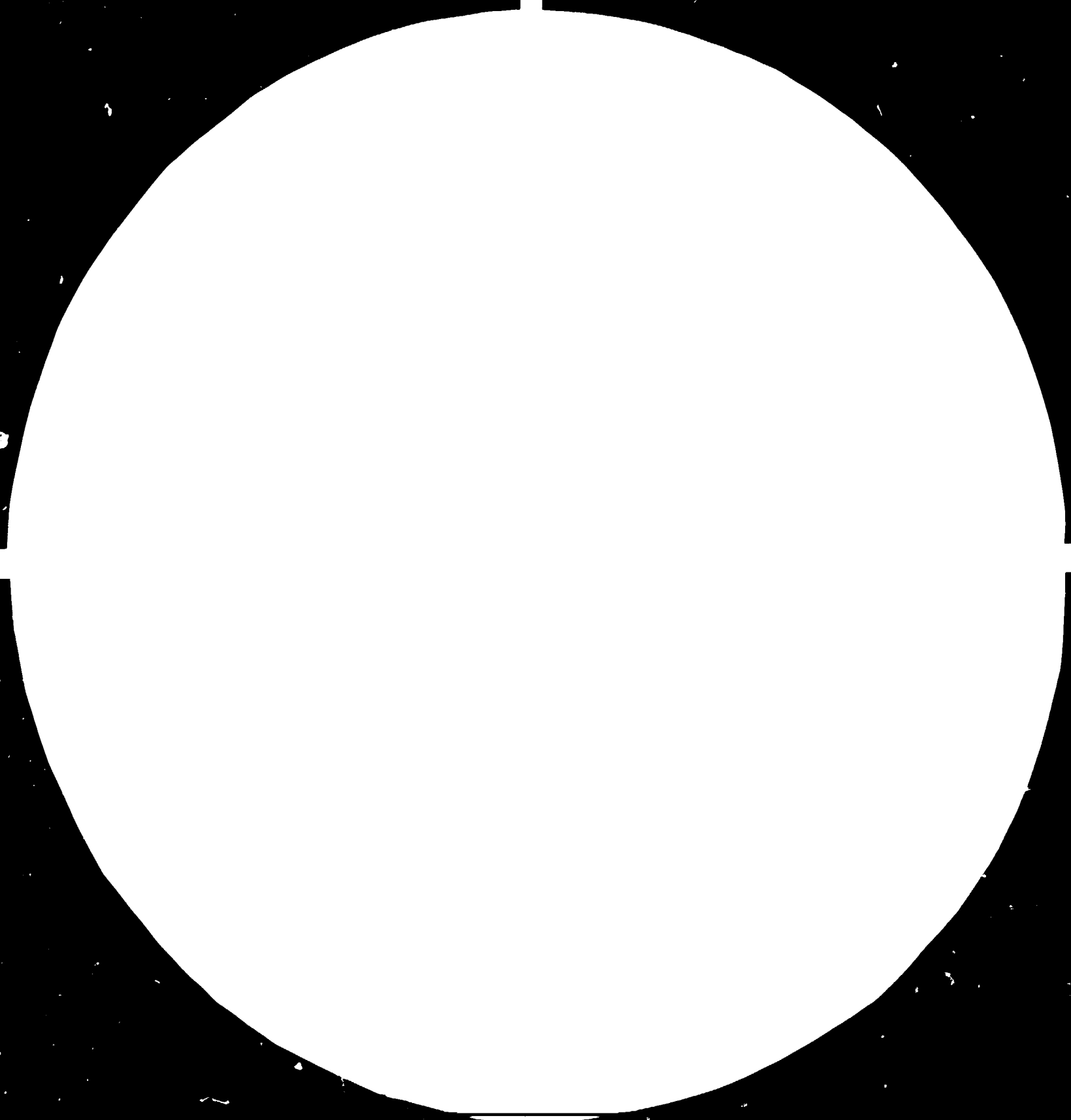
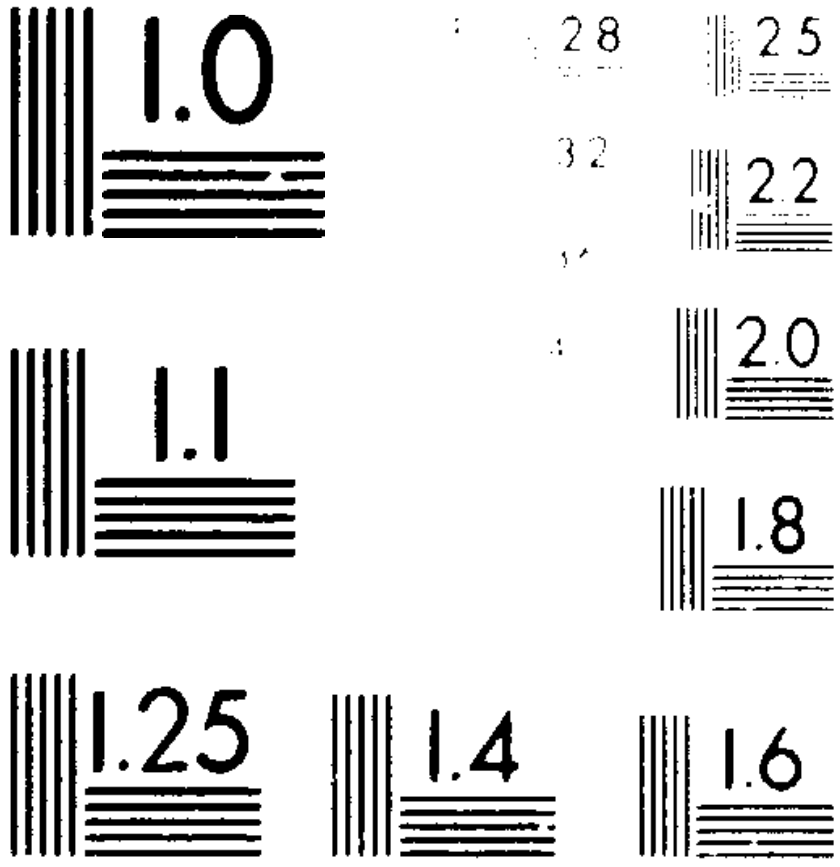
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org





14063

Sudan.

TRAINING COURSE IN INDUSTRIAL PROJECT PREPARATION, EVALUATION AND FINANCING.

12 May - 14 June 1984

organized in Khartoum, Democratic Republic of Sudan by the Ministry of Finance and Economic Planning and the United Nations Industrial Development Organization

F I N A L R E P O R T.

RP/SUD/84/004

prepared by the UNIDO Consultants:

André GUICHARD	Financial Analyst
David SUSSMAN	Industrial Engineer
Janusz LUKASIK	Industrial Eccnomist

2210

from. M. Kulczycki
D-1318

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I. OBJECTIVES OF THE TRAINING COURSE

a) Development objectives

To enhance the industrialization programme of Sudan through strengthening the human capacities in industrial project preparation, evaluation and financing.

b) Immediate objective

To train 25 persons of national staff from the Ministry of Finance and Economic Planning, Project Preparation Unit, Ministry of Industry, Ministry of Energy and Mining, Development Banks, State Development Centres and also from regional sections of the Ministry of Industry, the Ministry of Finance and Economy and the Ministry of Industry and Mining, to increase their skills and abilities in project identification, preparation, financial analysis, financial planning and industrial project evaluation.

2. PARTICIPANTS

28 participants were selected by the government but only 25 participated effectively, with a 90 to 100% presence score.

The level of educational background was quite high: all of them were University graduates, some with a specialisation acquired abroad.

The level of theoretical skills was fairly high in the preparation of projects but they were hesitating as soon as we entered into the practical exercises.

They were very interested in the evaluation of projects because they are very sensible to what happened in Sudan in the late 70's: ordering industrial projects (turn key projects) without sufficient infrastructure or management capacities.

..... The list of the participants is attached (see Annex I.1).

3. SCHEDULE

We had a five weeks period for explaining the preparation and evaluation of industrial projects, including case studies. The Sudanese authorities agreed that the course would consist of 4 hours of training per day, 6 days a week, say 120 hours which included lectures given by local lecturers and one visit to a factory. One day of holiday unfortunately diminished the scheduled number of training activities.

We planned roughly the following schedule:

3 weeks for industrial project preparation, including market analysis, technical analysis, financial analysis; this was based on the ID/206 Manual.

1 week for economic evaluation, based mainly on the IDCAS UNIDO Manual ID/244.

1 week for extensive case study: preparation of three alternative projects and economic evaluation along two or three methods. (IDCAS, Effects and UNIDO Guidelines).

The Annex I.2 presents the programmes of each week. In general, it has been possible to stick to the programme except when difficult questions necessitated further developments. The programmes have been established taking into account the different periods of missions of individual lecturers caused by budgetary constraints.

The last week devoted to practical exercises proved to be too short to the long time taken by the participants for establishing their work, due also to the Ramadan which slowed down the general activity. It would have been possible to achieve the programme if we had a quick reproduction system and better blackboards. Solutions are given in Annex II to IV.

4. OUTSIDE LECTURERS

We received the support of local lecturers from the University of Khartoum or from local banks and administrations. UNDP members and UNIDO experts have also delivered lectures. Here is the list of the lecturers in the chronological order:

16 May Mr. HARJU, Deputy Resident Representative of UNDP:
"Effectiveness of an Enterprise and the Efficiency of Management"

20 May Dr. R. NIELD from the UNIDO project DP/SUD/79/010 - Increasing the Effectiveness of Public Sector Industries. "Present Status of Textile Industry in Sudan. Presentation of the Case Study".

21 May Mr. Hubert JANISZEWSKI, UNIDO short term consultant.
"Acquisition of Technology"

23 May Dr. Mohamed Salah El Din SALEH from the project DP/SUD/79/010
"Overview of Leather Industry in Sudan".

2 June Dr. ABD EL MUSHIN University of Khartoum
"Planning Procedures in Sudan"

7 June Mr. BHATTACHARJYA, Food Processing Expert in project DP/SUD/79/010
"Investment Opportunities in Sudan in Food Industries"

10 June Mr. Ahmed El Bashir FADOUL, Faical Islamic Bank
"Recent Banking Methods and Procedures in Sudan"

10 June Mr. ZAHIR YACOUB of the Project Preparation Unit, Ministry of Finance and Economic Planning. "Sudanese experience in project preparation".

5. OTHER ACTIVITIES

29 May - Field Trip to Friendship Textile Cº. in El Hassaneisa. Integrated spinning, weaving and finishing textile industry financed by the Chinese cooperation. Discussions with the management of the factory.

6. SUPPORT FROM THE GOVERNMENT

The Government of Sudan has organized very efficiently the training course. The candidates participants have been selected very carefully. They were highly motivated and participated actively in the activity of the course.

The training course itself was given in a very spacious room of the Arack Hotel in Khartoum, with microphone and with coffee-break meals.

There was only one blackboard of a very poor quality and the distance between the participants sitting in the last rows and the chair was too important. Fortunately, the Government supplied an overhead projector which corrected somewhat this unconvenience. A typewriter has been provided for preparing stencils for the course and case study. Reproducing machines were practically out of reach of the budget of the project. A photocopy is between 0,5 and 1 LS per piece in Khartoum! This was the most serious obstacle for conducting efficient practical exercises with the students.

The Course coordinators, Ms. Amal Sid Ahmed Ismail from the Ministry of Industry and Mr. Faisal Mohamed Salih have provided a very efficient support to the lecturers and to the participants. Everything needed was provided as soon as desired. The organization of the field trip was also very good.

7. SUPPORT FROM UNIDO

UNIDO has provided solar cell pocket calculators for every participant as well as Manuals.

The Manual for the Preparation of Industrial Feasibility Studies (ID/206) formed the basis of the first three weeks course.

The Manual for Evaluation of Industrial Projects (ID/244) was utilised for the fourth week of the course and for the case study as well.

Two other manuals were distributed as examples of other appraisal methods: The Guidelines for Project Evaluation (ID/SER.H/2) and the Guide to Practical Project Appraisal (ID/SER.H/3).

Mr. Marek Kulczycki of the Feasibility Studies Section of UNIDO also came during the last week of the training course for delivering one lecture and evaluating the seminar.

8. TEAM COMPOSITION

Mr. André Guichard, Financial Analst, Team Leader, arrived on 10 May, and left on 19 June; he was in charge of the financial part of the training course and the organization of the case study.

Mr. David Sussman, Industrial Engineer, was charged with the engineering part of the preparation of industrial projects. He arrived in Khartoum on 15 May and departed on 1 June 1984.

Dr. Janusz Lukasik, Industrial Economist, arrived on 17 May and departed on 17 June 1984. He was charged with the market analysis in the preparation phase and with the macro-economic considerations in the evaluation phase. He has taken the major part of the INCAS Method explanation and also the Guidelines Method.

All members of the team have prepared additional explanatory papers on certain critical questions. Annexes I.3 to I.17 have been distributed to the participants during the training course.

Annex I.18 which is a bundle of interesting notes will be distributed to the participants through the channel of the Ministry of Finance and Economic Planning along with the Annexes II to IV which constitute the solutions to the Case Study.

II. CASE STUDY

1. A summary of a pre-feasibility study of a workshop to manufacture spare parts for the textile industry has been presented to the participants (see Annex II.1). As far as possible practical examples illustrating the theoretical part of the training course during the first three weeks have been related to that pre-feasibility study.

   During the fifth week devoted pricipally to the case study, the different previsional accounts (Sales Annex II.2, Operating Costs Annex II.3, Investment Costs Annex II.4, Working Capital Annex II.5 and Financial Charges Annex II.6) have been prepared for verifying in a first stage the commercial profitability of the project. A reasonable Internal Rate of Return for the Investor of 24.02% appears on the Net Income Statement and Net Cash Flow Statement tables (Annex II.7).

   That was the first part of the Case Study.

2. But this profitability was relying on different preliminary assumptions which were discussed in depth by the participants and submitted to a critical analysis. That formed the second part of the Case Study (See Annex II.8 "Practical Exercises" and Annex II.9 "Remarks on the Initial Project " which were the basis of our future work).

For examining the initial project and for proposing data closer to the reality, the participants were divided into five groups; each group examining one aspect of the project and trying to propose a more realistic approach.

Group	1	was	in	charge	of Energy problems; Capacity, cost, structure.
"	2	"	"	"	" Forwarding companies: clearance and transport costs.
"	3	"	"	"	" Foundry; Operating Costs.
"	4	"	"	"	" Taxation system; collection of accurate data.
"	5	"	"	"	" Textile industry; Needs of spare parts; price the industry is ready to pay for.

The conclusions of the groups were as follows:

Group 1. The initial data of the study have to be recalculated in order to adapt to the existing tariff. For 360.000 kWh per annum the tariff is 0,14 LS/kWh plus fixed cost on the basis of Peak Load Factor of 14.400 LS per annum; total about 65.000 LS. This is calculated for a production of 80 T of metal spare parts. The investment cost has also to be drastically reduced: cost of transformer is much lower than the initial price.

Group 2. It has been difficult for members of ministries and official departments to collect exact data from private companies. Transport by truck from Port Sudan to Khartoum has been estimated at 100 LS/tonne; clearance cost including remuneration of forwarding companies is about 2% of the C+F price of imported goods.

Group 3. Contacts with the existing Foundry. There is a plan to develop the existing foundry of Khartoum in order to include a sophisticated workshop for producing spare parts for the local industry (not only the textile industry but also other manufacturing industries).

That project could be compared with alternative projects
1) an independant workshop similar to that which formed the basis of the case study but slightly improved in what concern data and conception;
2) a workshop making spare parts for textile industry with a small foundry included and which can start up production with a very elementary equipment and which will be developed according to the demand.

The comparison between three projects can be done through appraisal techniques showing the different advantages of each project.

Further informations have been collected on the sales prices of metal castings practised by the Central Foundry. (5.500 LS/tonne instead of 2.000 LS/tonne in the initial case study).

On the other hand no informations could have been collected on the cost of equipment of a small foundry neither on operating costs of the existing foundry.

Group 4. Taxes. Precision were given on the new taxation system: 2,5% on capital and taxation on individual incomes. There is also a 5% sales tax and a 5% surtax.

Group 5. Contacts with Textile industry. The need of spare parts is considered as very important and the textile industry is ready to pay as much as 50.000 LS/tonne for metallic spare parts. Quick delivery will offset problems of lower quality. But we must be conscious that this scarcity of spare parts is mainly the result of general import restriction measures. If there are some facilities given to the import of spare parts for industry, prices will probably drop very quickly. On the other hand, textile factories are developing themselves the production of spare parts.

A probability analysis (sensitivity) conducted among the participants has given a sales price of 31.000 LS/tonne for metal castings.

Tha quantity to be sold (8o T/year) seems quite reasonable compared to the potential demand: 400T/ year for big size factories only. If another constraint on the textile industry could ease in the future (electric power availability) the demand of spare parts will soar as the equipment will function more actively and will need more spare parts.

3. On the basis of informations collected, a new set of previsional accounts has been established for the initial project.

The principal modifications are the following:

1) Sales. Metallic spare parts: Unit price 31.000 LS/tonne.

2) Investment Costs. Increase of the price of the land 60 LS/squ.m. instead of 20 LS.
Reduction of the price of building 400 LS/sq.m. instead of 500 LS.
Electricity infrastructure: 31.000 LS for transformer, 20.000 LS for wiring and control instead of 1.000.000 LS,
water infrastructure 25.000 LS instead of 150.000 LS
Air conditioning (aircoolers) 8.000 LS instead of 500.000 LS.
Vehicles have to be added to the investment cost:
1 car, 1 pick-up, 1 truck, 1 forklift estimated at 115.000 LS

3) Operating Costs.

Raw Materials Metal Castings	5.500 LS/T	c/ 2.000 LS/T
Electricity	65.000 LS/y	c/ 72.000 LS/y
Maintenance	70.000 LS	c/ 100.000 LS
Overhead	100.000 LS	c/ zero

4) Financing. The new islamic rules are forbidding the interest rate. Instead, there is a participation of the bank under the form of equity. (MUSHARAKA system which is equivalent to profit and loss sharing). Financing of the project has been established along that system.

5. Economic Evaluation of the Project.

The IDCAS Method (Manual for Evaluation of Industrial Projects, UNIDO ID/244) was utilized for evaluating the benefit the collectivity could find if the project was realised.

Annex II.16 is showing the transformation of current prices of output and inputs into the price system of the IDCAS method (See p. 56 of the Manual ID/244).

The Annex II.17 present the Net National Value Added for the project calculated along the rules

Output - Material Inputs = Value Added;
Net Domestic Value Added = Output - Material Inputs - Investment Costs;
Net National Value Added = Output - Material Inputs - Investment Costs - Repatriated Value Added,

for each year of the project.

The absolute efficiency test proves that for a Social Rate of Discount (SRD) = 17%, the NNVA value is smaller than the wages distributed. Then, the project, at least under this form, cannot be accepted from the national economy point of view.

That result confirms the appraisal from the private investor point of view.

Of course, there is some subjectivity in the choice of the SRD but, even with a lower SRD, for example 12%, the absolute efficiency test is also negative.

This is a clear indication that the State has no interest in subsidising the project for rendering it attractive for the private investor or for the banks.

What we have to do now is to find another form of project which can achieve the objective "production of spare parts for the textile industry (or for other industries as well).

At least, there are two alternative projects possible: 1. Expansion of the existing Central Foundry of Khartoum and 2. Another form of workshop.

We do not have sufficient data for conducting the study of the Expansion of the Central Foundry of a much higher capacity than 80 T a year.

The second alternative (a workshop with a small foundry attached) will be easier to formulate. Some data were collected during the training course but it was not possible to develop the previsional accounts because of lack of time. We have developed that alternative project after the training course and the results are presented below in part III of the report.

III. COMPARISON TO AN ALTERNATIVE PROJECT

The data of the alternative project "Spare parts workshop with a small foundry attached" are presented in Annex III.1.

There will be no plastic moulding machine anymore. The first basic machinery will come from an existing idle kenaf factory workshop. The initial capacity of these machines will be about 20T/year. The capacity will increase progressively to 80T/year with the acquisition of the equipment necessary to meet the demand.

The accounts have been presented in Annexes III.2 to 5. The commercial profitability is better than the previous alternative one: the intrinsic rate of return has reached 6,51% against 2,44% but is still very low. It can be improved if the workshop can be installed into a rented building. Such buildings exist in Khartoum North. The profitability to a very satisfactorily 20% if we can avoid the initial disbursement of about 2 million LS for land and building.

But even with this slight improvement of intrinsic profitability to 6,51%, the economic evaluation of the project conducted along the IDCAS Method do not succeed in passing through the Absolute Efficiency Test. (See Annexes III.6 to 7).

This is mainly due to the still excessive cost of investment during the first year of the life of the project. If we can rent an existing building instead of constructing a new one, the economic profitability will be increased.

We can try also to order the supplementary machinery and equipment at the right time we need them for increasing the production. In our project proposal, the time of order was estimated very roughly but in the reality the enterprise can adapt the supplementary investments in equipment to the demand of specific spare parts and, at the same time, take account of the availability of skilled manpower. So it can avoid some difficult periods like the years 7 through 10 when the project has a substantial portion of its equipment remaining idle.

This improvement of the project can be done on the basis of reliable prices of inputs and equipment.

We suffered from a very high degree of imprecision of the data collected for the preparation of the case study and during the training course we had practically no time for assessing the prices with a sufficient accuracy.

However, this was not completely negative since it has been possible to show to the participants the necessity of collecting accurate data and the practical difficulty of doing so.

IV. APPLICATION OF THE EFFECTS METHOD TO THE CASE STUDY

Annexes IV.1 to 7 remind briefly the procedure of the Effects Method Evaluation.

Annexes IV.8 to 12 present the application of that method to the alternative project (spare parts workshop with a small foundry attached) and Annex IV.13 contains the conclusions of that evaluation.

As the IDCAS Method and the Effects Method are very similar, there is, of course, no significative difference in the results but it has been interesting to show how to take account of the Indirect Value Added, only briefly mentioned in the IDCAS Method, and how to break down the Supplementary Value Added into its different components.

The Effects Method is concentrating mainly in the breakdown of the Value Added into its components while IDCAS Method is considering the Value Added more globally as the difference between Output and Material Inputs. Of course, it would also be possible to develop the IDCAS Method along the same breakdown into components of Value Added but this does not present much advantage since the value of the components will differ from the reality through the use of shadow prices.

Substracting from the Present Value of the project the discounted Supplementary Wages, as we have done in Annex IV.13, is an addition to the pure Effects Method, inspired from IDCAS Method. It can serve for seeing if there is effectively a Social Surplus created by the activity of the project.

V. CONCLUSIONS

Due to the very effective selection of the participants who were highly motivated, the perfect local organisation of the seminar, the quality of the lecturers recruited by UNIDO, the interest of the subject itself supported by excellent UNIDO manuals, it has been relatively easy for the team leader to conduct the training course in a manner that was generally well appreciated.

Very efficient support was received from other UNIDO project members present in Khartoum and we have to thank them for their active participation.

The training course was also of a very acute interest for many officials as the country is embarked into a rehabilitation of existing industries operation.

However, we have been too much optimistic about the progress of the case study during the last week of the seminar.

We intended to develop concurrently by 3 groups the case study and two alternative projects in order to show how to conduct a comparison among them and how to make a reasonable choice before deciding the investment.

The economic appraisal would also have been conducted along three different methods.

This has proven not feasible because of:

- the duration of material calculations by the participants which reflects somehow a lack of practical skills in accounting techniques;
- the limited time devoted to the case study (4 days of 4 hours) aggravated by the Ramadan period;
- the lack of accurate data for the projects which had to be collected locally;
- the lay-out of the training course room too long and narrow;
- the lack of quick and cheap reproduction facilities which would otherwise have provided already forms and data to work directly on.

It has just been possible to prepare one project, to correct the initial data by a sensitivity analysis, to make the commercial and financial analysis of it and conduct the economic evaluation by the IDCAS method only (See Annex II.1 to 17).

In addition, as promised to the participants, we have prepared one alternative project (spare parts workshop with a small foundry attached) in Annex III.1 to 5. The economic appraisal has been conducted along the IDCAS Method in Annexes III.6 and 7.

That project proves more promising if building can be rented instead of specially constructed and equipment carefully adapted to the demand and availability of skilled workers.

The evaluation of this alternative has also been prepared for the participants along the Effects Method. (See Annexes IV.1 to 13).

Khartoum, 14 June 1984

ANNEX I.1

Industrial Project Preparation, Evaluation Financing and Contracting

12 May - 14 June 1984 Khartoum

A) Course Coordinators :

1. Amal Sid Ahmed Ismail	Ministry of Industry
2. Faisal Mohamed Salih	Ministry of Planning (PP

B) UNIDO Experts

1. Andre Guichard	Ministry of Foreign Trade Foreign Affairs & Cooperation - Brussels
2. Janusz Lukasik	Central School of Planning & Statistics - Warsaw
3. David Sussman	Holyoke University, Massachusetts, U.S.A.
4. Marek Kulczycki	Feasibility Study Sectio UNIDO - Vienna

C) Participants

a) Khartoum

1. Igbal El Yamani	Ministry of Industry
2. Hamza Mohamed Elamin	" " "
3. Zein Elabdin Ali Sid Ahmed	Ministry of Planning
4. Babiker Abdalla Babiker	" " "
5. Tareg A/Salam El Shafie	Faisal Islamic Bank
6. Moneer Osman Ahmed	" " "
7. Faisal A/Rahman Zakaria	Sudanese Agric. Bank
8. Omer El Sayed Mohamed Salih	" " "
9. Soad Siddig	Ministry of Energy & Min
10. Kawther A/Gadir	" " " "
11. Amal Magzoub Rabah	Industrial Res. & Cons. Centre
12. Ihsan El Sadig Taha	Industrial Res. & Cons. Centre
13. Hassan Mahmoud Hamid	Sudan Industrial Bank
14. Mahmoud Hamid Sulieman	Islamic Coop. Devt. Bank
15. Ibrahim Mohamed Ibrahim	Sudan Rural Devt. Co.
16. Mohamed Mubarak Salih	Management Devt. Centre

b) Regions

17. Sharaf Eldin A/Fatah	Ministry of Industry
18. Ibrahim Hamad	" " "
19. Dr. Hussein Osman Hamid	Min. of Fin. & Eco. Central Region
20. Salah Abu Zeid Saboun	Min of Fin. & Eco. Kordofan Region
21. Mohamed Osman Hassan	Min. of Fin. & Eco. Northern Region
22. Aisha Abdalla Ahmed	Min. of Fin. & Eco. Eastern Region
23. Angelo Tako Mona	Min. of Industry & Minir Equatoria Region
24. Waru Henery Mandege	Min. of Industry & Minir Equatoria Region
25. Kour Deng Mareng	Min. of Industry & Minir Bahr El Ghazal Region

ANNEX I.2

TRAINING COURSE ON INDUSTRIAL PROJECT PREPARATION,
EVALUATION AND FINANCING
12 May - 14 June 1984, Khartoum, Sudan

COURSE PROGRAMME

WEEK 1

Time	Saturday 12.05.	Sunday 13.05.	Monday 14.05.	Tuesday 15.05.	Wednesday 16.05.	Thursday 17.05.
8.30 - 10.00	Opening Ceremony	Outline of project development A. Guichard	Presentation of accounting tables A.Guichard	Discounting methods A.Guichard	Technical feasibility L D. Sussman	Plant capacity economy of scale L A. Guichard D. Sussman
10.30-11.30	Presentation of lecturers and participants	Outline of project development (cont'd) A. Guichard	Presentation of accounting tables (cont'd) A.Guichard	Net Present Value A.Guichard	Production programme L D. Sussman	Plauter capacity static and dynamic analysis, increment; capacity build-up L + E D. Sussman
11.30-12.30	Outline of the course Comments on the manuals received A. Guichard	Outline of project development (cont'd) A. Guichard	Presentation of accounting tables (cont'd) A. Guichard	Simple rates of return A. Guichard	Plant capacity Definitions and constraints L D. Sussman	Materials and inputs Classifications characteristics L D.Sussman

WEEK 2

Time	Saturday 19.05.	Sunday 20.05.	Monday 21.05.	Tuesday 22.05.	Wednesday 23.05.	Thursday 24.05.
8.30-10.00	Supplies programme static and dynamic Inventory models L D. Sussman	Present state of textile industry in Sudan L Nield	Purpose and scope of demand and market analysis L J.Lukasik	Introduction to forecasting L J.Lukasik	Dr. Salem: Forecasting with elasticities L + E J.Lukasik	Marketing instruments: Distribution L J.Lukasik
10.30-11.30	Project engineering project layouts Technology alternatives L/E D.Sussman	Introduction to market analysis/ basic computer L J.Lukasik	Data requirements collection and processing L J.Lukasik	Time series decomposition analysis and extrapolation L J.Lukasik	Regression analysis L J.Lukasik	Marketing instruments: Pricing L J.Lukasik
11.30-12.30	Equipment Selection/equipment balance L/E	Market Research procedure L J.Lukasik	Acquisition of technology L H.Janiszewski	Time series exercise E J.Lukasik	Regression analysis E J.Lukasik	Equipment Costs Civil Engineering Costs J.Lukasik

WEEK 3

Time	Saturday 26.05.	Sunday 27.05.	Monday 28.05.	Tuesday 29.05.	Wednesday 30.05.	Thursday 31.05.
8.30-10.30	H O L I D A Y	Demand Forecasting Sales, Pricing, Marketing and Production Estimates J.Lukasik	Manpower Labour Costs Plant Overhead D.Sussma	F I E L D T R I P	Financial Analysis A.Guichard Financing Equity Loan Net Income Statement Cash Flow Statement	Discounted Cash Flow Methods Net Present Value Internal Rate of Return Intrinsic Rate of Return A.Guichard
10.30-11.30		idem Exercises J.Lukasik	Location and Site Implementation Critical Path D.Sussman	EL HASANEISA Textile Company Spinning Weaving Finishing	Evaluation from the point of view of the investor Simple Rates of Return A.Guichard	Sensitivity Analysis Break Even Point Probability Analysis A.Guichard
11.30-12.30		idem Exercises J.Lukasik	Financial Analysis Presentation of the Accounting Tables Sales Operating Costs Working Capital Requirements A.Guichard	↓ 16.00	Pay Back Period A.Guichard	Practical sequence of operations in view of investment promotion Different contacts to establish A.Guichard

WEEK 4

Time	Saturday 02.06.	Sunday 03.06.	Monday 04.06.	Tuesday 05.06.	Wednesday 06.06.	Thursday 07.06.
8.30-10.00	Planning Procedures in Sudan Dr.Abd El Mushin Prof., University of Khartoum	Value Added in National Accounts Input-Output Tables J.Lukasik	Rate of Foreign Exchange J.Lukasik	Industrial Complexes A.Guichard	Effects Method Alternative Situation A.Guichard	Mr.Bhattacharjya: Investment Opportunities in Sudan in Food Industries
10.30-11.30	Liaison between Project Formulation and Planning J.Lukasik	Value Added in IDCAS Manual Indirect Value Added A.Guichard System of Price ADMP-ACIF-AFOB J.Lukasik	Absolute and Relative Efficiency Test J.Lukasik	Additional Indices and other considerations J.Lukasik	Practical Calculation of Value Included A.Guichard	Organization of the Case Study Break Down of Participants into different groups for collecting data A.Guichard
11.30-12.30	Links between the enterprise and the other economic agents in the economic system A.Guichard	Social Rate of Discount J.Lukasik	Expansion of Project J.Lukasik	Effects Method Value Added Direct/Indirect A.Guichard	Parallel between IDCAS Method and Effects Method J.Lukasik	Guidelines UNIDO Method J.Lukasik

WEEK 5

Time	Saturday 09.06.	Sunday 10.06.	Monday 11.06.	Tuesday 12.06.	Wednesday 13.06.	Thursday 14.06.
8.30-10.30	Case Study Critical Examination of the numerical data of the case study E	"Recent Bank Methods and Procedures" by Mr.Ahmed El Bashir Fadoul from FAICAL ISLAMIC BANK L	Case Study Preparation of Alternative Projects A.Guichard J.Lukasik	Case Study idem	Case Study Economic Evaluation A.Guichard J.Lukasik	UNIDO and Investment Promotion M.Kulczycki
10.30-11.30	Price Forecasting E A.Guichard J.Lukasik	"Sudanese Experience in Project Preparation" by Mr.Zahir Yacoub from Project Prep. Unit, Ministry of Finance and Planning L	idem + Commercial Profitability Analysis A.Guichard J.Lukasik	idem	Economic Evaluation A.Guichard J.Lukasik	Evaluation of the Training Course M.Kulczycki
11.30-12.30	Cash Flow Accounting Calculation of NPV and IRR E A.Guichard J.Lukasik	Preparation of Alternative Projects E A.Guichard	Commercial Profitability Analysis A.Guichard J.Lukasik	idem	Economic Evaluation Necessity of Comparison of two or more alternative projects A.Guichard J.Lukasik	End of the Seminar Closing Ceremony Reported to the Evening

ANNEX I.3

Training Course in Industrial Project Preparation. Khartoum May - June 1984.

The Concept of Value Added.

National Income is the only source for increasing both consumption and savings in a country. Hence it can serve as a quantitative measure of the level and rate of increase in national welfare.

According to the rules of National Accounts, the National Income is constituted of : Wages
plus Household income from property and entrepreneurship
plus Saving of corporations
plus Corporate Tax
plus Government income from property and entrepreneurship
minus Interest on the public debt
minus Interest on consumers'debt.

If we consider that entrepreneurship is equivalent to the artisanal activity, we can say that the five first points of the list above find their source in the commercial and industrial activity.

The contribution of the enterprises to the National Income has been called the Value Added.

As such, the Value Added is the link between the micro-economics of one project and the macro-economics.

If the Value Added created during one period of activity by an enterprise is positive, one can say that that activity has contributed to the National Income.

Definition of the Value Added.

Strict definition varies from one country to another. Value Added can be determined by addition of its composants or by difference.

By difference:

Value Added = Value of the Production - Intermediate Consumption.

Production = Production sold, put into stocks, delivered by the enterprise to itself.

Intermediate Consumption = Raw materials and inputs, utilities, services and transport.

Services include : External services
Rent
Lease
Postage and TT
Temporary manpower
Fees

Are not included : Rent of the land
Product of the earth
Insurance premium
Royalties
Subsidies given by the enterprise.

Those latter elements are included into the Value Added.

.../...

2.

Value Added can also be determined by addition of the following elements:

- wages and social charges related to manpower
- taxes, included corporate tax
- gross income of the enterprise
  which includes, among others, : net profit of the enterprise
  depreciation
  interests paid to banking institutions
  insurance premium etc...

ANNEX I.4

Training Course in Industrial Project Preparation Evaluation and Financing
Khartoum Sudan 12 May - 14 June 1984.

From the idea of project to the financing.

Short description of the iterative process which leads to the adoption of a financial planning acceptable for the investor and the banker.

- - - - - - - - - - - -

1) Preparation of previsional accounts for at least two significant alternatives of the project.

That will be prepared on the basis of data collected at the very beginning of the preinvestment phase. The accuracy of the data will be improved during the elaboration of the prefeasibility study.

The following accounts will be prepared:

1) Investment costs.
Including working capital which will be prepared on the basis of the operating costs.
All costs will be broken down according to their origin of the items : foreign or local.

2) Depreciation.
For having an idea on the time of replacement of the equipment. and the amount of the salvage value. That account will serve to calculate the amount of the corporate tax.

3) Operating costs.
Broken down in foreign and local currency, with detailed accounts for Raw materials and inputs, Utilities, Manpower and, if necessary, for Transport, External Services etc...

4) Income.
Sales and other inflows like Subsidy, Other income
Broken down in foreign and local currency.

5) Integrated Net Income Statement and Net Cash Balance
1) first hypothesis : without outside financing for calculating an acceptable debt charge for the investor.
2) second hypothesis: With outside financing · first essay
This cash balance sheet will indicate if the financial resources are sufficient at any moment for covering the financial needs of the project. If they are not sufficient we must find additional financial resources.

2) Computation of some criterions of profitability from the point of view of the investor.

This will give to the investor the opportunity to decide if there is an advantage for him to realise the project under that form (if not, we have to look for another alternative of the project). Criterion of profitability will facilitate the choice between two or more alternative projects.

3) Sensitivity Analysis.

For taking risk and uncertainty into consideration. If the project proves too risky we will have to find another alternative and repeat the preceding steps.

4) Financial Analysis.

That step will show to the investor if the project can work in a smooth and independant way, from a financial point of view. It will allow the investor to open the dialogue with his banker in a view of getting additional resources.

If the banker agrees, the project can be realised on that base, If not,

we have to go back to the step 1)5)1 on the base of the remarks of the banker.

If the new alternative passes the steps 2) and 3) above and if the banker has not changed his mind, the project can be adopted from the point of view of the investor. He can go to the following step which is the introduction of an official demand to the government for obtaining a licence and the advantages of the Investment Code.

5) Economic Appraisal of the Project.

Normally, there are the public services which will evaluate the project from the point of view of the collectivity. That evaluation will give the way of deciding if the project can beneficiate of the incentives of the Code of Investment. Sometimes, the government will ask some modifications of the project. If so, we must go back to the step 1) above.

- - - - - - - - -

Practically, for avoiding long discussions with the financing institutions, we can prepare a set of financial alternatives of the project.

Showing that set of alternatives to the banker will prove to him that almost all possible alternatives have been scrutinised. Such a procedure can prevent further objections from the banker.

We must add that even at a very early stage of preparation of the project, it can be very useful to approach the banker(s) for knowing this (their) opinion concerning it. If the opinion is favorable, the presentation of the study when completed will be much easier. If not favorable, there will be an indication that the project must be presented to an another banker or simply abandoned

- - - - - - - - - -

ANNEX I.5

Training Course in Industrial Project Preparation, Evaluation and Financing Khartoum 12 May - 14 June 1984.

The Financial Analysis.

The financial analysis is based on balance sheets which show what a company owns (its ASSETS) and what it owes (its LIABILITIES) at a given moment of its existence.

It is a different approach that we utilised with the Cash Flow analysis. The Cash Flow Statement is referring to given periods (year, semester or month).

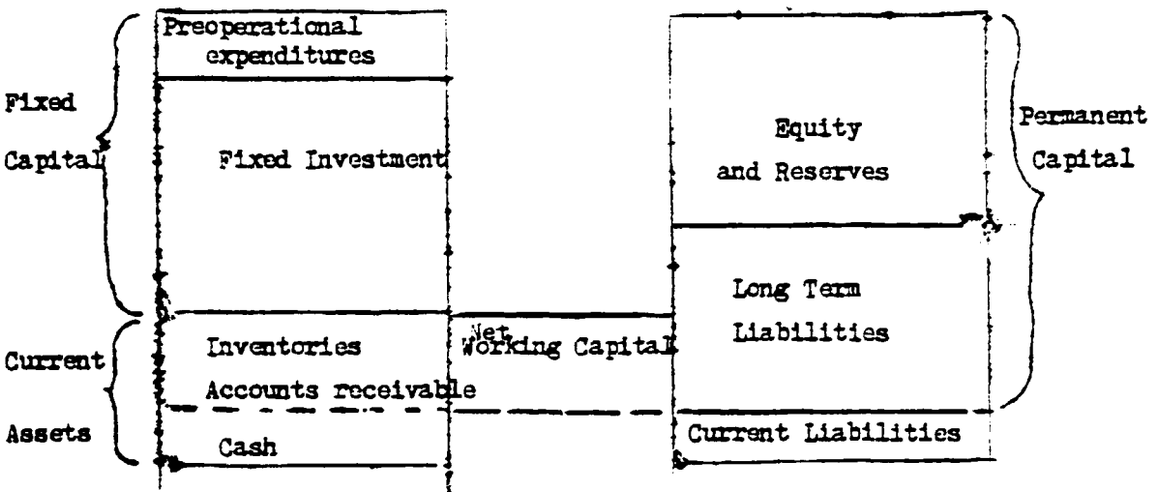
Anyway, the Cash Flow approach can give indications on the financial needs of the company and on the financial resources it can find. It was possible to make a sort of financial planning on that basis.

The next step is the financial analysis which covers a series of techniques estimating the financial soundness of a project.

Those techniques have been developed in the banking world for the appraisal of existing enterprises. With some precautions they can be extended to the study of projects that will be implemented in the future.

Structure of a Balance Sheet.

The balance sheet can be presented schematically as follows:



The items of the Assets are classified along their availability and the items of the Liabilities along how readily thecreimbursement can be demanded by the creditors.

Financial Analysis Techniques and Principles.

1) Fixed capital must be financed by Equity or Long Term Loans (Permanent Capital); Working Capital ought to be financed by Equity or Long Term Liabilities.

2) Ratio Analysis.

On the basis of balance sheets a series of ratios has been developed. Those ratios are useful for appraising the guarantees a company can offer to its lender.

.../....

They can also serve /to measure the financial autonomy of an enterprise.

The most common ratios are:

- The Current Ratio = $\frac{\text{Current Assets}}{\text{Current Liabilities}}$

That ratio gives a measure of the capacity of the enterprise to its short term debts. The bankers prefer a current ratio as high as possible but the company prefers a low current ratio because excess of liquidity or stocks too abundant is a sign of poor management.

- The Liquidity Ratio (or Acid Test Ratio) = $\frac{\text{Cash Balance + Accounts receivable}}{\text{Current Liabilities}}$

That ratio is more severe than the preceeding one.

- The Long Term Debt-Equity Ratio = $\frac{\text{Long Term Debt}}{\text{Equity}}$

which is an indicator of the financial risk of the enterprise.

Equity owners favour high long Term debt-equity ratio which allows to control a project with a relatively small amount of the capital.

Moreover, if the interest rate of the loan is smaller than the internal rate of return, the equity owners take advantage of the leverage effect. Paid interests can also be substracted from the taxation basis.

- Commercial Ratios:

Rate of Turnover = $\frac{\text{Cost of goods manufactured during the year}}{\text{Value of average stock.}}$

- Profitability Ratios:

$\frac{\text{Net Profit}}{\text{Total Assets}}$

$\frac{\text{Net Profit}}{\text{Equity + Reserves}}$

$\frac{\text{Net Profit}}{\text{Sales}}$

General Remark on the utilisation of ratios:

At the pre-investment stage, it is very difficult to assess correctly the amounts of the previsional balance sheets. This uncertainty is reflected and sometimes increased by the use of ratios.

We advocate the use of ratios when we have to contact bankers who are more accustomed to the approach of the balance sheets than to the approach of the cash flow statement.

ANNEX I.6

Food Industries in Sudan

Name of The Factory	Annual Production Capacity	
	Maximum	Actual Production
1) Kassala Onion Dehydration Factory	De-hydrated Onion-900 tons	Maximum - 611 tons (1974-75) Minimum - 108 tons (1969-70) 1980-81 - 110 tons
2) Wau Fruits and Vegetables Canning Factory	a) Tomato Paste 900 tons b) Pineapple Products 144 tons c) Mango Products 432 " d) Canned Vegetables including Beans 1080 "	Maximum (All Products) - 412 tons (1974-75) Minimum (All Products) - 18 " (1978-79) Since re-habilitation of this factory since 1980-81, the factory has made 435 tons of all products.
3) Kenana Fruits and Vegetables Canning Factory	a) Tomato Paste 3240 " b) Dates 1700 " c) Canned Fruits and Vegetables including Beans 1080 " d) Fruit Juices 720 " e) Fruit Jams 60 "	Maximum 1124 tons (1973-74) Minimum 39 " (1966-67) 1980-81 219 " 190 tons on average per year Maximum - 731 tons (1968 - 69) Minimum - 27 " (1980 - 81) 1980-81 - 27 " Maximum - 196 tons (1967-68) Minimum - 1.5 tons (1975-76) 1980-81 - 9 " Maximum - 128 tons (1979-80) Minimum - 0.6 " (1977-78) 1980-81 - 34 "
4) Babanousa Milk Products Factory The factory has been designed to manufacture some milk Products with the following capacities.	a) Spray dried whole milk Powder 900 tons b) Butter 216 " c) Ghee (Butter Oil) 72 "	Maximum - 74tons (1973-74) Minimum - 6 " (1976-77) Information not available " " "
However as adequate quantity of milk is not available to the factory, it has now switched on to manufacture De-hydrated Karkadeh and Gum Arabic Powders with the following capacities.	a) Karkadeh 280 tons b) Gum Arabic Powder 560 "	Maximum - 212 tons (1973-74) The Karkadeh manufacturing season was prolonged this year Minimum - 30 tons (1978-79) 1981-82 - 40 " The factory only provides Processing Facilities to Gum Arabic Company and therefore figures are not available.
The factory can manufacture one of these two products at a time. However in absence of milk, the factory can work year round for Gum Arabic and four months for Karkadeh. In that event, Production capacity will go up for these two Products.		
5) Krikab Sweets Factory, Khartoum North Hard and soft Boild Sweets including some Chocolate Products, [illegible]	4200 tons	The information is under collection

.2.

Name of The Factory	Annual Production Capacity	
	Maximum	Actual Production
6) Ras Sweets Factory, Khartoum North	3600 tons	The information is under collection.

ANNEX I.7

Proposals for Consideration by the World Bank To Allocate Credit Facilities for Development and Re-habilitation of Some Food Processing Industries in The Public Sector in the Democratic Republic of the Sudan

The Democratic Republic of the Sudan is considered to be one of the best potential areas for agricultural and horticultural development; this is due to the fact that land and water, two important factors for such development, are available in plenty in the county. Realising the importance of processing and preservation in making such integrated development successful, one of the earliest Public Corporations set up by the Government was Food Industries Corporation. It has now got five factories under its management and they are engaged in processing tomato, onion (white variety) citrus fruits, mangoes, pineapples, melons, different types of beans and vegetables, Karkade and Gum-Arabic. A sister organisation of the Corporation which is also one of the earliest Corporations is engaged in processing edible oil-seeds and it has got thre factories under its management.

Though the factories under the Food Industries Corporation were set up in early sixties yet it has not been possible to develop them further mainly because of lack of adequate finance and as a result they have now reached a stage where if necessary investments are not made for their development and re-habilitation then some of them will have to be closed down and this will have a serious adverse effect on the progress of food processing industry in the country. To avoid such a situation, the Corpoation has thought of developing agro-industrial complexes with some of its present factories as nucleus and re-habilitate its factories in the Southern and Western Regions. To implement such a plan, it needs Institutional Financial assistance for next few years and the World Bank is considered to be the appropriate institution for this purpose. The Corporation therefore submits, in order of priority, the following proposals for consideration:-

1. Setting up of Agro-Industrial Complexes

The Corporation plans to convert its existing factories into agro-industrial complexes that will have captive farms as well as captive farmers. The general sequence of activities in these complexes will be (a) To achieve higher productivity of fruits and vegetables in the Captive Farms and in the farms of the Captive Farmers through introduction of high yielding seeds,

planting materials, fertilisers, insecticides and better farm management techniques. (b) Harvesting at proper maturities. (c) Improved grading, packing transportation, storage. (d) Advisory guidance to Captive Farmers. (e) Product development through Research and Development activities and better quality control. (f) Continuous use of better technology for the processing of fruits and vegetables and packing of finished products. (g) Organised marketing of finished products in and outside the country. Some of these activities are now carried out but it is planned to expand them in such a way that these complexes become focal points of development and they act as catalysts for rural development and development of ancillary industries in the areas where they are located.

Two such complexes as indicated below are planned to be set up during the period 1980 - 1983.

A. Kassala Onion De-hydration Factory

This factory which is an export orientednone is situated at Kassala 300 km. East of Khartoum. It is equipped to make dehydrated onion on a commercial scale. Its capacity is to handle 50 (fifty) tons of fresh onions per day (3 shifts of 8 hrs each). However due to shortage of white onions for export it has not been possible to utilise fully this capacity. It is therefore proposed to increase the availability of white onions to the factory by establishing a farm of 1500 feddans at Tajog, 20 km from Kassala so that the factory can work for 240 days in a year. As the production will increase, it is necessary to increase storage facilities for raw material and finished product. It is also necessary to introduce mechanical peeling of onions to cope up with increased production and improve quality and decrease losses. Estimated financial assistance required to implement these proposals in as below :-

a) Establishment & Development of 1500 acres of Farm at Tajog near Kassala.	$,400,000
b) Expansion of storage facilities for raw materials and finished products.	300,000
c) Additional Machinery and Equipment.	100,000
Total	$.800,000

B. Kariema Fruits and Vegetables Canning Factory :-

This factory is situated at Kariema in a suitable place near the River Nile 500 kms. North of Khartoum. It is equipped to make tomato paste on a commercial scale and a few products from citrus, mango and pulses on a small scale. The installed capacity of this factory is to process 117 tons of fresh tomatoes per day (three shifts of 8 hrs. each) in two tomato paste making lines. It has got its own can (two sizes) making line; it has also got its own generator and water supply. If the installed capacity is fully utilised, the factory can produce 2340 tons of tomato paste in 100 working days but due to inadequate supply of tomatoes, it has so far been possible to make maximum 500 tons of concentrate from fresh tomatoes and 900 tons of re-constituted paste from imported tomato concentrate. In order to increase capacity utilisation considerably it is proposed to develop Kariema Factory as an Agro-Industrial Complex where growing of tomatoes and other raw materials for the factory will be an important operation. In order to diversify production, it is also proposed to set up a new line to process mango, citrus fruits and pulses.

The estimated financial requirements for these two proposals are as below :-

a)	i) Development of the Farm (1000 acres) attached to the factory.	$.260,000
	ii) Development of Islands in River Nile within a radius of 100 kms from the factory for growing tomatoes including two power-driver river transport for transportation of farm inputs to the Islands and tomatoes to the factory.	300,000
b)	Setting up a new processing line for citrus mango and pulses.	500,000
		$.1060,000

2. Re-habilitation of Factories in the Southern & Western Regions

A. Factory in the Southern Region - Wau Fruits and Vegetables Canning Factory :-

This factory is situated at Wau in the Southern Region. It is equipped to make tomato paste on a commercial scale and products from mango and pineapple on a small scale. The capacity of the factory is to handle 45 tons of fresh tomatoes per day of three shifts. However, due to non-availability of tomatoes in Wau Area, it has not been possible to make at all tomato paste from fresh tomatoes in this plant. There is good scope of developing this factory to process mango and pineapple. It is therefore proposed to develop farms after carrying out feasibility studies to grow tomatoes and pineapples for this factory as an integrated agro-industrial plan and install machinery and equipment for processing mango and pineapple. It is also proposed to have some 'on going' programme to process mango and pineapples. Estimated Financial requirements to implement these proposals are given below :-

a)	Establishment and development of farms to grow tomatoes and pineapples including cost of feasibility studies.	$.500,000
b)	Machinery and equipment to process mangoes and pineapples.	250,000
c)	For 'on-going' programme to process mango and pineapples.	250,000
		$.1000,000

.5.

B. Factory in the Western Region - Babanusa Milk De-hydration Factory :-

This factory which is situated at Babanusa 1700 kms West of Khartoum is equipped to make de-hydrated milk and some other milk products. Due to lack of adequate supply of milk to the factory, spray-dried, Karkade and 'Gum Arabic' are now made in it. There is a good export market for these two products. It is therefore necessary to develop their production in this factory. In order to do so, a feasibility study that will show new equipments are necessary and deletion of unnecessary existing equipments is necessary. The estimated financial requirement to carry this study is £.100,000.

The present estimated investments, capacities and products mix of the factories under the Corporation are in Annexure 1.

The financial requirements of the Corporation for development, diversification and re-habilitation of some of its factories as indicated above are summarised below :-

1. Establishment of Agro-Industrial Complexes:		
a. At Kassala		$.800,000
b. At Kariema		1060,000
	Total	$.1860,000
2. Re-habilitation of Factories in the Southern and Western Regions.		
a. Factory at Wau		1000,000
b. Factory at Babanusa		100,000
	Total	$.1100,000
	Grand Total (1 + 2)	$.2960,000

or 2.9 millions $.

.6.

The sister organisation of the Corperation that is the Oil Corp. is engaged in the manufacture of edible oils from cotton seeds and it also carries out refining operations with regard to groundnut oils. However, due to lack of multi-purpose machinery and equipment, it has not been possible for this Corporation to utilise its capacity fully; percentage of utilisation is only 30%. The organisation therefore wants to re-habilitate its factories by installing additional machinery and equipment including solvent extraction plants so that it can process ground-nuts and other edible oil seeds in addition to cotton seeds and thereby increase capacity utilisation. It can carryout such a plan only if it gets Institutional Financial assistance from an organisation like the World Bank. The Corporation therefore submits the following proposals for consideration:-

A. Re-habilitation of African Oil Mill

This mill is at Khartoum North and it has a crushing capacity of 150 tons of cotton seeds per day. The machinery and equipment have become old and obsolete and hence they need replacements immediately. The Corporation has therefore entered into a contract with M/S. French Oil Disc Corporation, Piqua, Ohio, USA to supply new machinery and equipment at an estimated cost of $.2.1 million. It has become extremely difficult for the Corporation to arrange this finance. It therefore needs assistance of the World Bank to get this finance.

B. Re-habilitation of the Sudan Oil Mill

This mill established in 1945 is also at Khartoum North; its original crushing capacity was 200 tons of cotton seeds per day, but due to complete worn-out conditions of machinery and equipment, it can crush now hardly 75 tons of seeds/day. It therefore needs complete overhauling and the Corporation wants to put pre-press expellers and solvent extraction plants for this purpose. The estimated investment is as below :-

1.	Buildings	$. 600,000
2.	Machinery, Equipment for Pre-press solvent Extraction	$.3,850,000
3.	Boilers	350,000

.7.

C. Installation of DELINTERS

During recent years, the Corporation is getting more of white cotton seeds with high lint contents and as a result it has become necessary to install delinters so that productivity of the three oil mills is not effected. It therefore proposes to set up delinters at an estimated cost as indicated below :-

1. Building	-	$. 100,000
2. Machinery and Equipment	-	900,000
Total		$.1000,000

The total financial assistance needed by the Oil Corporation is summarised below :-

A.	Re-habilitation of African Oil Mill	-	$.2.100 million
B.	Re-habilitation of the Sudan Oil Mill	-	$.4.866 "
C.	Installation of Delinters	-	$.1.000 "
			$.7.966 million

Annexure 1.

Estimated Investments, Capacities and Products mix of the Factories under the Food Industries Corporation

1	2	3	4	5	6	7	8	9
Sr. No.	Name of the Factory	Products Mix.	Capacity (3 shifts per day)	L A N D		B U I L D I N G S		
				Factory $.	Farm $.	Factory $.	Farm $.	Residential $.
1	Kariema Fruits & Vegetables Canning Factory.	a)Tomato Paste. b)Canned Fruits & Vegetables including jams.	a)23 tons. b)Very small quantity.	The land has been given free by the Govt.	At present only 20 acres of land is used; it is proposed to develop 1000 acres of farm & 3 islands in River Nile as part of an Agro-Industrial Complex.	203.506	948	25$.064
2	Kassala Onion Dehydration Factory.	Dehydrated onion	7 tons	Do	20,000	423,700	-	195,032
3	Wau Fruits & Vegetables Canning Factory.	a)Tomato Paste. b)Mango & Pine-apple products.	a) 8 tons b) 3 tons	Do	400 acres of land given free by Govt.	500,000	-	95,200
4	Rabanusa Spray-dried Factory.	Spray dried Karkade & Gum-Arabic.	Full capacity	Do	-	731,660	3,090	271,926
5	Kariema Dates Packing Factory.	Processed Dates in Consumer Packs	Do	-	-	52,000	-	-

10	11	12	13	14	15	16	17	18	19	
SR. No.	Machinery & equipment including utilities.		STAFF Factory		Farm		Transport		Working Capital (Average)	Remarks
	Factory ₹.	Farm ₹.	Permanent ₹.	Casual ₹.	Permanent ₹.	Casual ₹.	Factory ₹.	Farm ₹.	₹.	
1	598,776	2,552	303	27	37	-	104,326	15,138	1,065,202	The casual staff is mainly for peeling onion.
2	438,574	1,510	205	831	-	-	99,032	16,292	2,121,148	
3	240,000	-	319	-	92	-	18,000	-	412,800	Working Capital is yet to be provided.
4	1,470,306	2,000	242	5	12	-	287,740	-	2,509,680	The fact was set up for Dehyd. Milk; not is used to make spray dried Karkade & Gum-Arabic.
5	34,000	-	25	-	-	-	2,116	-	190,400	

CASE STUDY AND EXERCISE SERIES

IE - 5218 - P
Rev. Sept. 1979

TINNED MILK MARKET FORECAST
MARKET RESEARCH CASE STUDY

Problem

This case study is based on a consultant's market research report for a pre-feasibility study of a proposed new factory. The consultant forecasted future demand by analysis of past imports. The case raises questions on proper methods of demand forecasting and the interrelationship with the rest of the "marketing mix". Approximate working time: 2½ hours.

Prepared by: Robert Youker

IE-5218-P
Rev. Sept. 1979

I

INTRODUCTION

OBJECTIVES

To determine if the project is sufficiently attractive to justify proceeding with detailed engineering studies and final cost calculations preparatory to an investment decision.

To answer such major questions as type of oil to be used in the reconstituting process, size of can to be produced, size of the factory and the total amount of investment required.

SCOPE

Product - reconstituted tinned milk, either natural or filled.
Geographical Area - Ghana and export markets in nearby countries.
Planning Horizon - five years to 1968.

DEFINITIONS

Reconstituted or recombined milk is the result of blending nonfat dry milk powder with water and anhydrous milk fat to produce a product which is very similar to either fresh or evaporated whole milk.

Filled milk is the product made from skim milk (reconstituted powder or liquid) with vegetable fats or oils added in approximately the same proprotion as the butterfat removed from the whole milk. The vegetable fat may be any one of a number of edible fats and oils, such as coconut oil, corn oil, etc. Earliest available reports of production show filled milk, mainly in bulk form, produced in the United States as early as 1916. It is believed that filled milk is currently being produced in about ten countries including Ghana, where the Ghana Cold Storage Company in Accra is already producing filled whole milk and distributing it as far as 70 miles from Accra.

Tinned milk is any form of evaporated or condensed milk which has been packaged in tin cans, usually of a standard size, for purposes of preservation.

CONCLUSIONS

A reconstituted filled evaporated milk plant would be a favorable addition to the Ghana economy.

Nine parts coconut oil the one part corn oil should be used in the reconstituting process.

Production should be exclusively in the 14.5-ounce can size.

A factory producing 17 million pounds per year operating on one shift full capacity would require a total investment of ₺ 417,684 if taxes and import duties are waived, or of ₺ 438,043 if these taxes and duties must be paid, raising the working capital requirements.

A sales prices of ₺2.25 per case would produce a 75.2% return on invested capital if taxes and imported duties are waived, or a 19% return if these taxes and duties must be paid. This assumes operation at full plant capacity and over 90% of the present market (17-million-pound output, or 390,805 cases vs. 18.9-million-pound 1963 consumption). The break-even points are 110,894 cases and 177,882 cases under the two alternatives.

Protection from import competition by means of either restrictive licensing or protective tariffs is recommended for the first three to five years of production.

IE-5218-P
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II

MARKET

SUMMARY

We have restricted our market projection to unsweetened evaporated milk for the following reasons: (1) The quite separate and distinct market for unsweetened evaporated milk as compared with other forms of liquid milk, resulting largely from its major use for infant feeding; (2) the greatly superior keeping quality of tinned evaporated milk in a tropical country such as Ghana (for example, shelf life of this product is estimated at over six months, and an opened can will keep for over 24 hours without refrigeration if kept in a reasonably cool place); (3) the fact that this is the form of liquid milk to which most consumers are accustomed; and (4) the difficulty of widespread distribution of any other liquid milk form. Total demand for this unsweetened evaporated milk is approximately 19 million pounds per year (1963), and the market has been growing at an average compound rate of approximately 12% per year. The one-shift capacity of the plant envisioned in this report is 17 million pounds per year. This is the smallest economical-sized plant. It seems, therefore, that with a lower price than present imports and/or government protection against imports, the factory should be able to operate successfully at capacity or beyond.

PAST GROWTH

In view of the lack of local milk production, the official import figures are considered to be a reliable estimate of the total size of the market. Total milk consumption in Ghana is (1) small in relation to other comparable countries, (2) increasing, and (3) satisfied almost entirely by imports. These points are illustrated in Table 1, which shows the imports of all forms of dry and liquid milk into Ghana from 1955 through 1963. Figures are shown both in cwt. and in kilos to facilitate comparison between the Ghana statistics and the international statistics in Appendix A. Demand for unsweetened evaporated milk has grown from 67.9 cwt. in 1955 to 168.3 cwt. in 1963, or an average compound rate of increase of approximately 12% per year. On a per capita basis, this increase has been from .59 kilos per person in 1955 to 1.18 kilos per person in 1963. These rates can be compared with per capita consumption of other countries shown in Appendix A. Comparable consumption figures of evaporate milk on a per capita basis for a few selected countries with low whole milk consumption are as follows:

.4.

Country	Kilos Per Year
Ghana (1963)	1.18
Panama	4.7
Trinidad and Tobago	9.4
British Honduras	20.0
Greece	2.4
Malaya	7.4
Philippines	1.9
Thailand	1.8

FUTURE DEMAND

The projected future demand presents a favorable market situation for establishment of an evaporated milk plant in Ghana. This projection is shown in Table 1 and Graph 1. The projection in Graph 1 is based only on past per capita consumption figures. Other considerations would probably increase demand for this product at an even greater rate than that projected. Such considerations include a lower possible price for a local product as compared with the imported variety and the expected overall growth of national income during this period. The general product -- unsweetened evaporated tinned milk -- is already widely accepted and its demand has grown rapidly. With the introduction of a comparable product at a lower cost into a growing economy, and with additional sales promotion, the rate of growth in demand will probably increase even more rapidly than projected on the basis of past figures.

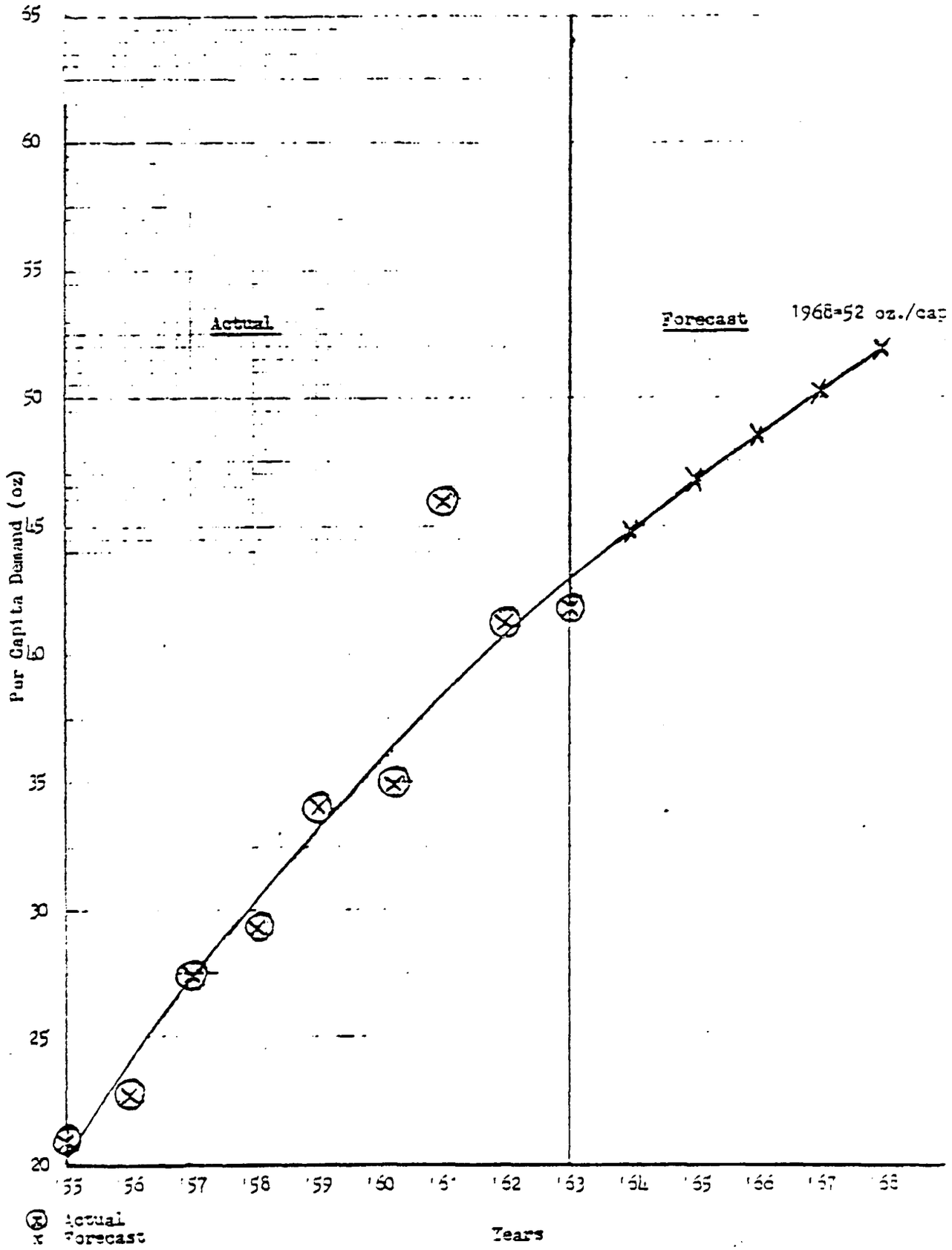
The projected per capita demand from Graph 1 is used in Table 1, together with the projected population to provide total projected demand for this product. This projection is shown in cwt. for comparison with past Ghana figures, in kilos for comparison with international figures, and in pounds for comparison with expected output of the proposed factory. It should be noted that even the highest projected per capita demand figures of 1.479 kilos for 1968 is conservative when compared with the selected international figures of 1.8 to 9.4 kilos and higher. The projected demand indicates a sufficient market to justify a plant of the capacity proposed in this report.

COUNTRY OF ORIGIN

Table 2 shows the imports for 1961, 1962 and 1963 broken down by country of origin. Betwen 90% and 95% are from the Netherlands. This reflects the large percentage of the market controlled by PEAK, the major Dutch producer.

.5.

Trend of Per Capita Consumption
Unsweetened Evaporated Milk (Eye-Fitted Regression Line)



			Projected Years				
1961	1962	1963	1964	1965	1966	1967	1968
6,901,717	7,081,121	7,265,234	7,454,123	7,647,923	7,846,788	8,050,793	8,260,131
7,650	5,331	4,816					
389,455	371,396	245,178					
55,685	39,133	31,966					
.056	.038	.036					
36,506	39,636	261,414					
1,756,567	2,017,833	1,356,269					
267,200	266,025	316,461					
.255	.285	.187					
26,940	32,691	17,167					
1,371,491	1,644,269	874,975					
167,215	107,171	115,453					
.199	.235	.120					
176,920	162,676	168,945					
9,666,836	8,281,687	8,600,836					
34.9	(08.1)	03.9					
1,212,995	1,176,812	1,213,193					
6.68	7.23	7.18					
1.30	1.170	1.184					
43.93	41.16	41.67					
31.5	(10.4)	01.3					
			44.75	46.75	48.50	50.25	52.00
			1.371	1.328	1.378	1.428	1.478
			186,145	199,520	215,225	224,755	239,490
			20,848,240	22,346,240	24,105,200	25,204,560	26,828,880

Table 1

GHANA
Import Statistics - Milk and Cream

	Actual Years					
	1955	1956	1957	1958	1959	1960
Population 1/	5,908,613	6,062,237	6,219,856	6,381,572	6,551,922	6,726,830
Fresh (021-010 and 022-300) 2/						
Quantity (cwt.)	3,232	3,658	5,674	5,985	6,426	6,492
Quantity (kilos)	164,538	186,225	288,858	304,691	327,245	330,502
Value (C£)	18,304	22,399	33,816	41,621	40,912	43,001
Kilos per capita	.028	.031	.046	.048	.050	.049
Dry: (022-010 and 022-200)						
Quantity (cwt.)	2,748	3,265	3,731	3,427	8,657	13,227
Quantity (kilos)	139,898	166,218	189,942	174,465	440,720	673,373
Value (C £)	39,602	49,431	58,553	56,141	89,941	125,025
Kilos per capita	.024	.027	.031	.027	.068	.100
Sweetened Condensed: (022-011 and 022-110) 2/						
Quantity (cwt.)	16,577	15,404	18,015	12,517	14,961	12,356
Quantity (kilos)	843,716	784,204	917,127	637,229	761,651	629,033
Value (C £)	114,873	[illegible] 418	114,240	95,418	101,380	86,366
Kilos per capita	.143	.129	.147	.100	.116	.094
Unsweetened Evaporated (022-012 and 022-120) 2/						
Quantity (cwt.)	67,969	76,349	93,015	104,126	124,968	131,130
Quantity (kilos)	3,459,222	3,883,040	4,837,122	5,300,940	6,362,058	6,675,709
Percent Increase		12.3	24.1	9.6	20.0	04.9
Value (C £)	501,329	559,632	700,658	758,921	877,285	954,010
Approx. Value per cwt. (C £)	7.38	7.31	7.37	7.29	7.02	7.28
Kilos per capita	.591	.643	.778	.831	.971	.992
Ounces per capita	20.81	22.63	27.37	29.23	34.17	34.81
Percent Increase per capita		8.75	20.8	6.80	16.9	2.2
Unsweetened Evaporated						
Projected Per Capita Demand (cwt.) 3/						
Projected Per Capita Demand (kilos)						
Total Projected Demand (cwt.)						
Total Projected Demand (lbs.)						

1/ Based on 1960 census growth estimated at 2.6% per year by Development Plan, 1964
2/ Source: External Trade Statistics of Ghana, Central Bureau of Statistics
3/ Projection of past demand as per Graph 1.

TABLE 2

GHANA IMPORT STATISTICS BY COUNTRY OF ORIGIN

UNSWEETENED EVAPORATED MILK AND CREAM*

Countries	1961				1962				1963			
	Quantity		Value		Quantity		Value		Quantity		Value	
	cwt	lbs	Pounds	Dollars($)	cwt	lbs	Pounds	Dollars($)	cwt	lbs.	Pounds	Dollars($)
Netherlands	169,555	18,990,160	1,174,558	3,288,762	153,521	17,194,352	1,119,343	3,134,160	152,263	17,053,456	1,107,787	3,101,804
U.K.	6,135	687,120	36,128	-	8,547	957,264	53,353	-	14,934	1,672,608	90,397	-
Canada	-	-	-	-	-	-	-	-	1	112	25	-
Denmark	804	90,048	5,071	-	100	11,200	1,274		1,317	147,504	7,659	-
New Zealand	-	-	-	-	9	1,008	241	-	-	-	-	-
Nigeria	-	-	-	-	-	-	-	-	1	112	2	-
Belgium Luxemburg	-	-	-	-	-	-	-	-	53	5,936	780	-
France	-	-	-	-	8	896	40	-	67	7,504	199	-
W. Germany	333	37,296	1,562	-	77	8,624	488	-	290	32,480	3,379	-
Switzerland	93	10,416	476	-	-	-	-	-	19	2,228	165	-
U.S.A.	-	-	-	-	414	46,368	2,073	-	-	-	-	-
Total	176,920	19,815,040	1,217,995	3,410,386	162,676	18,219,712	1,176,812	3,295,074	168,945	18,921,840	1,210,393	3,497,500
				95%				94%				90%

* Source: External Trade Statistics of Ghana, Central Bureau of Statistics

SIZE OF CONTAINER

Interviews with importers in Ghana and import figures from U.A.C. have revealed that six-ounce cans have controlled about 90% to 95% of the unsweetened evaporated milk market. We aknowledged that certain marketing problems may be involved in selling the 14.5-ounce cans, but we feel that the people will buy this size if it can be obtained at a substantially cheaper price and it is the only size available. In view of the lesser investment required for production of a single size can, and of the more economical production cost and sales price of the larger size, we have decided to base this report on production and the sale of only the larger 14.5-ounce can. In the Philippines, where only the larger size can was produced, there was no difficulty in inducing consumers to change from the smaller can which had been previously imported.

COMPETITION AND EXPECTED MARKET SHARE

Ghanaians are known to be brand conscious, as is witnessed by the large share of this market traditionally occupied by PEAK milk from Holland. This gives us reason to doubt that locally manufactured milk would be able to compete successfully with this established brand without a substantial price advantage. The reason for this doubt is increased by the necessity to produce only the larger size cans. The required price advantage can be attained in part by the lower costs involved in local manufacturing, but we feel that either protective tariffs or restrictive import licensing will also be required for at least the first three to five years of local manufacture in order to ensure successful market acceptance of this new product.

Prior to the introduction of this new product, the new company will have to conduct market surveys to determine the name of the new product and its acceptability at various market levels. During the early period of introduction, an extensive advertising program will be required to develop the new company's brand image and to guarantee market acceptance of the new product.

The government should ensure that the local product does not rise in price or fall in quality while the government is providing a protected market.

DISTRIBUTION

It is expected that local production will fit into the normal distribution system in place of imports. Sales would be made to present importers and other wholesale dealers. It is also expected that the new company would make a substantial effort to expand the distribution system to better reach all points of possible sales and thereby accelerate the increasing demand for this product. This expansion of the distribution system and the previously mentioned extensive advertising program are reflected in the Advertising and Miscellaneous Sales Expenses section of Table 16.

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PRICE AND MARGINS

The projection in Table 16 is based on sales price at the factory of per 48-can case, or 0.046875 per can. This sales price was derived in an attempt to provide a lower price than the present import price of ₺2.9 per case, or .06042 per can, and still allow a satisfactory return on investment to the new plant. In addition to an attempt to broaden the market, the lower price is justified by the lower cost of raw materials used in filled milk.

We feel that it may be necessary, in order to gain maximum assistance from the distributors in promoting this new product, to allow the same amount of margin on this new product as is presently being applied to imports. This procedure would result in a pricing structure which compares with the present pricing structure as follows:

Present Pricing Structure

	Import	Wholesale	Retail
Per Can	.06042	.06542	.07083
Per Case	₺2.9	₺3.1375	₺3.4
Margin Per Case		0.2375	0.2625

Proposed Pricing Structure

	Factory	Wholesale	Retail
Per Can	.046875	.05167	.05833
Per Case	₺2.25	₺2.49	₺2.75
		0.2375	0.2625

EXPORT MARKET

The imports of unsweetened evaporated milk in countries adjacent to Ghana are listed in Table 3. It appears that substantial markets exist in these countries and that these markets will grow rapidly, but local factories may displace imports in much the same manner as is now being considered in Ghana. We feel that the uncertainty of these markets prevents their inclusion in our forecast of the potential market for the Ghana plant now being considered. The possibility of developing these export markets should be kept in mind, however, and an attempt should be made to develop them to whatever extent is possible.

Table 16

ESTIMATED PROFITABILITY

	Source	Taxes and Import Duties Waived		Taxes and Import Duties Imposed	
SALES					
390,805 cases @ Ł2.5/- per case			Ł879,311		Ł879,311
VARIABLE COSTS					
Raw Materials	Table 7	Ł620,840		Ł701,590	
Direct Labor	Table 11	2,628		2,628	
Utilities	Table 12	2,500		2,500	
Advertising and Misc. Sales Expense	Est.	34,000	659,968	34,000	740,718
Sub-Total			Ł219,343		Ł138,593
FIXED COSTS					
Personnel, Indirect and Administrative	Table 11	Ł 13,048		Ł 13,048	
Rent, Land	Table 8	600		600	
Professional Fees	Est.	300		300	
Misc. Supplies and Expenses	Est.	1,000		1,000	
Interest	Table 13	16,707		17,522	
Depreciation - Equipment	Table 9	15,505		15,505	
Depreciation - Building	Table 8	4,000		4,000	
Maintenance	Table 9	7,753		7,753	
Electricity Fixed Charge	Table 12	960		960	
Amortization of Start-up Costs	Table 15	1,372		1,389	
Directors' Fees	Est.	1,000	62,245	1,000	63,077
Net Profit Before Tax (Assume 5 years tax free)			Ł157,098		Ł 75,516
Tax @ 45%					33,982
Net Profit After Tax					Ł 41,534
Equity Investment			Ł208,842		Ł219,022
Rate of Return on Equity			75.2%		19%

Table 3

IMPORTS OF UNSWEETENED CONDENSED MILK
(converted to pounds in weight and £ in value)

	1961	1962	1963
Upper Volta			
Quantity 3/	354,944	954,600	1,430,798 7/
Value 4/	£ 19,731	£ 66,485	£ 72,365 7/
Togo 1/			
Quantity 3/	-	1,574,099	2,048,092
Value 4/	-	£ 75,755	£ 89,788
Ivory Coast			
Quantity 5/	7,560,008	4,850,197	-
Value 4/	£ 444,940	£ 272,271	-
Dahomey 2/			
Quantity 3/	-	-	793,663
Value 6/	-	-	£ 42,500

1/ Condensed milk of all kinds.
2/ Imported from France only; includes evaporated and condensed milk and cream.
3/ Metric tons multiplied by 2,204.62 (1 mt = 2,204.62 lb.).
4/ F. CFA divided by 691.18 ($1.00 = 246.85 F. CFA), rounded to nearest £.
5/ Kg multiplied by 2.204622 (1 kg = 2.204622 lb.).
6/ $ divided by $2.80 (1 £ = $2.80).
7/ Eleven months.

Sources: Upper Volta - Bulletin Mensuel de Statistique; Togo - Bulletin de Statistique; Ivory Coast - Statistique du commerce exterieur de la Cote d'Ivoire; Dahomey - Commodity Trade Statistics (United Nations).

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ADVANTAGE OF FILLED MILK

In some situations, especially where the country concerned has a surplus of some acceptable type of vegetable oil such as coconut oil, foreign exchange can be conserved and the selling price of the milk reduced by subsitituting vegetable oil for anhydrous milk fat. The resulting product, which is similar to evaporated whole milk in both taste and nutrition, is called filled milk.

Ghana's supply of coconut oil lends itself to use in the manufacture of this product. Not only is foreign exchange conserved, but a less expensive product is produced. As seen in Table 4, the United States CCC export sales price of butter is now about $.35 per pound, or 0.125, and since butter is only about 80% anhydrous milk fat (butter oil), the price per pound of oil would be about $.44, or 0.15833. It must also be noted that freight and handling would have to be added to this price in order to get a landed cost in Ghana. In contrast to this high cost, interviews in Ghana have shown that refined coconut oil is available on the Ghana market for about ₵ 28.5 per 44 gallons (imperial), or about 0.07083, or $.20, per pound. This amounts to a saving of 0.85417 per 9.8 pounds of oil required for 100 pounds of milk output, or 55%.

A combination of one part corn oil with nine parts coconut oil was found to be the best oil combination in the Philippines. We feel that a similar combination should be utilized in the Ghana production. Table 5 shows that the cost of corn oil is also less than that of butter oil, with its most recent price per pound being about $.15,
ation to Ghana.

The nature of the markets and end-uses of filled milk resembles that for evaporated whole milk. This new product will be competing with and, hopefully, displacing the presently imported evaporated whole milk.

For all of these reasons, we belive that the production in Ghana of reconstituted unsweetened evaporated milk should be a filled milk rather than a whole milk, using both coconut oil and corn oil.

RAW MATERIALS

As noted above, it is proposed to use locally available refined coconut oil and imported corn oil as the oil components of this milk.

Nonfat dry milk would probably be imported from the United States, although Commonwealth countries such as New Zealand or Australia might also be able to supply some or all of this requirement. It is interesting to note that the world supply situation for nonfat dry milk is such that even Holland is now importing it from the United States.

The steadily rising trend of U.S. prices for nonfat dry milk is shown in Table 6. The most recent price at which this product is available is about $.13, or 0.05417, per pound. It is likely that this price trend will continue upward. This is because U.S. supplies are presently limited, the dairy producing areas are intensifying their pressures on the government for increased dairy price supports, and also because it is not expected that the government export subsidy (PIK = payment in kind) program will be reinstated in the future to subsidize any reduction in export prices from the higher support price.

The desired vitamin additives would also be imported. The exact requirements would depend on medical research to determine precise needs in Ghana. The cost would be minor in any event.

There are no companies in Ghana now able to supply the type of cans required for this milk-producing operation. The cost of equipment to produce the 14.5-ounce sanitary-top cans used in the proposed plant is too high (in the area of $ 143,000, FAS New York) to be supported exclusively by this size milk factory. Initially, therefore, the tin cans could most economically be imported. The nearest factory is in Nigeria. There are several factories in Ghana that may soon be able to supply the necessary cans.

Labels could be printed in Ghana at a very small cost.

The amounts and costs of the vairous raw materials required are summarized in Table 7.

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Table 6

U.S. PRICE OF NONFAT DRY MILK

Period or Date	Announced CCC[1] Export Sales Prices[2]	Payment Rates Under Payment-in-Kind Program[2]
July-Sept., 1962	6.12-6.21[3][4]	8.18-8.25[3]
Oct.-Dec.	6.22-6.35	8.22-8.91
Jan.-Mar., 1963	6.29-6.35	8.84-8.90
April-June	6.33-6.40	8.78-8.85
July-Sept.	6.40-6.47	8.73-8.78
Oct.-Dec.	6.46-7.10	8.08-8.73
Jan.-Mar., 1964	7.10-7.57	7.80-8.08
April-22 May	7.90-9.25	6.13-7.75
August 1964		1.00-2.95
2 Sept.[5]		.82

As of 10 Feb. 64, the U.S. Department of Agriculture support buying price for spray nonfat dry milk, U.S. Extra Grade, is:

Bags without tape	14.40
Bags with tape	14.60

In view of the halted PIK program, export sales for at least the near future must be expected to be for at least this minimum support price. Therefore, for the purposes of this report, an average price of $.15 is used.

1/ CCC = Commodity Credit Corp., an affiliate of the U. S. Department of Agriculture.
2/ Source: U.S. Department of Agriculture.
3/ U.S. cents per pound.
4/ F.A.S. basis, other-than-Pacific ports.
5/ The last PIK export sales registration accepted. No more are planned for at least the near future.

Table 7

RAW MATERIAL COSTS

Item	Amount Per Hundred Pounds of Finished Product	Assuming Import Duties Waived: Cost Per Hundred Pounds of Finished Product	Assuming Import Duties Waived: Total Cost at Annual Output of 17 Million Pounds	Assuming Import Duties Imposed: Cost Per Hundred Pounds of Finished Product	Assuming Import Duties Imposed: Total Cost at Annual Output of 17 Million Pounds
Milk Constituents:					
Nonfat dry milk	18.3 lb.	Ł 1.144 1/	Ł 194,480	Ł 1.296 2/	Ł 220,320
Coconut oil	8.8 lb.	.623 3/	105,910	.623 3/	105,910
Corn oil	1.0 lb.	.063 4/	10,710	.079 5/	13,430
Total		Ł 1.830	Ł 311,100	Ł 1.998	Ł 339,660
Cans (14.5-oz.)	110.345 cans	1.534 6/	260,780	1.841 7/	312,970
Shipping cartons	2.299 cases	.288 8/	48,960	.288 8/	48,960
Total		Ł 3.652	Ł 620,840	Ł 4.127	Ł 701,590

1/ Imported from USA at $.15 per pound plus $.02 per pound freight and handling, or a total of .0625 per pound. Assumes present import duty of Ł 1 per cwt. would be waived for this project.

2/ As in footnote 1, but includes import duty, or a total of .07083 per pound.

3/ From local supplier at Ł 28.5 per 44 imperial gallons, 9.21 lbs. per imperial gallon, .07083 per pound.

4/ Imported from USA at $.15 per pound plus $.02 per pound freight and handling, or a total of .0625 per pound Assumes import duty of 25% waived for this project.

5/ As in footnote 4, but includes import duty, or a total of .07917 per pound.

6/ Imported from Nigeria at estimated cost of .01390 per can plus shipping. Assumes present 20% import duty waived for this project.

7/ As in footnote 6, but includes import duty, or a total of .01668 per can.

8/ From local supplier, 48 cans per carton at .125 per carton.

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APPENDIX A-1

PER CAPITA CONSUMPTION WESTERN HEMISPHERE, 1959-61 1/
(Kilograms per year)

Country	Whole Milk	Skim Milk	Dry Milk	Evaporated Milk
Canada	189.1	-	3.6	8.3
Argentina	81.6	-	.6	.4
Bolivia	9.8	4.0	.3	.3
Brazil	52.9	1.8	.6	.3
Chile	89.4	5.3	2.2	.1
Colombia	55.2	3.2	.7	-
Costa Rica	94.4	5.1	1.7	.8
Cuba	93.6	4.0	.1	1.0
Ecuador	62.3	3.2	.2	-
Guatemala	24.7	5.0	.5	.3
Haiti	8.4	-	.3	-
Honduras	21.6	1.6	.5	-
Mexico	70.2	1.0	.3	.3
Panama	16.8	-	.9	4.7
Peru	22.4	4.3	.3	.4
Trinidad & Tobago	18.8	-	4.7	9.4
Venezuela	9.6	8.7	6.5	.4
British Honduras	.4	-	2.7	20.0

1/ Source: Food Balances for 24 Countries of the Western Hemisphere, 1959-61. Foreign Regional Analysis Division, Economic Research Service, U.S. Department of Agriculture.

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APPENDIX A-2

PER CAPITA CONSUMPTION WESTERN EUROPE, 1959-61 1/
(Kilograms per year)

Country	Whole Milk	Skim Milk	Dry Milk	Evaporated Milk
Austria	165.8	11.2	.4	.4
Bel-Lux	101.9	6.0	2.6	2.6
Denmark	135.2	37.4	-	-
France	105.6	-	1.1	1.4
W. Germany	105.4	10.5	1.2	7.1
Netherlands	121.6	45.1	.8	7.5
Norway	188.4	7.6	.1	1.9
Sweden	152.8	33.3	3.2	.5
Switzerland	178.7	2.7	2.4	1.3
U.K.	148.5	-	2.0	2.6
Greece	45.0	5.8	.5	2.4
Italy	63.4	-	.2	.3
Spain	59.8	-	.1	1.1

1/ Source: Food Balances for 16 Countries of Western Europe, 1959-61. Foreign Regional Analysis Division, Economic Research Service, U.S. Department of Agriculture.

APPENDIX A-3

PER CAPITA CONSUMPTION
FAR EAST AND OCEANIA, 1959-61 1/
(Kilograms per year)

Country	Whole Milk 2/	Dry Milk	Evaporated Milk
Burma	16.2	-	-
Ceylon	8.9	1.2	.9
India	48.5	0.1	-
Indonesia	0.3	-	0.1
Japan	15.6	0.5	-
Malay	2.6	0.3	7.4
Pakistan	45.0	-	-
Philippines	0.9	0.6	1.9
Taiwan	0.5	0.2	-
Thailand	0.3	0.1	1.8
Australia	137.0	3.3	4.0
New Zealand	209.6	4.2	3.3

1/ Source: Food Balances for 12 Countries in the Far East and Oceania, 1959-61. Foreign Regional Analysis Division, Economic Research Service, U.S. Department of Agriculture.

2/ Economic Research Service estimates.

APPENDIX A-4

PER CAPITA CONSUMPTION
AFRICA AND MIDDLE EAST, 1958 1/
(Kilograms per year)

Country	Whole Milk 2/	Country	Whole Milk 2/
Algeria	41.9	French Eq. Af.	33.9
Egypt	20.0	French West Af.	10.4
Ethiopia	66.7	Ghana	7.0
Libya	14.5	Guinea	6.6
Morocco	64.3	Kenya	50.5
Tunisia	49.7	Liberia	3.1
Sudan	77.5	Nigeria	9.3
Angola	6.4	Tanganyika	33.8
Bel. Congo & R.U.	5.6	Togoland	1.8
Cameroon	2.5	South Africa	81.5
Rhod. & Nyas.	18.1		

1/ Source: Food Balance, Calendar Year 1958, Foreign Regional Analysis Division, Economic Research Service, U.S. Department of Agriculture.

2/ Cow's, sheep's and goat's milk. Include the whole milk equivalent of canned and dried milk; dried whole and skim milk not separately specified.

CASE STUDY AND EXERCISE SERIES

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TINNED MILK MARKET FORECAST

Market Research Case Study

Solution

The major issue in this case is whether the National Investment Bank should promote a factory to manufacture unsweetened evaporated tinned milk. Before we can arrive at any decision, we have to analyze the consultant's report and see whether its findings are reasonable. We can also improve the analysis with more rigorous methods for forecasting demand. It would also be useful to check the reasonableness of the consultant's forecast with additional forecasts by other methods.

We first look at Graph 1 which projects future demand. This graph is very simple and the trend line is an eye-fitted rough estimate. Another method of forecasting is by a simple regression line.

Graph 2 and Graph 3 show the trend of per capita consumption through the use of regression analysis. Graph 2 differs from Graph 3 in that Graph 2 projects the trend by leaving out 1961 data whereas in Graph 3 the 1961 data is included.

At first glance it looks as if the 1961 figure is abnormally high. If this is the case it should be left out. However, on further investigation and research, we discover that 1962 and 1963 figures were depressed because the Ghanaian Government introduced import and exchange restrictions in late 1961 to correct balance of payments deficits. In this case we should include 1961 figures in our regression analysis.

Taking it one step further, we should do a regression analysis excluding 1961 and 1963 figures. This is as shown in Graph 4. This would be the case if we believe that the main reason for cut-back in imports of milk in 1962 and 1963 were due to government import restrictions. In this case if milk was available locally, the demand would be higher than actually imported. However, we should be careful in making this analysis especially if we project too far into the future or else we may get an unrealistic figure.

In looking at the points on our graph for the years 1955 to 1961 and knowing that 1962 and 1963 results were artificially low, it appears that we may have an increasing curve rather than a straight line or a decreasing curve. An increasing curve on plain graph paper would suggest a compound rate of growth. This can be

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checked graphically by using semi-log paper. A straight line on semi-log paper indicates a compound rate of growth.

In Graph 5 we have the data for the years 1955 to 1963 plotted on semi-log paper. This is total demand--not per capita. An eye-fitted line could be a straight line if we reject the artifically low figures for 1962 and 1963. However, it may be dangerous to fit a straight line too far out into the future. If we expect the rate of increase to decline, then the trend line plotted on semi-log paper will be a gradually decreasing slope.

Graph 6 shows the trend of total consumption through the use of regression analysis. All the data from 1955 to 1963 is used for the analysis. Graph 7 differs from Graph 6 in that the 1962 and 1963 data are left out. Again as in per capita consumption if we believe that the figure for 1962 and 1963 were abnormally low--because of artificial constraints, then Graph 7 will be a better forecast of the future total demand for tinned milk.

Through the use of regression analysis by computer, the forecast of per capita consumption for 1964-1968 is as follows. The consultant's estimate is also given as a basis for comparison (data for all years).

Year	Estimate Through Regression (Graph-2)	Consultant's Estimate (Graph-1)
1964	45.97 oz.	44.75 oz.
1965	46.72 oz.	46.75 oz.
1966	51.46 oz.	48.50 oz.
1967	54.24 oz.	50.25 oz.
1968	56.99 oz.	52.00 oz.

This trend line as obtained through regression analysis is shown on Graph 2.

Through regression analysis we estimate 1968 per capita consumption to be 56.99 oz. compared to 52.00 oz. as originally estimated by the consultant. If we use the projected population figure of 1968 of 8,260,13' we get a difference of 1',216,059 oz. or 2,576,128 lbs. (this is 9.6% greater). This may make a difference to our decision on the size of plant we should build.

The data in the case is very confusing as it is given in both metric and non-metric values. It would have been much better if the consultant had kept to one type of value, i.e. kilos or lbs. and not both. Also, cwts. are used in some instances.

Although it is necessary to make simplifying assumptions, the consultant seems to have made questionable assumptions:

'. He assumed that because 1.5 oz. cans are accepted in the Philippines they will be equally accepted in Ghana. This is not necessarily so. He should have suggested a survey to find out the consumers' opinion.

Although it is cheaper to buy in larger size cans some consumers may be so poor that they cannot afford to lay out a large sum of money at a time to buy the bigger can. Also, milk cans once opened cannot be kept too long without refrigeration. Hence some consumers may prefer to buy smaller cans. Unless imports of 6 oz. cans are totally banned, it is likely some consumers will continue to buy imported milk even though it may be cheaper on a per oz. basis to buy locally produced milk. If this happens the demand for locally produced milk will be less than projected. The project, however, would be based on the banning of imports.

2. The consultant also assumed filled milk will be equally acceptable to the consumers even though it will taste different. Quality-wise it may be the same but very often consumers are not that rational in their thinking. Psychologically speaking they tend to resist changes and may therefore have negative feelings towards filled evaporated milk. A survey would have helped to gauge the consumers' feelings. On the other hand filled milk will reduce cholesterol in the diet because it replaces animal fat with vegetable oil.

3. In estimating profitability, the consultant estimated advertising and sales expenses to be 4% of sales. This seems to be on the low side. In launching a new product, there needs to be intensive and extensive advertising to make the people aware of the product. The product also needs to be promoted through point of sale displays, cents-off coupons and samples in order to get the consumers to try the product. To encourage distributors to carry and push the product, more salesmen must be employed. Contests for distributors can also be featured. Hence when a product is launched initially it is better to target advertising and sales expenses at a certain amount rather than as a percentage of sales. This is because sales initially are very low.

The consultant recommends a single shift, 17 million lbs. plant. However, this would be insufficient if demand is as forecasted. The consultant should also have looked into the export market. There appears to be potential for export especially to the neighbouring countries that have a small population and cannot support a milk plant that is of a large enough size to be efficient. More investigation in this area needs to be carried out. If needs be, a second shift can be added. Some analysis needs to be done on the costs of adding a second shift.

No attempt has been made by the consultant to segment the market for milk. There appear to be 4 distinct markets.

a. Baby feeding
b. As a complement to beverages (tea, coffee, etc.)
c. Cooking
d. Bakeries

If we can find out what percentage of the total milk consumed goes to each of the segments, we can then forecast more accurately the growth in demand.

The consultant's report seems to indicate the feasibility of establishing a 17 million lb. capacity unsweetened evaporated milk plant in Ghana. This was just an inexpensive pre-feasibility study. It accomplished its objective of identifying an opportunity. However, there should be more analyses and surveys carried out before we can determine whether this is a feasible project. It is best if further surveys are done by the experienced investor who plans to build the plant.

Since this report was prepared a little more than 10 years ago we now have the benefit of hindsight. The following table shows the actual imports in 1966, 1967, and 1968 versus our various forecasts. The plant was actually built after 1968. The actual figures for 1966, 1967, and 1968 may be high because of the inclusion of products in addition to tinned evaporated milk.

The imports in 1968 were 52% higher than the consultant's conservative forecast. They were only 3% higher than our final forecast using more sophisticated methods (regression analysis, leaving out 1962 and 1963) but with the identical data of the consultant.

TABLE 1

UNSWEETENED EVAPORATED MILK (022 - '20)
Total Consumption (cwt)

	1966	1967	1968
Actual (Import Statistics)	27',990	28',530	364,599
Forecast (Consultant's Estimates-Table 3)	2'5,225	225,755	239,690
Difference	(56,765)	(55,775)	('24,909)
% Difference	(25.4%)	(24.7%)	(52.'%)
Forecast (Regression Analysis Using all Data-Table 3)	222,680	236,399	251,'19
Difference	(46,310)	44,631	'13,480
% Difference	(20.8%)	'8.8%	45.2%
Forecast (Regression Analysis Without '962 & '963 Data-Table 3)	2'4,'04	260,748	277,392
Difference	(27,686)	(20,782)	(87,207)
% Difference	('1.4%)	(8.0%)	(31.4%)

TABLE 2

PER CAPITA CONSUMPTION (OZ.)

Comparative Data

Year	Actual	Consultant's Estimate	Regression Analysis (without 1961 data)	Regression Analysis (all data)	Regression Analysis (without 1962 & 1963 data)
1955	20.81	-	-	-	-
56	22.63	-	-	-	-
57	27.37	-	-	-	-
58	29.23	-	-	-	-
59	34.17	-	-	-	-
60	34.93	-	-	-	-
61	45.93	-	-	-	-
62	41.16	-	-	-	-
63	41.67	-	-	-	-
64	-	44.75	45.97	48.25	53.60
65	-	46.75	48.72	51.27	57.45
66*	61.31	48.30	51.48	54.30	61.23
67*	61.98	50.25	54.24	57.33	65.04
68*	77.97	52.00	56.99	60.37	68.85

*Total Consumption (from Import Statistics) divided by Population Figures (from 1970 UN Demographic Yearbook)

TABLE 3

TOTAL CONSUMPTION (CWT.)

Comparative Data

Year	Actual	Consultant's Estimate	Regression Analysis (all data)	Regression Analysis (without 1962 & 1963 data)
1955	67,949	-	-	-
56	76,549	-	-	-
57	95,015	-	-	-
58	104,126	-	-	-
59	124,966	-	-	-
60	131,130	-	-	-
61	176,920	-	-	-
62	162,676	-	-	-
63	168,945	-	-	-
64	-	186,145	194,240	210,816
65	-	199,520	208,460	227,460
66	271,990	215,225	222,680	244,104
67	[illegible]1,530	229,755	236,899	260,748
68	364,599	239,690	251,119	277,392

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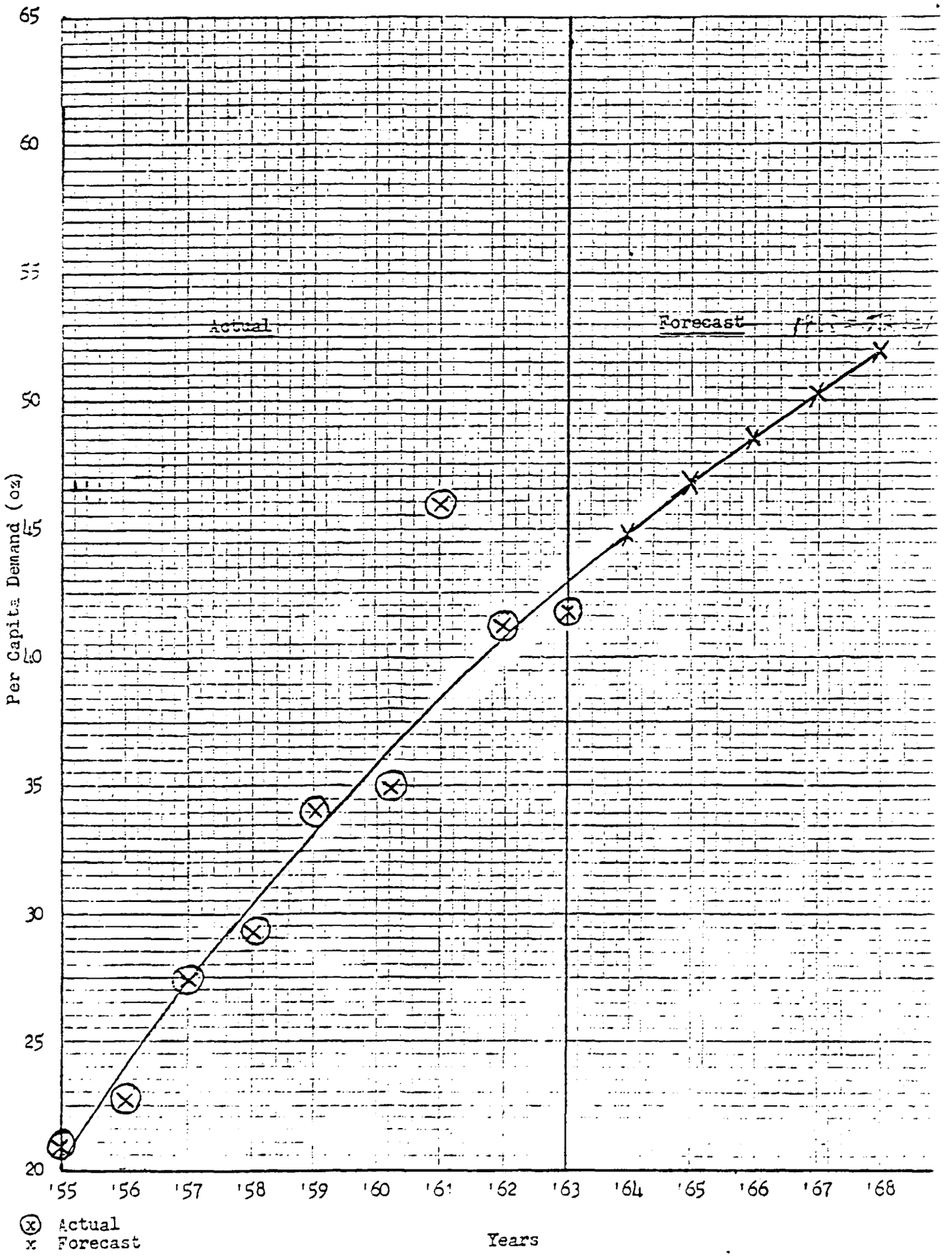
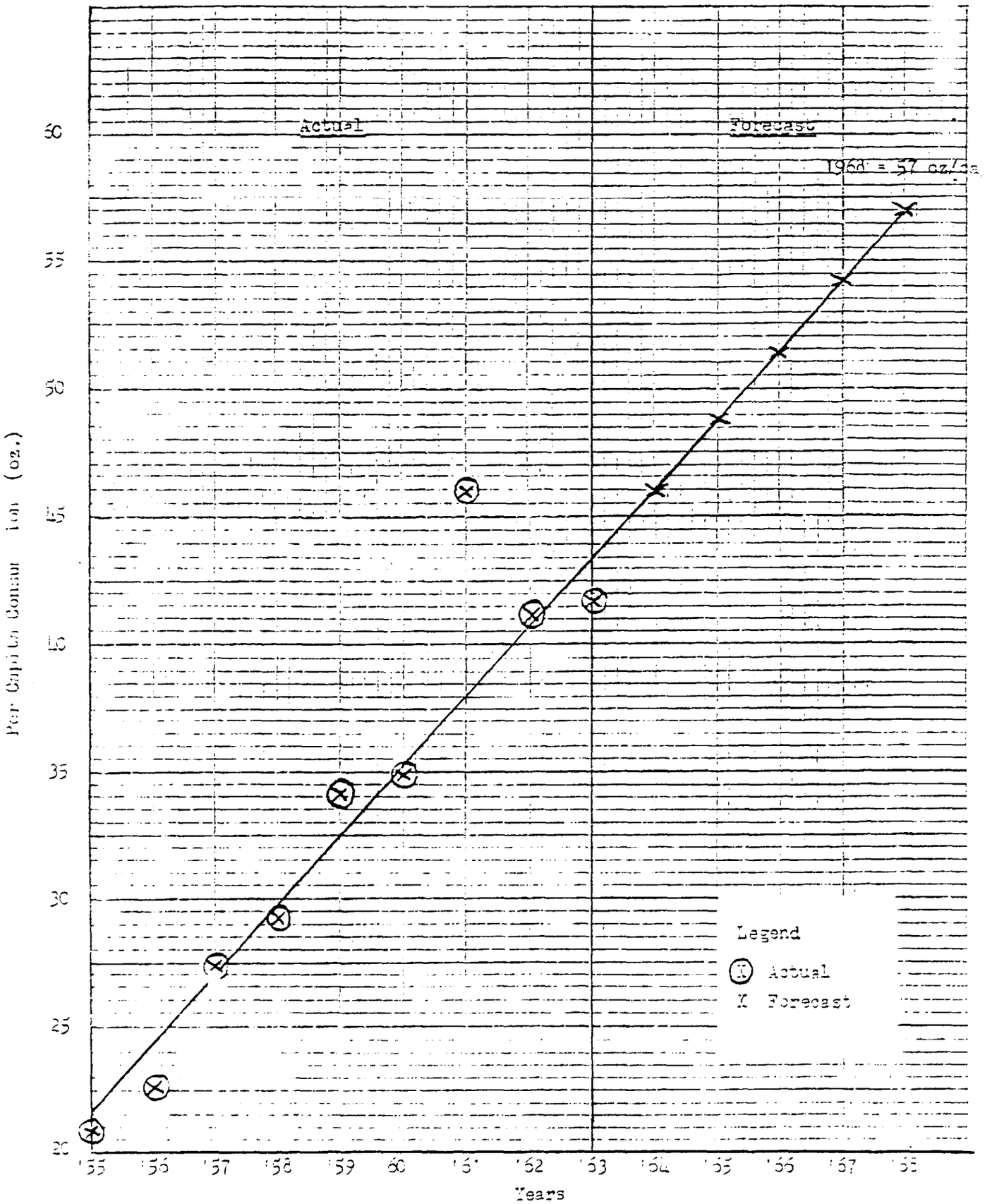
Trend of Per Capita Consumption
Unsweetened Evaporated Milk (Eye-Fitted Regression Line)



Graph 2

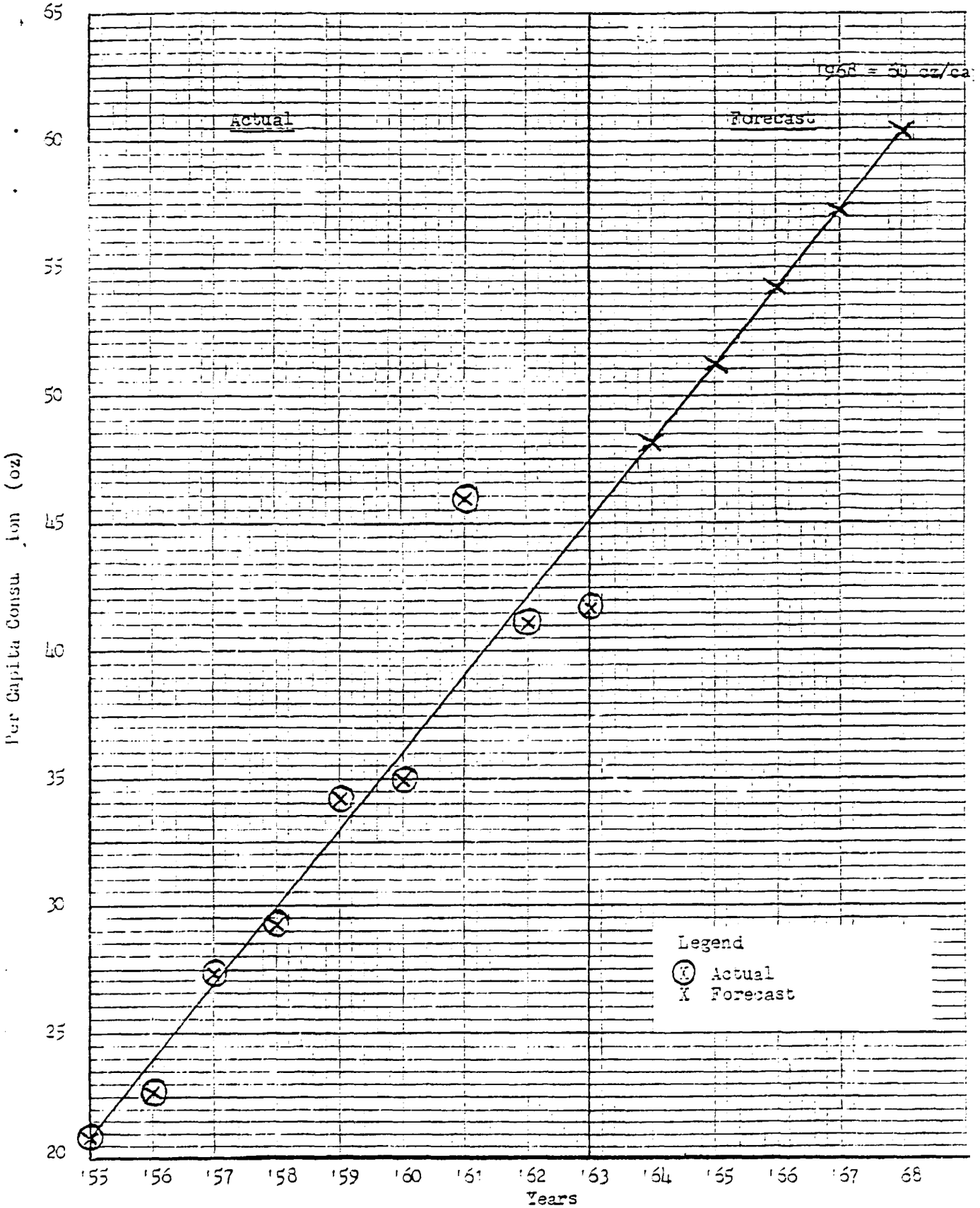
Trend of Per Capita Consumption - Unsweetened Evaporated Milk

Regression Analysis Trend Line (Without '961 Data Taken into Account)



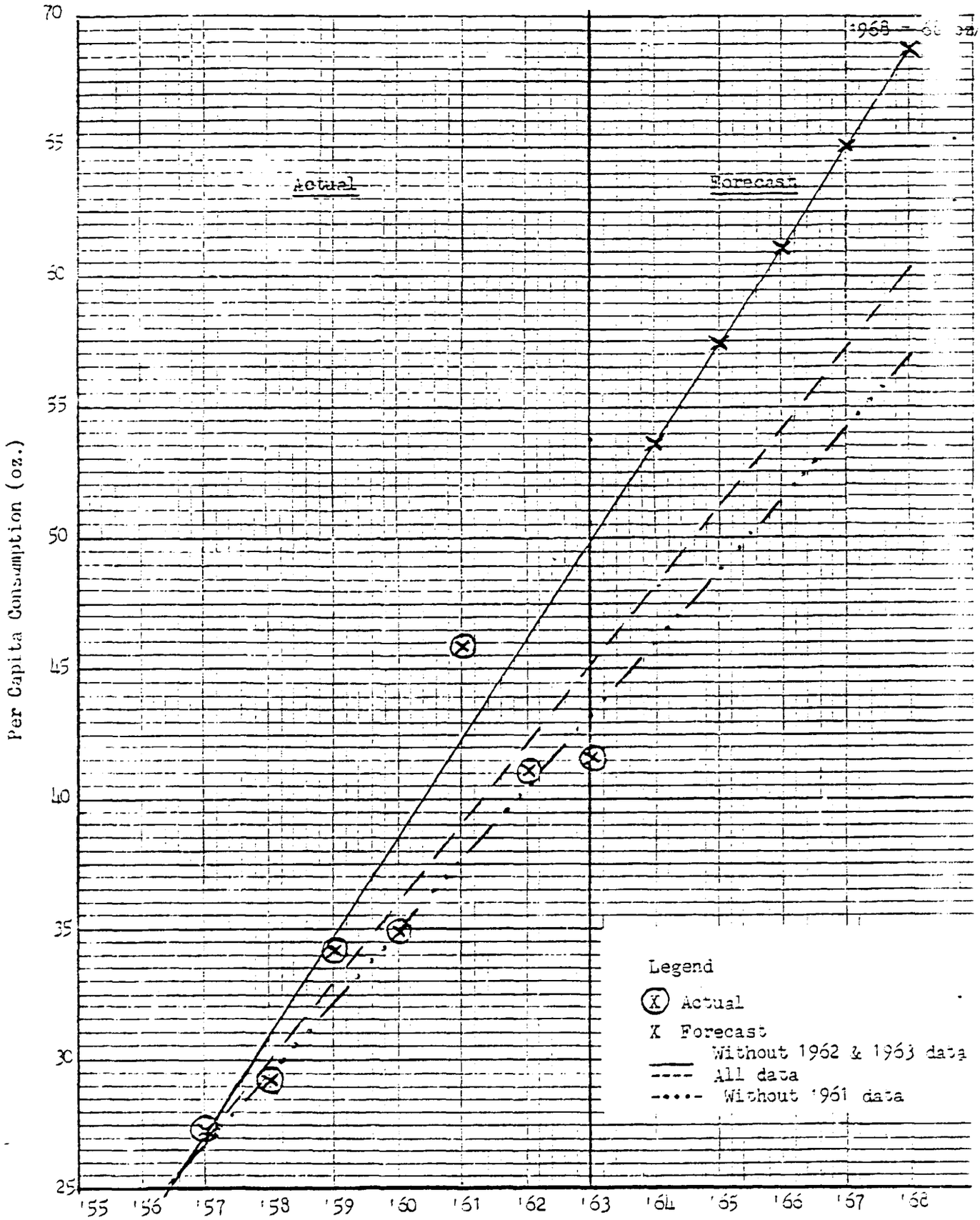
Graph 3

Trend of Per Capita Consumption - Unsweetened Evaporated Milk
Regression Analysis Trend Line (All data included)



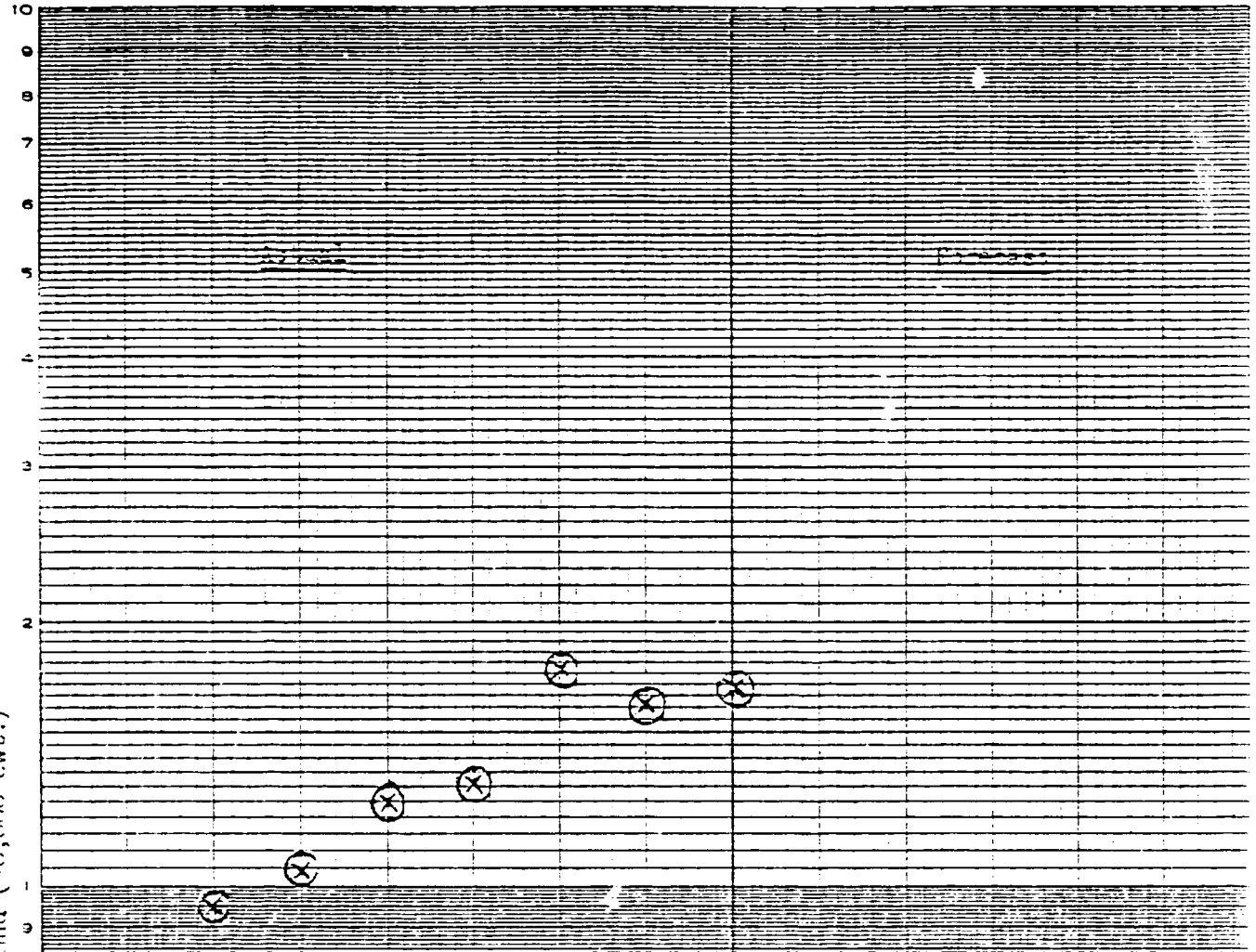
Graph 4

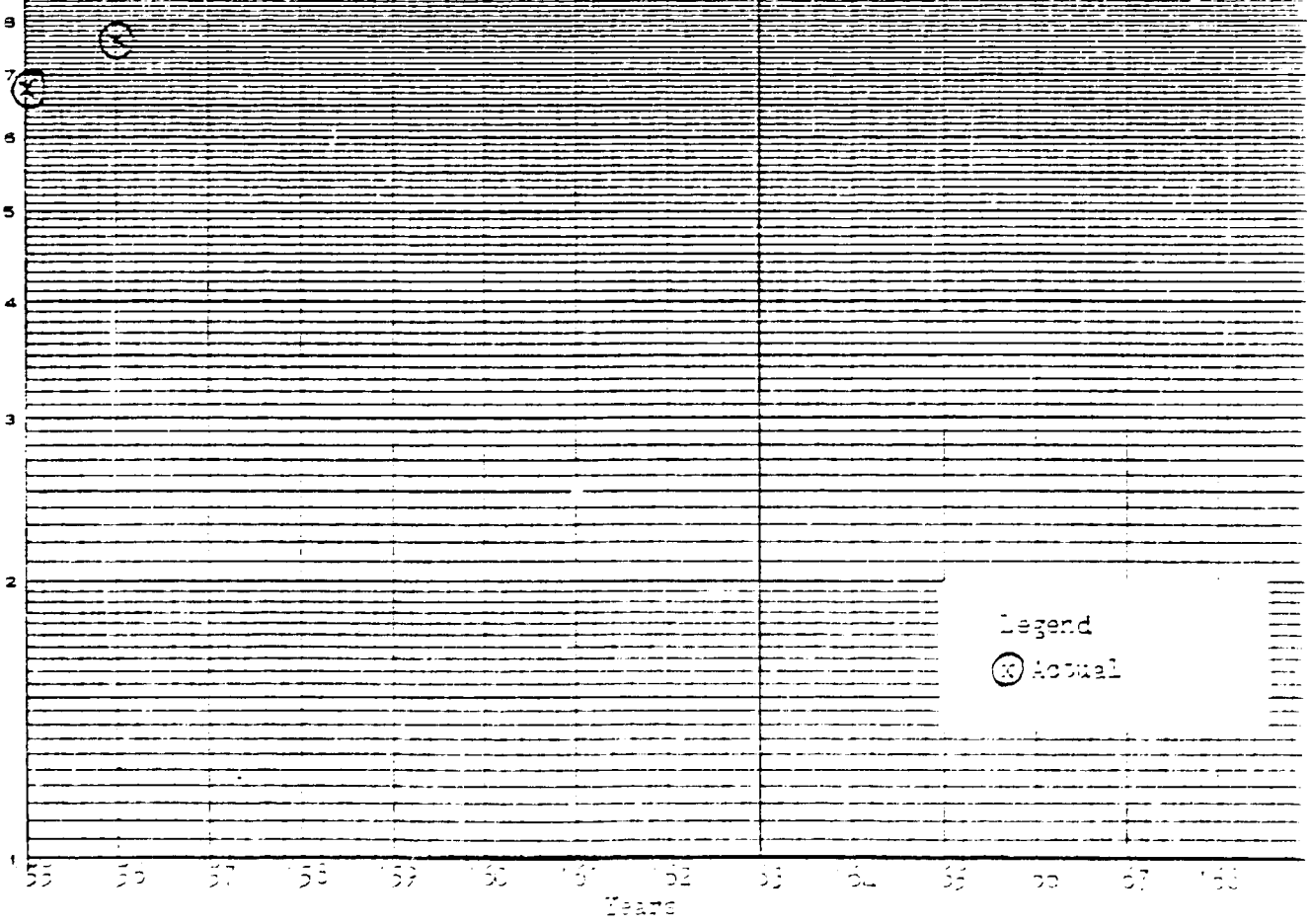
Trend of Per Capita Consumption
Regression Analysis Trend Line - A Comparison

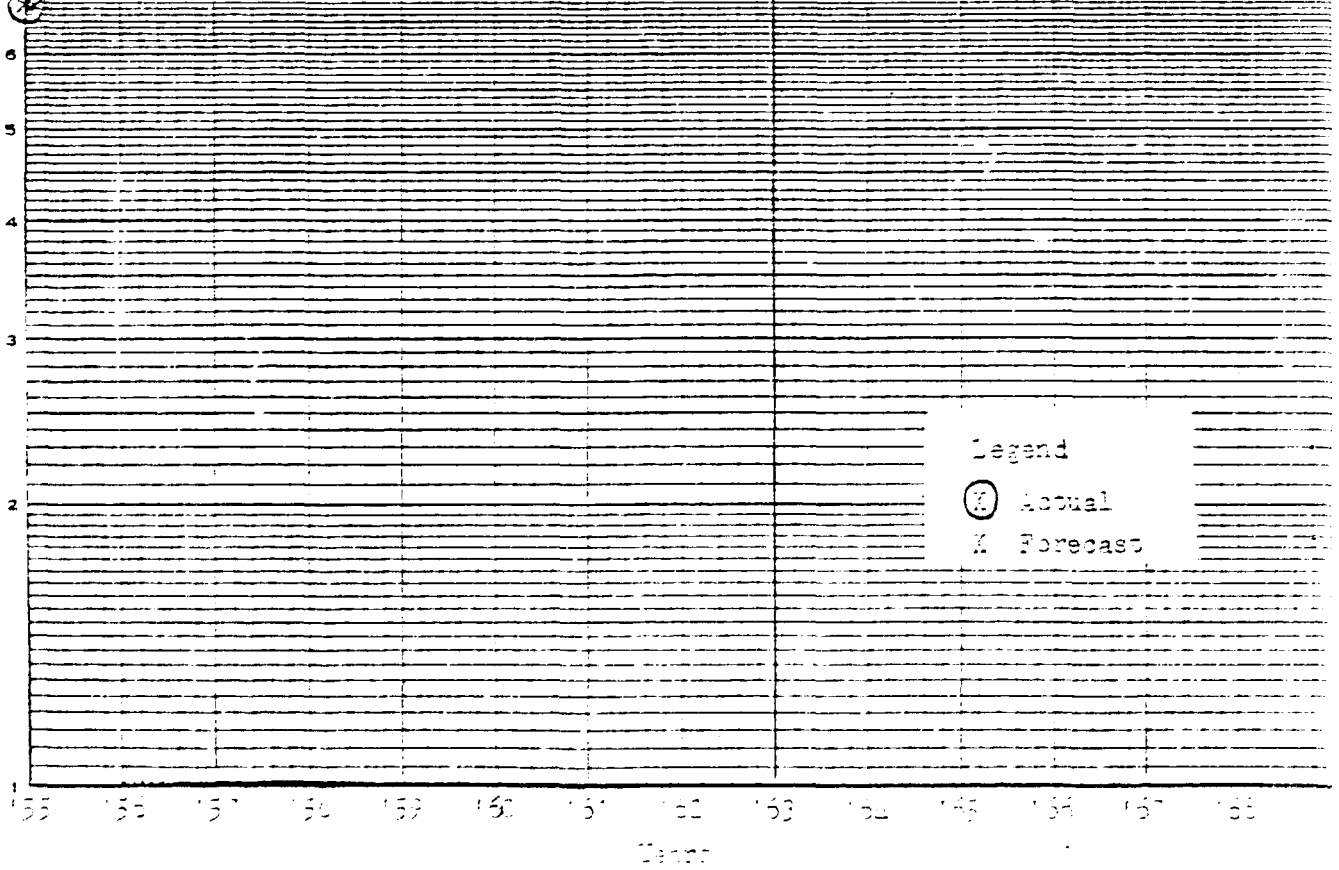


Trend of Total Consumption - Unsweetened Evaporated Milk

Graph 5



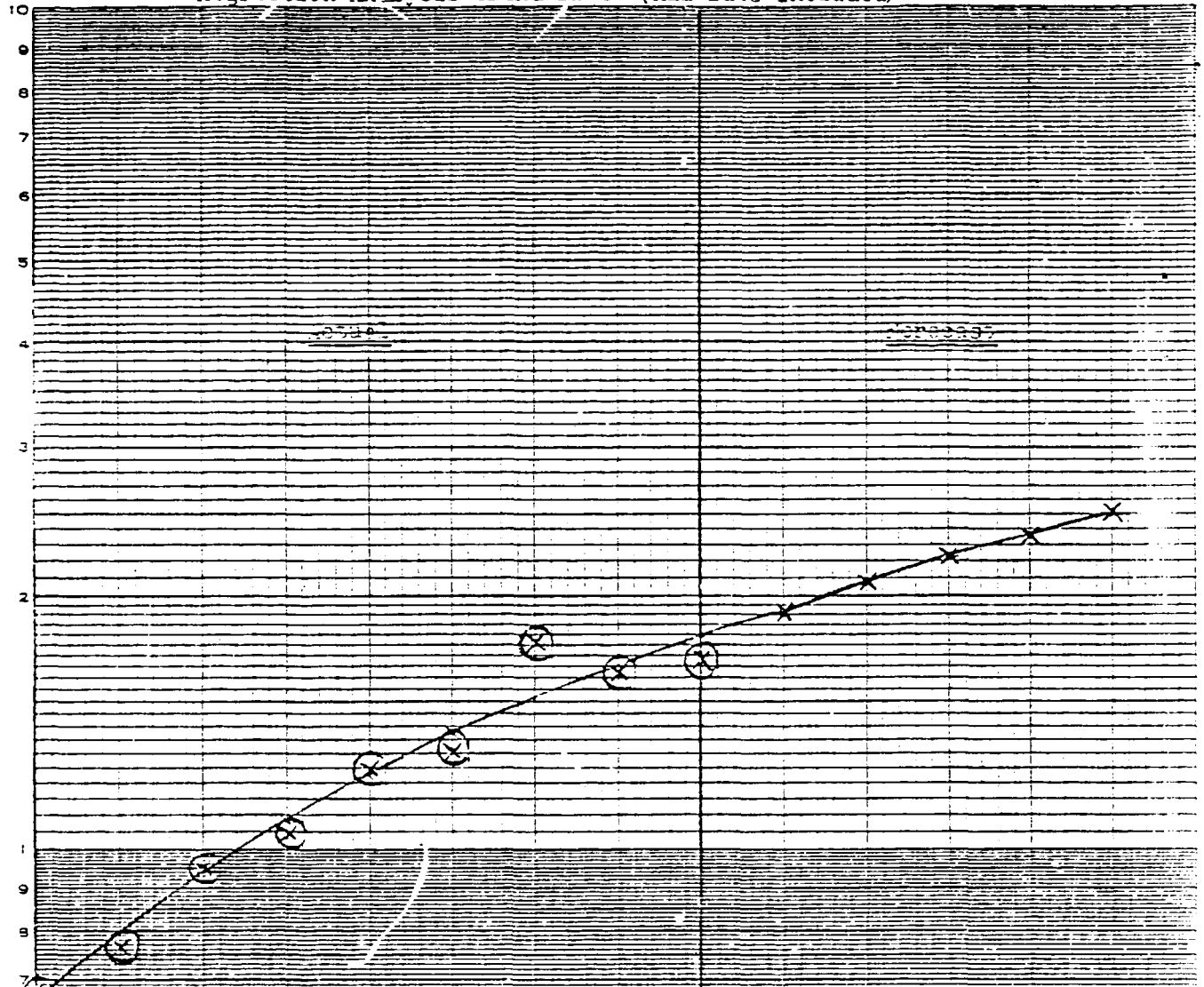

Legend
Actual
Years


6
5
4
3
2
1
Legend
Actual
Forecast

Trend of Total Consumption - Unsweetened Evaporated Milk

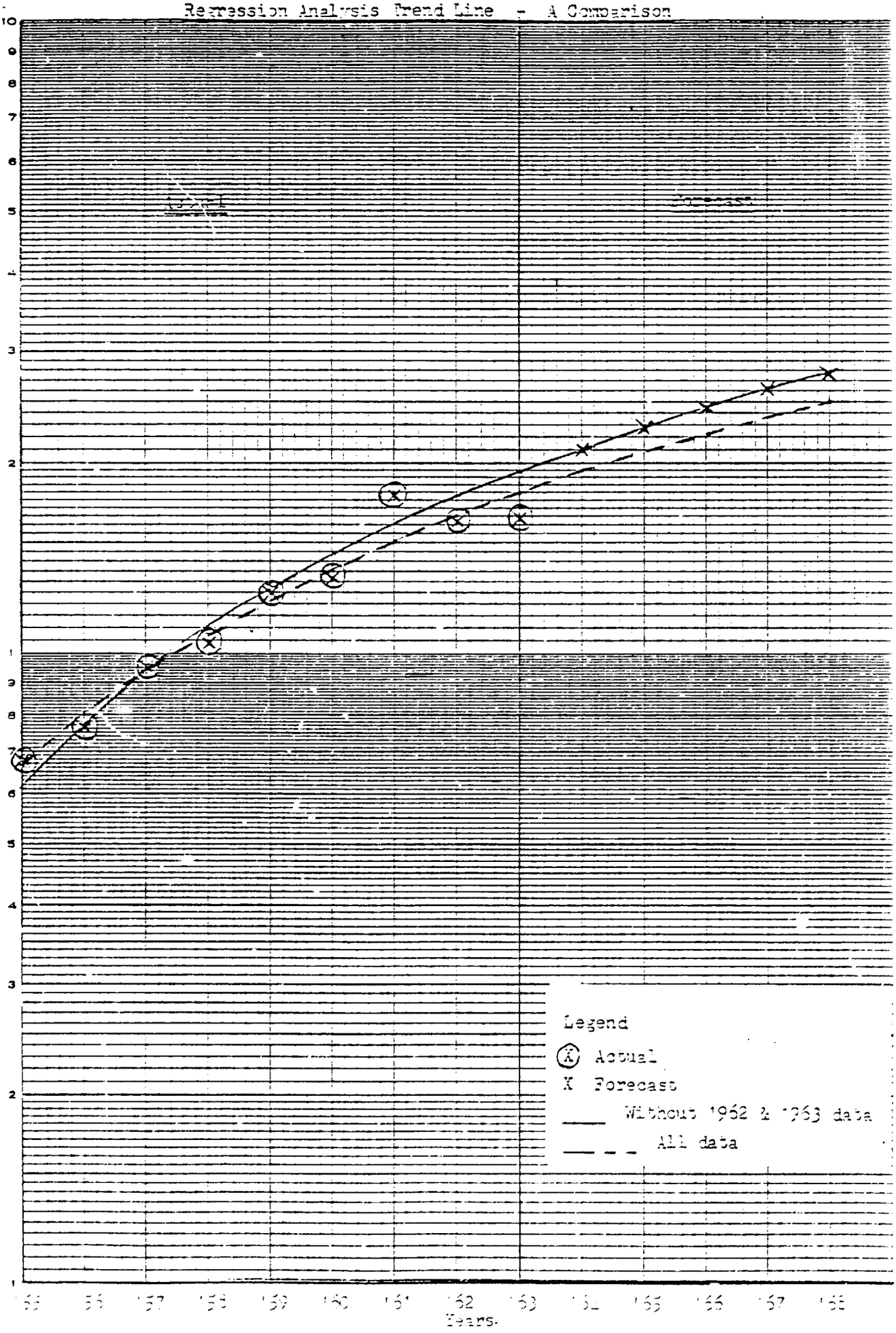
Regression Analysis Trend Line (All Data Included)

Graph 6



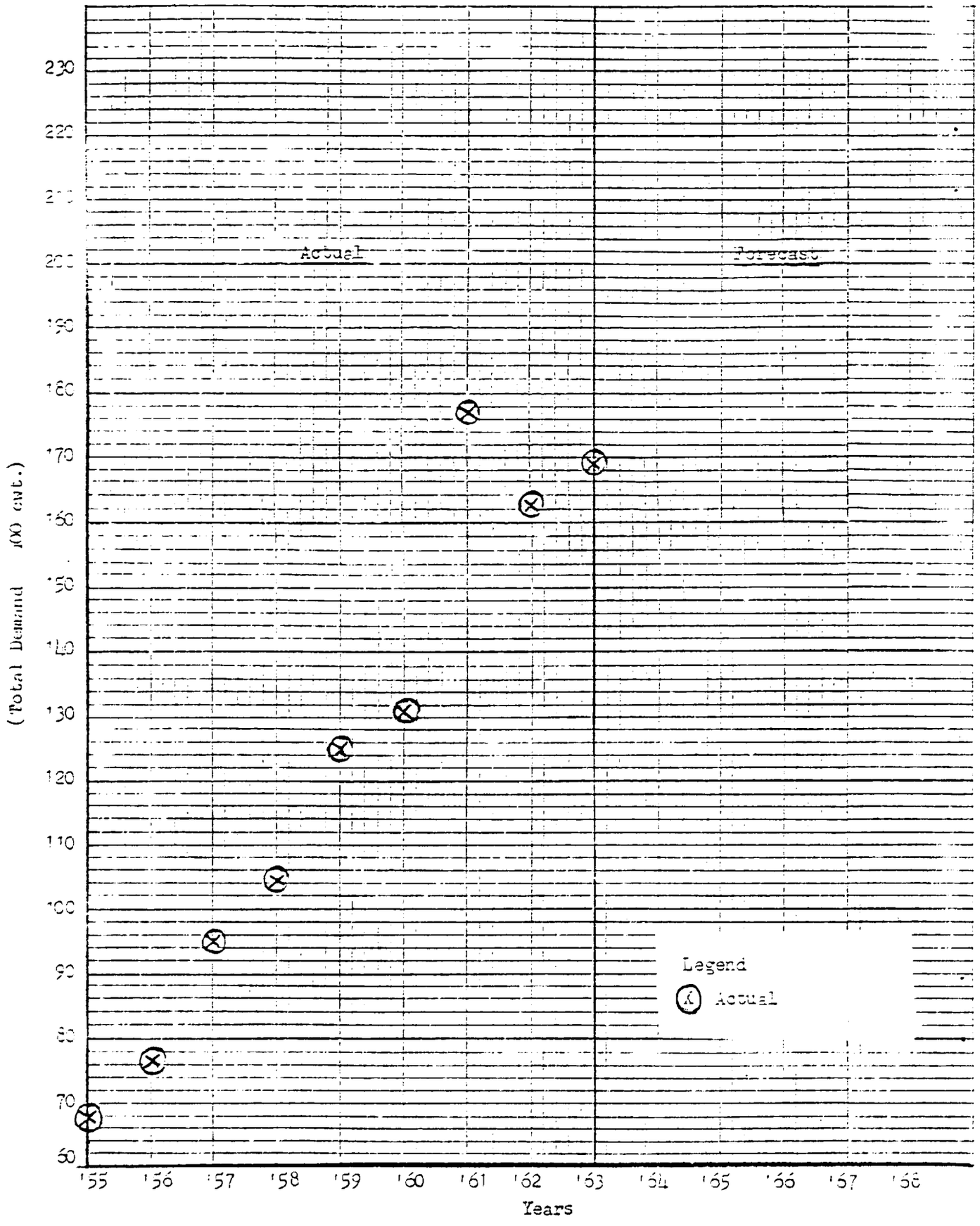
Trend of Total Consumption - Unsweetened Evaporated Milk — Graph

Regression Analysis Trend Line - A Comparison



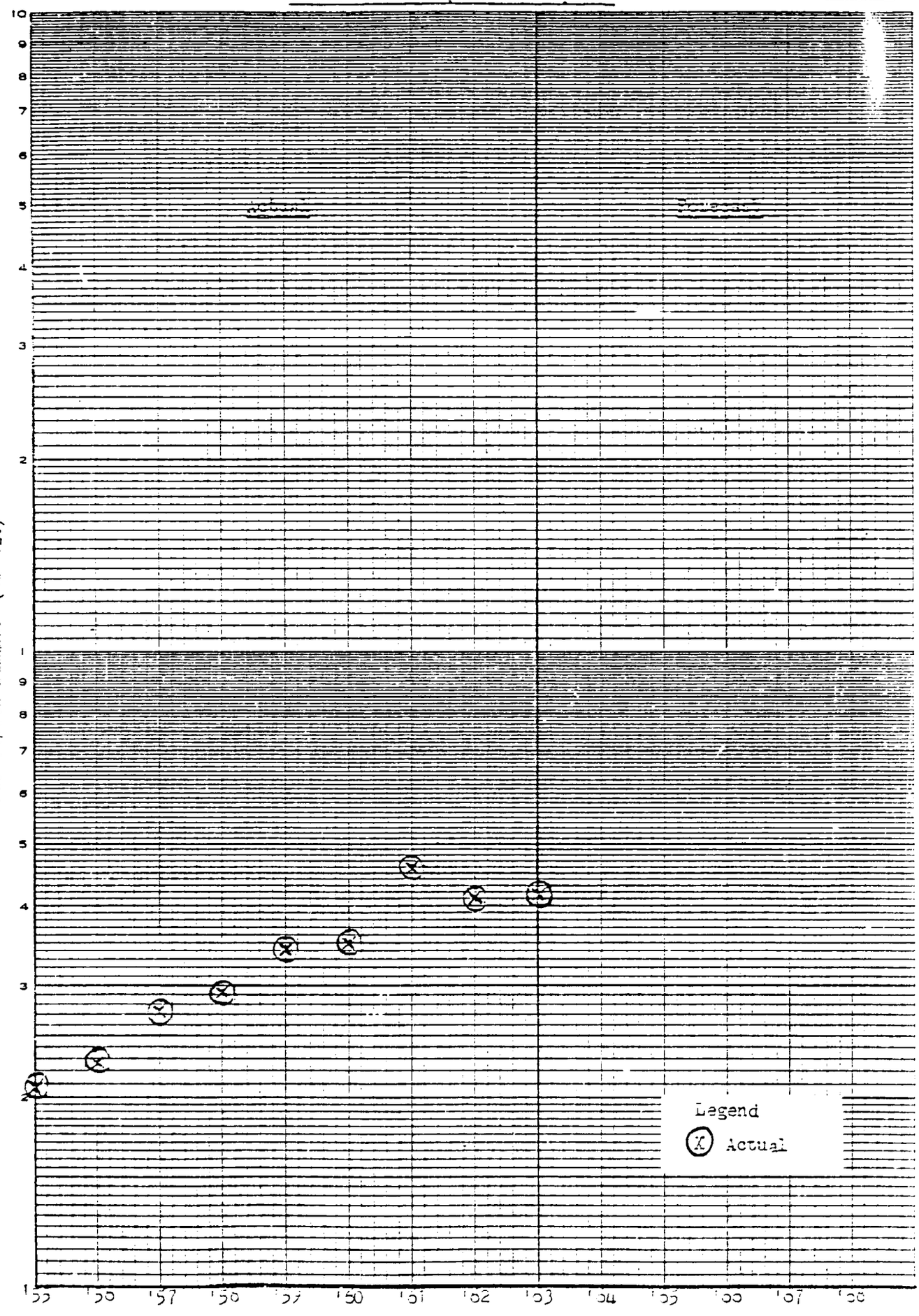
Graph 8

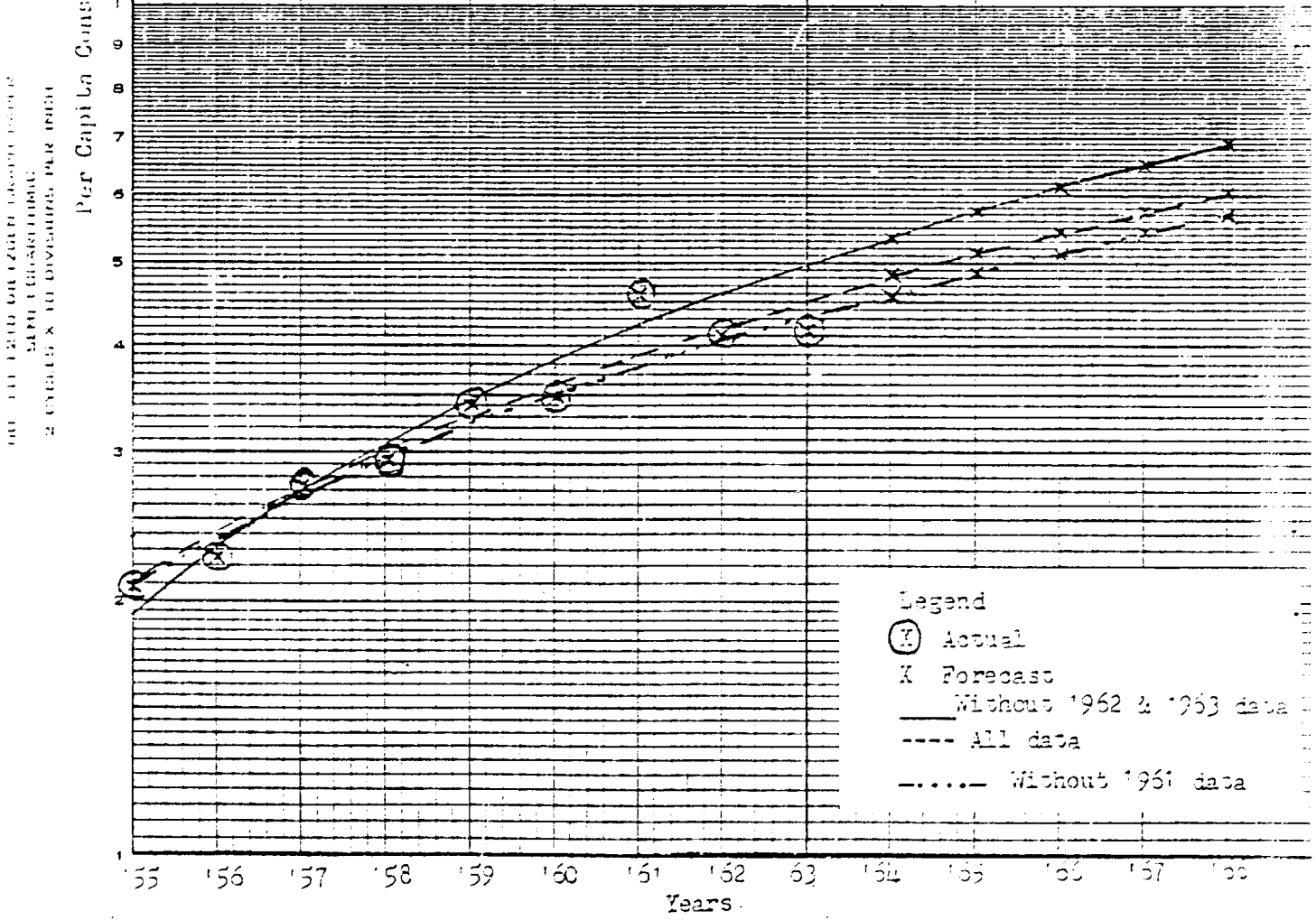
Trend of Total Consumption



Trend of Per Capita Consumption

Graph 9




Per Capita Consu
9
8
7
6
5
4
3
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1
'55
'56
'57
'58
'59
'60
'61
'62
63
Years
Legend
Actual
Forecast
Without '962 & '963 data
All data
Without '961 data

Trend of Per Capita Consumption

Graph

Regression Analysis Trend Line - A Comparison

M A R K E T

END USE

BABIES

HOME COOKING

COMMERCIAL

COMPLEMENT TO
TEA AND COFFEE

S E G M E N T A T I O N

GEOGRAPHY	POINT OF SALE
URBAN	MAMMY TRADERS
	SMALL STORES
	LARGE STORES
RURAL	INSTITUTIONAL

VARIOUS MILK PRODUCTS

- FRESH WHOLE
- RECONSTITUTED WHOLE
- RECONSTITUTED FILLED
- EVAPORATED WHOLE TINNED
- *EVAPORATED, FILLED, RECONSTITUTED, TINNED
- CONDENSED (SUGAR)
- CHOCOLATE DRINK
- POWDERED (SKIM)
- POWDERED (WHOLE)
- POWDERED (FORTIFIED)

CASE STUDY AND EXERCISE SERIES

IE-5218-SII
Dec 77

SUPPLEMENTARY SOLUTION
TINNED MILK MARKET FORECAST IN GHANA

Prepared by Takashi Nobehara

This case study is based on a consultant's report prepared for the National Investment Bank of Ghana.

When you receive a consultant's report, I assure you, you should not receive their judgements without doubting them. There are many check points on a consultant's report. Among them, the most important would be as follows:

Consultants reach conclusions taking the following process, Objective → Fact Finding → Logic → Judgement. Accordingly, you should make your own evaluation on each stage of the process. First, whether the objective of the study which consultants understand and define is exactly what you need. Second, whether the facts that consultants have shown are exact and comprehensive. Third, whether the logic that consultants invented for reaching the conclusion is correct. Fourth, whether judgements are made on all points to meet to the research objective.

Let's take a simple case. For example, you might receive a consultant's report, in which the objective of the research is defined as to identify the market size of ball point pens in a certain country. The consultant found out that the market size of fountain pens was 1 million dozen per year. He adopted the logic that the ball point pen is a product similar to the fountain pen and could be expected to replace that market. And he judged that the potential market size of ball point pens is 1 million dozen per year.

If you were a client, you should check the following. Was it your true intention to know the potential market size of ball point pens. What you need might have been to know the

acceptability of the products by the people and to identify the size of the market. Next you would examine whether the figure 1 million dozen per year for fountain pens is based on a firm calculation. You might also doubt whether the fountain pen is the only product which might compete with the ball point pen in the market. Your doubt would be far greater on his logic in the case. This is the area that you sould give greatest care in the examination of a consultant's report-jump of logic from facts to judgements. The logic in this case is that the present market size of fountain pens is the potential market size of ball point pens. Your common sense would easily teach you that you can not expect that all of the users of fountain pens would become users of ball point pens, even if the price of ball point pens is cheaper than that of fountain pens and the features of ball point pens are generally superior to those of fountain pens. If the consultant added further logic support that in another country some percentage of the fountain pen market was replaced by the appearance of the ball point pen, his logic would become more acceptable. Of course there are many other ways for the logic to be supported and elaborated.

Now, let's go back to the original case study. The primary purpose of the study is to answer the question of whether the National Investment Bank of Ghana should promote a factory to manufacture unsweetened evaporated tinned milk. Although the technical analysis of the project is neglected in the study, the basic inforamtion for our final judgement is that the minimum economic production capacity of the factory is 17 million pounds per year. Accordingly, the first objective of the study is to identify the potential market size in Ghana for unsweetened evaporated tinned milk and to see whether it might satisfy the minimum production capacity. The consultant is

also requested to answer such major questions on the nature of products as the type of oil to be used in the reconstituting process, size of can to be produced, or the size of the factory.

In the fact finding process, the consultant collected the data on the import of milk and cream of Ghana. The statistical data of this is summarized in Table One of the report.

The table is simplified by me as follows:

Based on the fact that there is no domestic manufacturing of milk, and their import statistics are sub-categorized as fresh milk, dry milk, sweetened condensed milk and unsweetened evaporated milk, the consultant decided to use that import volume of unsweetened evaporated milk as the indicator of the potential market size of their product.

Then, the consultant proceeded to project the future market size of the product. Instead of taking the simple scatter diagram of the movement of the total consumption (import), the consultant changed the consumption level into that of a per capita basis.

The you can look at the following table.

Based on this trend of per capita consumption in the past 9 years from 1955 to 63, the consultant made a scatter diagram. The diagram is shown on graph 1 of the solution set. Based on the line, which was eye fitted by the consultant in the most appropriate position, he projected the per capita consumption level in the year 1968 as 52.00 ounces. After multipling the projected population of 8,260,131 in the year 68, the consultant calculated the total consumption level as 26,845,280 pounds in 1968.

Here, if you are more familiar with the theoretical methods of projection using least square methods, you would get a different conclusion.

How to use the least square method is well described in the "course note" which is attached to the case study as "Analysis of Time Series by Regression Analysis for Demand Forecasting". Those persons who are not still accustomed to the methods, please read that text by yourself. I think the material is sufficient to understand the idea, and to learn how to use the method.

In brief, you can use the least square method by knowing only the following 3 equations.

$$Y = a + bX$$
$$Na + b\Sigma X = \Sigma Y$$
$$a\Sigma X + b\Sigma X^2 = \Sigma XY$$

Then, you can get the equation $Y = 17.95 + 3.03X$
And the per capita consumption level of 60.37 ounces in the year 1968, which obviously leads to the different total market size of 31,166,250 pounds.

Of course, you might also apply the least square method using the total consumption as Y axes.

At this stage, let's go back again to the examination of the original statistical table of imports.

Is the table credible?

Looking at the table, the line of the import of unsweetened evaporated milk, you would easily find the irregularity in the years 1961, 62 and 63. Compared with the smooth and steady increase trend from 1955 to 60, the import volume in 61 shows

a sudden rise and then the trend reversed to a decline both in 62 and 63. Looking at other items of milk products, all of other items show more or less the same declining trends in both the years of 61 and 62.

Taking the fact into consideration that the consumption level of milk in Ghana is still very low compared with other countries, this decline might show that some kind of irregular factor might have worked during these years between 1961 to 63.

If you are experienced in analysing the import statistics, you might have a question "whether the Ghana Government introduced any import restriction for milk products". If the import restriction was introduced in the year 1962, and importers of milk products had anticipated that imposition of the restriction, you would be able to explain both the sudden rise of imports in 1961, and the sudden drop in 1962.

Of course there might be another explanation. The import statistics are not exact enough. Because I visited Ghana last year, I know myself that it is also true. They have a relatively large amount of trade with neighboring countries which is not recorded in the official statistics. For reference, let's look at the import figures of Upper Volta or Togo, the countries having adjacent borders with Ghana. The import of unsweetened condensed milk of these countries show an unbelievably sudden increase from the year of 1962, which is the year of import restriction in Ghana.

Presumably, the consultant had done most of the work based on desk work, using official publications. If he made a few field interviews with traders in Ghana, he might have been able to find out the reason for this irregular trend of the statistical data.

5

Although we can not know what the real reason is for the irregularity of the trend just from the case, the solution set delivered today tells us that the import restriction was imposed in Ghana from 1962.

In the case that we find out the fact that the import volumes in the recent three years are politically distorted, what can we do for the estimation of the potential market size of evaporated milk in Ghana at present and in the future?

One method would be for us to apply the least square method based on those data during 1955 to 60, which do not have biases due to the import restriction.

The calculated equation is $Y = 17.48 + 3.06 X$
And the per capita consumption level in 1963 is 45.02 ounces
The total estimated import volume is 20.4 million pounds

Out of the same equation, we can also estimate the import volume in 1968. However, this would be too risky under the condition that the recent 3 years figures are also estimated figures.

In this case, it would be better for us to conduct several field interviews, and find out the general market condition and the probable future trends.

There is another question here. That is, the consultant judged that the import volume of Ghana of unsweetened evaporated milk and cream is the exact indicator of the potential market size of the unsweetened evaporated tinned milk that the new factory is going to manufacture. In order to decide whether this assumption is correct, we must know what types of products

are actually included in this product's category and what the percentage share of each item would be.

Then let's analyse aspects of the report other than the market size.

One important aspect is the consultant's judgment that filled milk, using 90% coconut oil and 10% corn oil, is the best choice for the product. The primary reason for this judgment is based on the price advantage to reconstituted milk production. The consultant described in the report that "This new product will be competing with, and hopefully, displacing the presently imported evaporated milk".

Obviously, this is a risky judgment without further examination of the people's acceptability of the product.

The consultant made another risky judgment on the choice of the size of can. He recommended manufacture exclusively of a 14.5 ounce-can size, while the generally accepted size of can is the 6 ounce-can in the present market. His recommendation is also based on the cost advantage of the large-size can. We should make further examination of the people's acceptability of the large-size can. For the examination of the people's acceptability, we should also analyse the usual trade custom of the evaporated milk in the market. In the case that final consumers buy products in the form of canned milk, we should examine whether consumers or average households drink such a large quantity of milk within 24 hours. If it is the case that the retailers buy products in the form of canned milk and they dilute them with water and deliver or sell to the final consumers, we should examine the acceptability of the large-size can products by retailers.

Although there are several other factors which you should examine further, I will stop my comment here. On those other aspects, please read the solution set delivered.

Finally, but the most important thing, is that it does not mean you should not proceed with the project when you find faults in the consultant's report. What is needed is that you should examine the report as carefully as possible, and refine the report by yourself and make judgments of your own.

Thank you again for your participation. I enjoy the seminar myself.

ANNEX I.9

Training Course in Industrial Project Preparation, Evaluation and Financing

UNIDO - J. Lukesik

KHARTOUM 12 MAY – 14 JUNE

Exercise VI. 1. SEASONAL INDEX /stationary series/

Given the following quarterly data on sales of product "X" calculate the average seasonal indexes for all three quarters:

Quarter	Actual Quarterly Sales /thousand tons/		
	1980	1981	1982
I	13.1	12.3	15.4
II	10.0	8.8	11.8
III	8.6	8.2	10.4
IV	12.3	10.7	14.4

Solution

/1/ Calculate total sales for each year

$$\sum_{i=1}^{4} X_i^{80} = 13.1 + 10.0 + 8.6 + 12.3 = 44$$

$$\sum_{i=1}^{4} X_i^{81} = 12.3 + 8.8 + 8.2 + 10.7 = 40$$

$$\sum_{i=1}^{4} X_i^{82} = 15.4 + 11.8 + 10.4 + 14.4 = 52$$

/2/ Calculate mean quarterly sales for each year

$$\bar{X}^{80} = \frac{\sum_{i=1}^{4} X_i^{80}}{4} = \frac{44}{4} = 11.0$$

$$\bar{x}^{81} = \frac{\sum_{i=1}^{4} x_i^{81}}{4} = \frac{44}{4} = 10.0$$

$$\bar{x}^{82} = \frac{\sum_{i=1}^{4} x_i^{82}}{4} = \frac{52}{4} = 13.0$$

/3/ Divide each year's actual quarterly sales figure by that year's quarterly average /and multiply by 100/ to express the quarterly sales as percentage of this year's average sales indicator

$$\text{Quarterly sales indicator} = \frac{x_i}{\bar{x}} \cdot 100$$

Year / Quarter	1980	1981	1982
I	[illegible]	[illegible]	113
II	[illegible]	[illegible]	91
III	[illegible]	[illegible]	80
IV	[illegible]	[illegible]	115

/4/ Find a quarterly sales [illegible] for the four quarters of different years to reach [illegible] seasonally adjusted

$$\text{[illegible]}_{I} = \frac{[illegible] + [illegible] - [illegible]}{3} = [illegible]$$

$$\text{[illegible]}_{II} = \frac{91 + 91 - 91}{3} = 91$$

$$\text{[illegible]}_{III} = \frac{78 + 82 + 80}{3} = [illegible]$$

$$\text{[illegible]}_{IV} = \frac{112 + 107 + 115}{3} = [illegible]$$

Adjustment:

If $\sum_{i=1}^{4} x_i < 400$

multiply each x_i by the adjustment coefficient:

$$c = \frac{400}{\sum_{i=1}^{4} x_i}$$

If $\sum_{i=1}^{4} x_i > 400$ then same [illegible] applies.

x^{-} = [illegible]

ANNEX I. 10

Training Course in Industrial Project Preparation, Evaluation and Financing

UNIDO - J. Lukasik

KHARTOUM. 12 MAY — 14 JUNE

Exercise VI. 2. DECOMPOSITION OF TIME SERIES

Note: This exercise consists of enumeration of steps necessary to decompose time series into its components. An interested student may try to test himself with numerical example attached at the end. Only original data and final values for all four components are given.

Assuming the multiplicative form of relationship between its components, the time series model will be of the form:

$$Y = T \times C \times S \times R$$

where:

Y - original data for the variable analyzed,
T - trend,
C - cyclical component,
S - seasonal component,
R - random /irregular/ component.

Decomposition of original time series /Y/ will then consist of four stages designated to eliminate its particular components*

/1/ Trend.

A number of methods is available here.

See: Manual Annex VI, p. 242, ~~also Section VI and Section VIII handouts for this course~~

* It should be clearly realized that the presented approach is a technique of approximation and not a deterministic method of establishing values of particular components with absolute certainty.

/2/ Seasonal Component

Any attempt to decompose a multiplicative series will rely on division, thus:

$$\frac{T \times C \times S \times R}{T \times C} 100 = S \times R$$

Since the values of cyclical component are not yet known the trend values established at stage /1/ are of no help here.

Assumption:

- a moving average of properly selected duration will consist of two components: Trend x Cycle,
- by averaging the Seasonal x Random values for the corresponding time-periods the Random component will be smoothed out and thus pure Seasonal values will be arrived at.

Steps:

- calculate the moving average for each period*
- center the moving average obtained, so that their values correspond to data points,
- divide original data values by their corresponding centered moving averages,
- calculate averages of the above quotients for the corresponding periods thus arriving at the unadjusted seasonal indexes,
- in case the sum of quarterly/monthly seasonal indexes is not equal to 400/1200, which it usually is not, adjust each, following the formula:

$$A.S.I. = USI \frac{400}{\sum USI}$$

where:

A.S.I. - adjusted seasonal index
USI - unadjusted seasonal index

the numerator of the formula will be 1200 in case of monthly data.

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* Denominator value should be 4 in case of quarterly and 12 in case of monthly data.

/3/ Cyclical Component.

A similar approach may be applied to obtain the cyclical variations and namely:

$$\frac{T \times C \times S \times R}{T \times S} 100 = C \times R$$

Assumption:

Random component will be cancelled out /or rather smoothed out/ by moving averages.

Steps:

- multiply Trend Component /stage /1// by Seasonal Component /stage /2// for each period of time series and divide by 100,
- divide original data values /Y/ by the corresponding results of the above stage and multiply by 100 to arrive at Cyclical x Random percentage values,
- calculate odd-number moving averages* from the series obtained above to arrive at Cyclical Percentages.

/4/ Random Component.

Following the same approach the irregular /Random/ variations can be obtained from stage /3/ i.e.:

$$\frac{C \times R}{C} 100 = R$$

Steps:

- divide the Cyclical x Random percentages calculated at stage 3, step 2, by Cyclical percentages, arrived at stage 3, step 3, and multiply by 100 to arrive at Random percentages.

---

* The number of periods for moving average should be:
  - odd - to avoid the problem of centering,
  - long enough to cover the duration of irregular /Random/ variations.

It is therefore suggested that for quarterly data a 3-quarter moving average and for monthly data 5,7 or 9 month moving average should be calculated.

.4.

Table VI. 1
Decomposition of quarterly series by multiplicative model

Year, by quarters /1/		Original data TxSxCxI /2/	Trend value T /3/	Seasonal percentages S /4/	Cyclical percentages C /5/	Irregular percentages I /6/
1964:	3	398	291.75	107.59		
	4	352	298.07	91.11	124.12	101.63
1965:	1	283	304.41	80.18	122.06	96.22
	2	454	310.75	121.12	117.16	100.39
	3	332	317.09	107.59	117.53	97.76
	4	345	323.43	91.11	111.67	104.66
1966:	1	274	329.77	80.18	105.67	98.67
	2	392	336.11	121.12	92.88	107.72
	3	290	342.45	107.59	80.36	95.95
	4	210	348.79	91.11	73.78	89.38
1967:	1	218	355.13	80.18	76.63	92.21
	2	382	361.47	121.12	86.73	100.94
	3	342	367.81	107.59	94.90	101.12
	4	340	374.15	91.11	97.98	101.80
1968:	1	298	380.49	80.18	97.96	99.71
	2	452	386.83	121.12	98.05	96.59
	3	423	393.17	107.59	99.56	100.11
	4	372	399.51	91.11	101.82	100.37
1969:	1	336	405.85	80.18	99.72	103.30
	2	468	412.19	121.12	94.31	93.80
	3	387	418.53	107.59	86.50	93.23
	4	309	424.87	91.11	80.71	96.30
1970:	1	264	431.21	80.18	77.16	99.23
	2	599	437.55	121.12	70.05	94.79
	3	408	443.89	107.59	85.75	95.19
	4	396	450.23	91.11	96.08	100.43
1971:	1	369	456.57	80.18	103.51	100.55
	2	604	462.91	121.12	109.56	97.31
	3	579	469.25	107.59	113.60	100.95
	4	513	475.59	91.11	121.68	97.93
1972:	1	510	481.93	80.18	120.71	102.34
	2	661	488.27	121.12		

Trend: $Y_t = 285.39 + 6.34t$

Table, trend model and decomposition sequence based on:
L.L.Chao. Statistics, Methods and Analyses,
McGraw-Hill Kogakusha, Ltd. 1974

ANNEX I.11

Training Course in Industrial Project Preparation, Evaluation and Financing

UNIDO - J. Łukasik

KHARTOUM 12 MAY - 14 JUNE

Exercise VIII. 1. REGRESSION ANALYSIS FOR FORECASTING

/1/ Given the 5 years time series for two variables Y and X construct the regression model using X as explanatory /independent/ variable.
The analysis of dependent variable Y suggests the cause-effect relationship between the two.

thou. t

	Y_i	X_i	X_i^2	Y_i^2	X_iY_i
1976	1	2	4	1	2
1977	3	3	9	9	9
1978	4	5	25	16	20
1979	7	7	49	49	49
1980	10	9	81	100	90
Σ	25	26	168	175	170

$(\Sigma X)^2 = 676$

- Correlation coefficient;

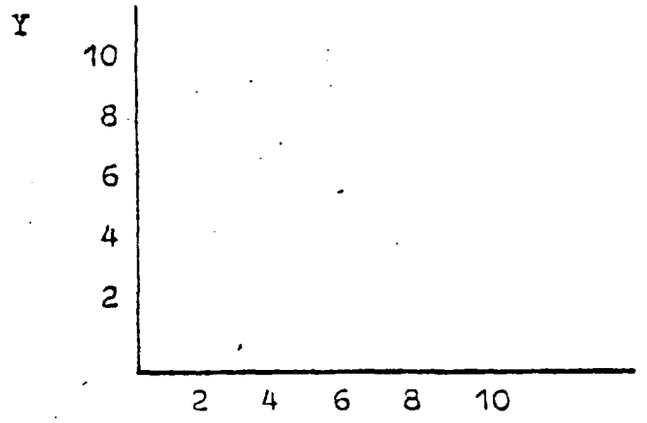
$$r = \frac{\Sigma XY - \frac{1}{n}\Sigma X \Sigma Y}{\sqrt{\left[\Sigma X^2 - \frac{(\Sigma X)^2}{n}\right]\left[\Sigma Y^2 - \frac{(\Sigma Y)^2}{n}\right]}} =$$

$$\frac{170 - \frac{1}{5}(650)}{\sqrt{\left[168 - \frac{676}{5}\right]\left[175 - \frac{625}{5}\right]}} = \frac{40}{\sqrt{(32.8)\ (50)}} =$$

$$\frac{40}{\sqrt{1640}} = \frac{40}{40.5} = \underline{.9877}$$

$R^2 = .9756$

- Scatter diagram:



- Regression coefficient

$$b = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2} = \frac{5(170) - (26)(25)}{5(168) - (26)^2} = \frac{850 - 650}{840 - 676} =$$

$$= \frac{200}{164} = \underline{1.22}$$

$$a = \frac{\sum Y - b\sum X}{n} = \frac{25 - 1.22(26)}{5} = \frac{25 - 31.72}{5} = \frac{-6.72}{5} = \underline{-1.34}$$

- Model:

$$\hat{Y}_i = -1.34 + 1.22(X_i)$$

/2/ The alternative model suggested was time-trend extrapolation. Calculate the parameters of the trend equation assuming the linear development of the variable Y.

Time	Y_i	t	t^2	XY
1976	1	1	1	1
1977	3	2	4	6
1978	4	3	9	12
1979	7	4	16	28
1980	10	5	25	50
$\sum$	25	15	55	97

$$b = \frac{5(97) - (15)(25)}{5(55) - 225} = \frac{485 - 375}{275 - 225} = 2.20$$

.3.

$$a = \frac{25 - 2.24(15)}{5} = \frac{-8.0}{5} = -1.60$$

- Model:

$$Y_i = -1.60 + 2.2(t_i)$$

/3/ Evaluate causal regression and trend models using MPE MAPE:

The values obtained by solving the models for the per analysis are as follows;

Time	Y	REG	Error	%error	E^2	TREND	Error	%erro
1976	1	1.10	-.10	-10.0	.01	.60	.4	40.0
1977	3	2.32	+.68	+22.7	.46	2.80	.2	6.67
1978	4	4.76	-.76	-19.0	.58	5.00	-1.0	-25.0
1979	7	7.20	-.20	-2.9	.04	7.20	-.2	-2.8
1980	10	9.64	+.36	+3.6	.13	9.40	.6	6.0
Σ				-5.6	1.22			+24.8

	Reg.	Trend.
MPE /bias/	- -1.12%	4.96%
MSE	- .244	.32
MAPE	- 11.62%	16.1%

$$MPE = \frac{\sum_{i=1}^{n} \frac{(Y_i - \hat{Y}_i)}{Y_i}}{n} 100;$$

$$MSE = \frac{\sum (Y_i - \hat{Y}_i)^2}{n};$$

$$MAPE = \frac{\sum_{i=1}^{n} \frac{|Y_i - \hat{Y}_i|}{Y_i}}{n} 100;$$

Analysis of all three tests consistently indicates c regression model as superior to time-trend model.

.4.

/4/ Knowing that expected value of X in 1985 will be within the range of 16.3 and 17.7 give optimistic, pessimistic and most likely estimate of sales of Y for 1985, using causal regression model.

$$\hat{Y}_i = -1.34 + 1.22 \quad (X_i)$$

$$\hat{Y}^{o}_{1985} = -1.34 + 1.22\,(17.7) = \underline{20.254}$$

$$\hat{Y}^{p}_{1985} = -1.34 + 1.22\,(16.3) = \underline{18.546}$$

$$\hat{Y}^{ML}_{1985} = -1.34 + 1.22\,(17) = \underline{19.400}$$

/5/ Give 1985 forecast extrapolating the time-trend of Y:

$$\hat{Y}_i = -1.60 + 2.20\,(t_i)$$

$$\hat{Y}_{1985} = -1.60 + 2.20\,(10) = \underline{20.40}$$

ANNEX I.12

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Exercise VIII. 2. REGRESSION ANALYSIS - PROBLEMS OF MODEL CHOICE

Given below are figures representing 1976-1981 total yearly imports /hundreds kg/ of commodity "Z" to country "Q", together with yearly f.o.b. exporters' prices /thousands US $ / for this commodity. There is no local production of this essential consumer product and locally available substitutes, however expensive, are of inferior quality.

Time	Import '00 kg	Price '000 US $
1976	594.4	103
1977	521.3	95
1978	585.5	95
1979	586.7	129
1980	337.1	208
1981	302.2	183

/1/ Construct causal regression and time trend demand models for commodity "Z" on the basis of information available.

/2/ Which model would you choose to estimate future demand for product "Z" in "Q" market for the purpose of new investment project under consideration?

.2.

Solutions:

/1/A. Causal regression model:

$$\hat{Y}_i = a + bX_i$$

where:

Y_i - imports of commodity "Z"

X_i - f.o.b. price per '00 kg

a, b - parameters

Time	Y_i	X_i	X_iY_i	X_i^2	Y_i^2
1976	594.4	103	61223.2	10609	353311.4
1977	521.3	95	49523.5	9025	271755.7
1978	585.5	95	55622.5	9025	342810.2
1979	586.7	129	75684.3	16641	344216.9
1980	337.1	208	70116.8	43264	113636.4
1981	302.2	183	55302.6	33489	91324.8
Σ	2927.2	813	367472.9	122053	1517055.4

$(\Sigma Y)^2 = 8568499.8$

$(\Sigma X)^2 = 660969$

$r = -.8966$

$$b = \frac{6(367472.9) - 813(2927.2)}{6(122053) - 660969} = \frac{-174976.2}{71349} = -2.452$$

$$a = \frac{2927.2 + 2.452(813)}{6} = 820.113$$

$$\hat{Y}_i = 820.113 - 2.452X_i$$

/1/B. Time trend model:

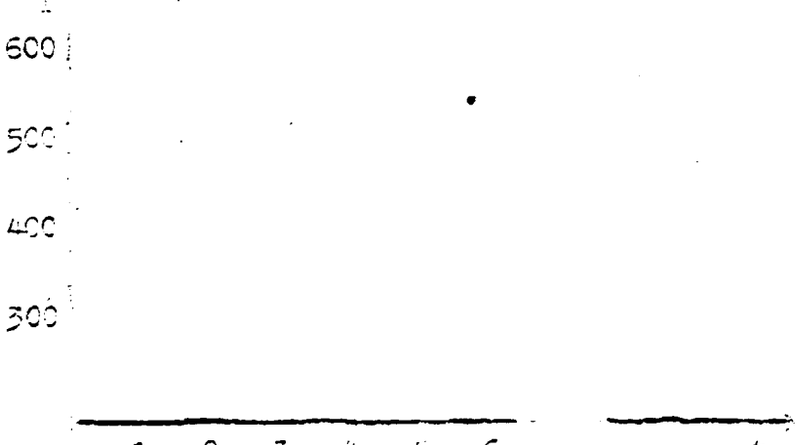
$$\hat{Y} = a + bt$$

.3.

Time	Y_t	X_t	XY	X^2
1976	594.4	1	594.4	1
1977	521.3	2	1042.6	4
1978	585.5	3	1756.5	9
1979	586.7	4	2346.8	16
1980	337.1	5	1685.5	25
1981	302.2	6	1813.2	36
$\sum$	2927.2	21	9239.0	91

$(\sum Y)^2 = 8568499.8$

$(\sum X)^2 = 441$



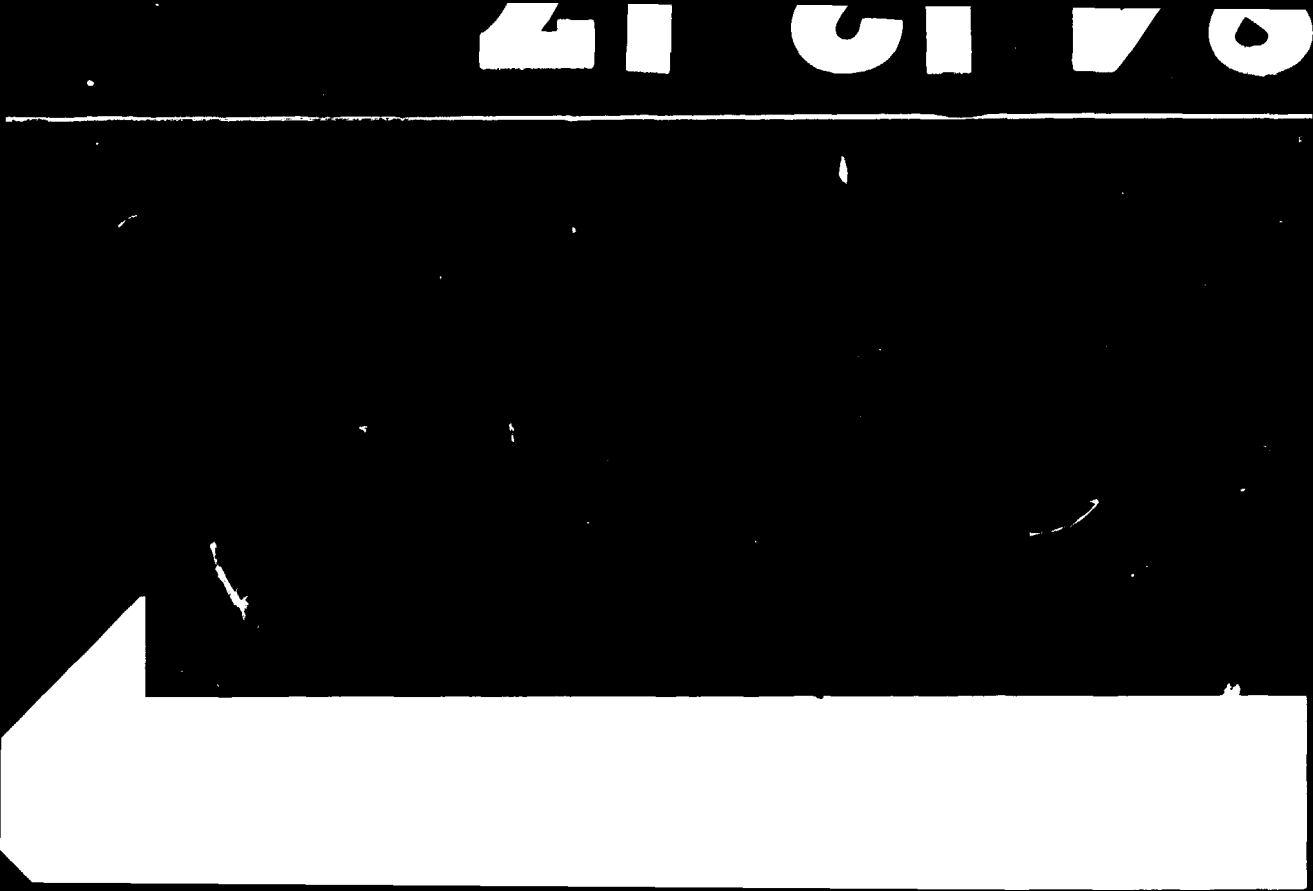
$$b = \frac{55434 - 61471.2}{6(91) - 441} = \frac{-6037.2}{105} = -57.5$$

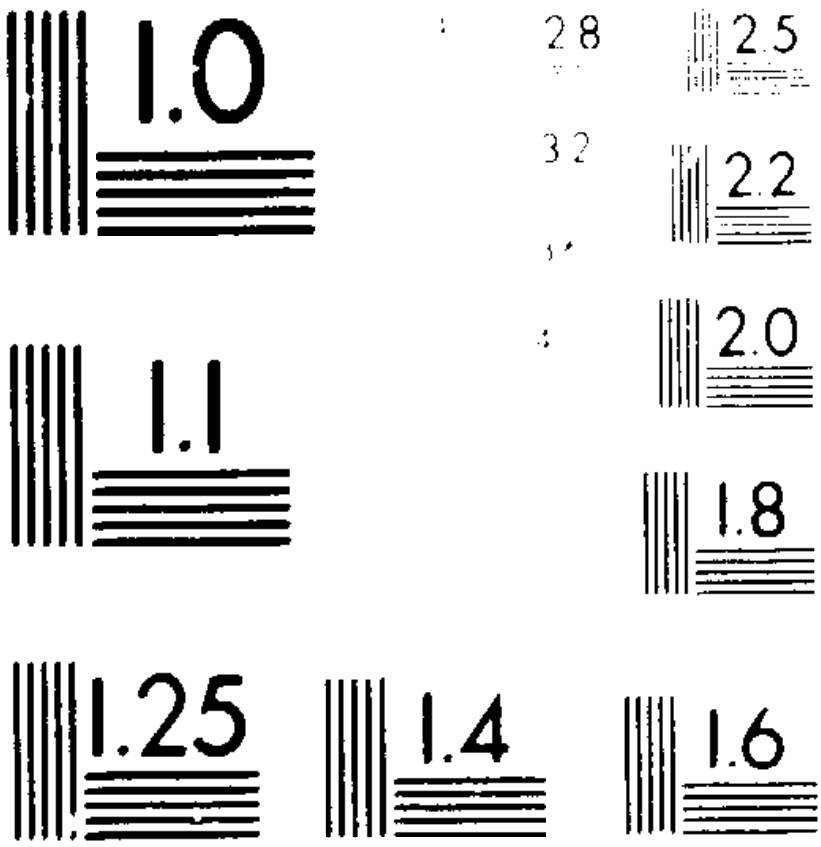
$$a = \frac{2927.2 - 1207.5}{6} = 689.1$$

$$\hat{Y} = 689.1 - 57.15$$

/a/ None at this stage, irrespective of "goodness of fit" test results.

- Time trend extrapolation shows 0 demand in less than





.4.

six years' time [illegible] " being [illegible]
consumer pr[illegible] [illegible] [illegible].

- There is no [illegible] [illegible] [illegible] [illegible]
sales [illegible] [illegible] [illegible] several consumer [illegible]
/currency changes, [illegible] [illegible] derogations e.t.c./
- There is [illegible] [illegible] [illegible] would be sensitive to
price only. At least [illegible] incomes, population
growth rates, local rental [illegible] charged and their im-
pact on demand are needed to [illegible] duct realistic demand
model [illegible] for forecasting [illegible].

In the absence of time series [illegible]," market a cross-
section analysis or a consumer survey should be considered.

ANNEX L.13

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Exercise VIII.3. FORECASTING MODEL EVALUATION /quantitative and qualitative aspects/

The following table presents the actual consumption of fire-proof Construction Materials /Y/ and consumption estimated on the basis of linear /$\hat{Y}^{I}$/ and exponential /est. $\hat{Y}^{II}$/ time-trend equations /data in thousand tons/ over the period of sixteen years.

Time /years/ /t/	Actual Consumption /Y/	Estimated Consumption /$\hat{Y}^{I}$/	Estimated Consumption /$\hat{Y}^{II}$/
1	350	395.0	408.0
2	341	428.5	432.0
3	464	462.0	457.0
4	559	495.5	483.0
5	628	529.0	511.0
6	631	562.5	540.0
7	567	596.0	571.0
8	589	629.5	604.0
9	636	663.0	639.0
10	685	696.5	676.0
11	756	730.0	715.0
12	764	763.5	757.0
13	785	797.0	800.0
14	797	830.5	846.0
15	856	864.0	895.0
16	903	897.5	947.0
$\bar{Y}$	644.4	646.25	642.6

.2.

The equations are as follows:

$$\hat{Y}_{I} = 361.5^{t} + 33.5t$$

$$\hat{Y}_{II} = 386 \times 1.058^{t}$$

/1/ Using the above models forecast demand for Fire-proof Construction Materials for five years ahead.

/2/ Knowing that:

- the main sole user, accounting for about 90 per cent of consumption, is the steel industry,
- there is a substantial number of other users but none of them accounts for more than 2 per cent of present consumption,
- none of the small users is likely to significantly increase its share in overall consumption of F.C.M. in the foreseeable future,
- the planned increase of steel industry's capacity over the next three years amounts to 83 per cent of the present level.

Evaluate both above levels.

Would you suggest any other approach to forecast the demand for F.C.M. for t+5 ? Specify.

Solutions:

/1/ $\hat{Y}_{I} = 361.51 + 33.5(21) = \underline{1065.01}$

$\hat{Y}_{II} = 386(1.058)^{21} = \underline{1251.21}$

/2/ [illegible] - goodness of fit:

	$\hat{Y}_{I}$	$\hat{Y}_{II}$
Mean Percentage Error	-1.89%	-1.6[illegible]%
Mean Absolute Percentage Error	6.6%	7.[illegible]
Mean Square Error	2103.4	2[illegible]
Standard Error of Regression	45.86	[illegible].33

- absolute deviations from actual consumption figures are

lower than for Y^{III}, as [illegible] ed by M.A.P.E., [illegible] C.E.P. On the other hand [illegible] nds to overestimate consumption more consistently [illegible] n Y^{AII} /see NPE /bias/ values/.

2B - qualitative evaluation

None of the two models can be used in view of the information given. The planned increase in steel industry capacity is bound to increase consumption of [illegible] at much faster rate than any of the two models would indicate.

2C - suggested other approaches

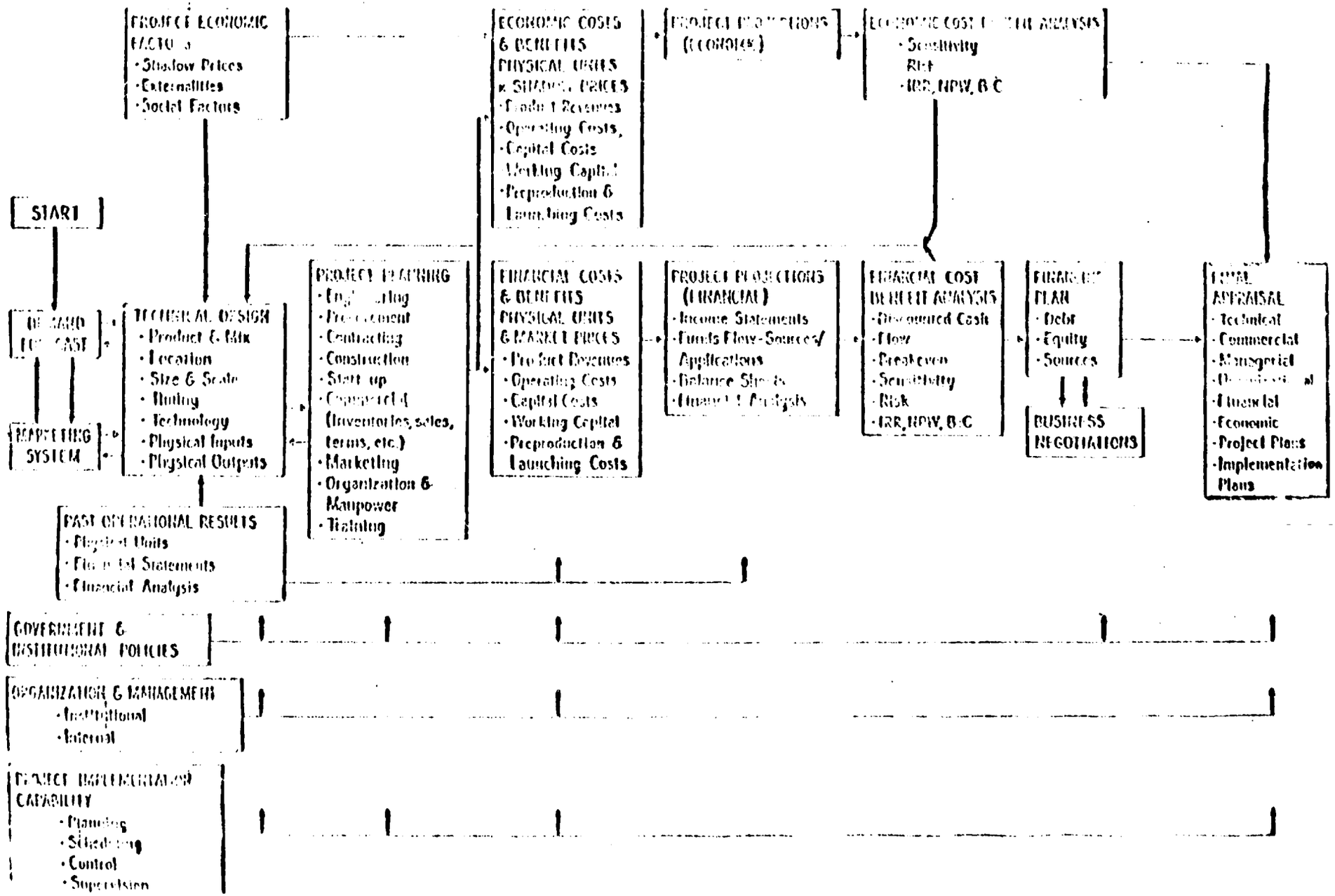
/i/ End-use method for all users.

/ii/ Combination: end-use method to estimate steel industry consumption [illegible] trend to account for future consumption [illegible] other users.

/iii/ Causal regression model/s/ with:

- one independent variable: Steel Industry Activity,
- two independent variables: 1/ Steel Industry Activity 2/ variable accounting for other users consumption:
  - Industrial Activity /without Steel Industry/, or:
  - Aggregate Activity Indicator for other users of [illegible], or:
  - Time.

DETAILED FLOW CHART OF THE PROJECT FORMULATION / ANALYSIS PROCESS



COMMERCIAL V.S. NATIONAL VALUATION

A COMPARISON

COMMERCIAL	NATIONAL
PROFIT MAXIMIZATION / net financial result of the project /	OBJECTIVES FULFILLMENT / contribution to all fundamental development objectives - economic & non-economic /
DIRECT MONEY EFFECT	DIRECT + INDIRECT / LINKAGE / EFFECTS / measurable & non-me
BASED ON MARKET PRICES	BASED ON ADJUSTED PRICES / social prices /
PREVAILING RATE OF INTEREST ON CAPITAL MARKET	SOCIAL RATE OF DISCOUNT

COST $\neq$ COST

BENEFIT $\neq$ BENEFIT.

WHAT MAKES SOCIAL COST-BENEFIT DESIRABLE IN DEVELOPING COUNTRIES

(1) - Higher generally rate of inflation associated with some price controls that distort national price relations compared with world market prices
(2) - Currency overvaluation and foreign exchange controls
(3) - Non-structured labour market with unemployment and underemployment
(4) - Imperfect capital markets (for equal risks - different interest rates
(5) - Large projects compared to market dimensions
(6) - Low elasticity of demand for exports
(7) - High degree of local industries protection
(8) - Insufficient domestic savings
(9) - Unequal distribution of wealth
(10) - Exagerated role of external effects

OBJECTIVES

FIRM - profit maximization

GOVERNMENT ① - regulation of economic processes to assure the best economic performance

② - control of unemployment

③ - price and wage controls

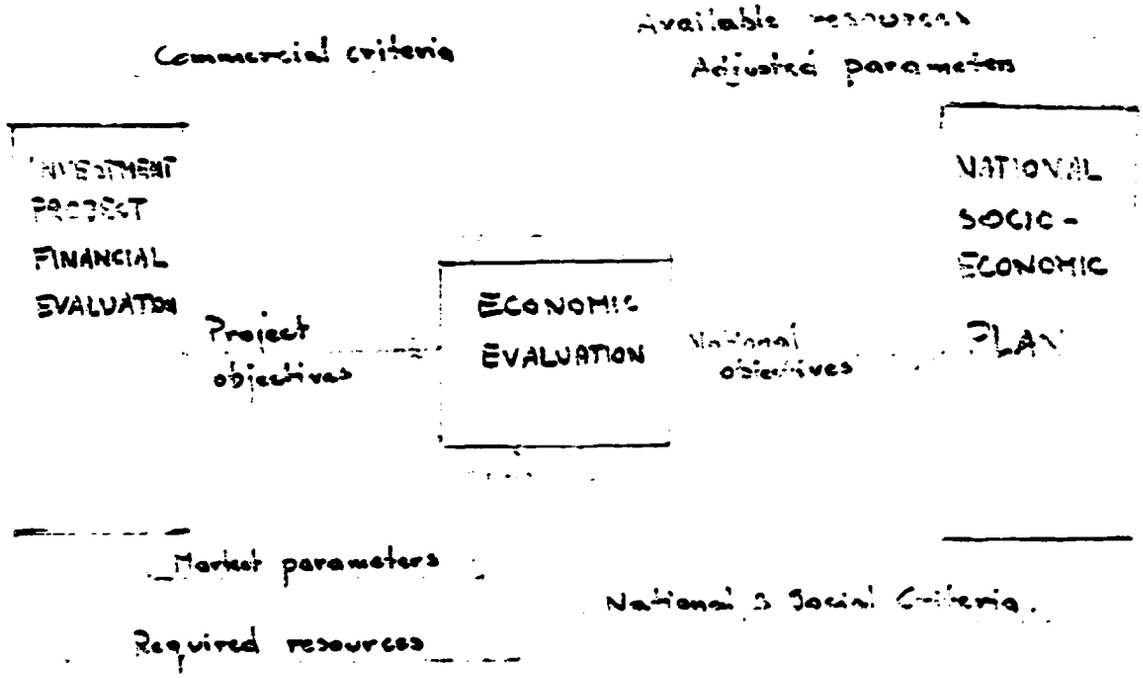
④ - more equal income distribution

⑤ - protection of national substance agains foreign agression

⑥ - protection of some types of production in the country

⑦ - protection of people against other's private activities

ECONOMIC EVALUATION OF PROJECT.



MAT. BALANCE

PRODUCT X

(S) SUPPLY / SOURCES	(D) DEMAND / DESTINATION
① Output 1.1 Plant A 1.2 Plant B 1.3 Plant _	① Consumption ② Production inputs 2.1 Plant A 2.2 Plant B 2.3 Plant C . . . . .
② DECREASE OF INVENTORIES	③ Investment 3.1 Project A 3.2 Project B 3.3 Project C . . . . .
③ Imports /when D > S/	④ Δ Inventory ⑤ Exports (when D < S) ⑥ Reserves.

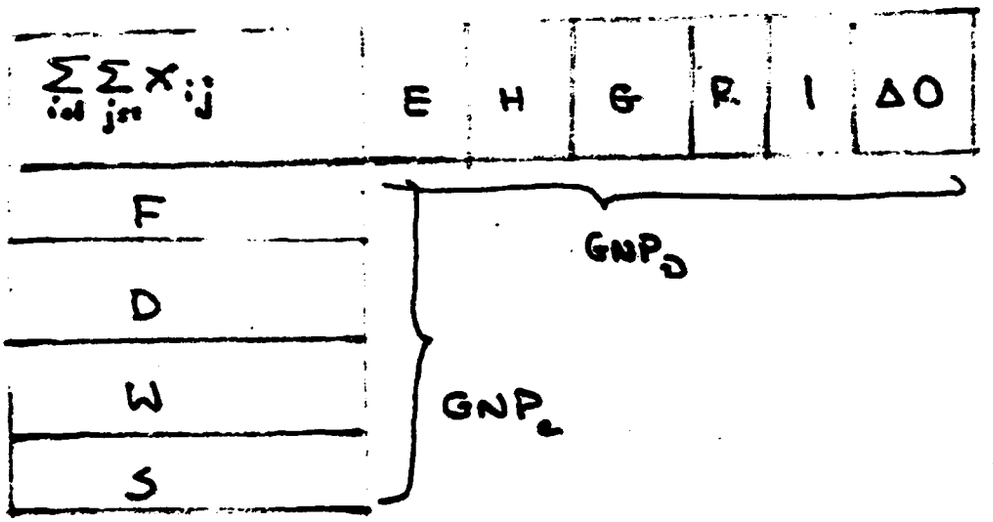
RESOURCE BALANCE

Resource V

(S) SUPPLY	(D) DEMAND
① Domestic Resources 1.1 Capital 1.2 Labour 1.3 Land 1.4 Others	① Production 1.1 Plant A 1.2 Plant B . . . . .
② Foreign Resources / when S < D/	② Investment 2.1 Project A 2.2 Project B . . . . .
	③ Export / when S > D /

(8)

	SECTORS					
	1	2	3	.	.	n
SECTORS 1	x_{11}	x_{12}	x_{13}	.	.	x_{1n}
2	x_{21}	x_{22}	x_{23}	.	.	x_{2n}
3	x_{31}	x_{32}	x_{33}	.	.	x_{3n}
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
.	.	.	.	.	.	.
n	x_{n1}	x_{n2}	x_{n3}	.	.	x_{nn}



PRICING RULES

OUTPUTS	
① Exported	A.F.O.B.
② Domestically marketed /import-substituting/	A.C.I.F.
③ Domestically marketed	ADMP + subsidy
- basic	ADMP + indirect tax
- non-basic	ADMP or cost ↗
④ Infrastructural services if not exportable /	
INPUTS	
① Imported /inv. + current mat./	ACIF + internal charges /transport, ins. etc/
② Domestically produced /inv. + current mat./	
- exportable	ADMP or AFOB ↗ ?
- importable	ADMP or ACIF ↘ ?
- other	ADMP + subsidy
③ Domestically procured infrastructural services /if not exportable or importable/	ADMP or cost ↗
④ Land	ADMP
⑤ Labour	A. salaries/wages + fringe benefits

ANNEX I.15

BIBLIOGRAPHY OR NATIONAL COST BENEFIT ANALYSIS

The following list incorporates mainly widely-known and easily available texts. The literature on the subject is now very considerable and this bibliography only includes a selection of the works which are likely to be of use to the practising project analyst.[1/]

Manuals

This manual follows on from:-

UNIDO Manual for the Preparation of Industrial Feasibility Studies 1978 Sales No. E.78.II.B.5

Earlier works whose broad methodology is followed by this manual are:-

UNIDO Guidelines for Project Evaluation (Authors P. Dasgupta, A. Sen and S. Marglin) 1979 Sales No. E.72.II.B.11

UNIDO Guide to Practical Project Appraisal: Social Cost-Benefit Analysis in Developing Countries (Author J.R. Hansen) 1978 Sales No.E.78.II.B.3

UNIDO Practical Appraisal of Industrial Projects: Application of Social Cost-Benefit Analysis in Pakistan (Author J.D. Weiss) 1980 Sales No. E.79.II.B.5

Basic works on the Little-Mirrlees methodology are:-

Little, I.M.D. and Mirrlees, J.A. Manual of Industrial Project Analysis in Developing Countries, Vol.2: Social Cost-Benefit Analysis (Paris, OECD, 1969)

Little, I.M.D. and Mirrlees, J.A. Project Appraisal and Planning for Developing Countries (Johns Hopkins Press)

Squire, L. and van der Tak, H., Economic Analysis of Projects (Johns Hopkins Press, 1975)

Baldwin, G.B. "A Layman's Guide to Little-Mirrlees" Finance and Development 1972, No. 9. pp 16-21

Overseas Development Administration (UK) A Guide to the Economic Appraisal of Projects in Developing Countries (1977 Revised edition)

1/ A fuller bibliography on project planning has been prepared by J. Coulson, Structured Reading List and Bibliography on Project Planning (Discussion Paper No.64, Project Planning Centre for Developing Countries, University of Bradford, U.K. 1981)

Works on the "effects" method include:-

Prou, C. et Chervel, M. Etablissements des Programmes en Economies Sous-Développées: Vol 3: L'Étude des groupes des projets (Dunod, Paris, 1970)

Chervel, M. et Le Gall, M. The Methodology of Planning: Manual of Economic Evaluation of Projects: The Effects Method (Ministère de la Coopération, France, 1978)

UNIDO Manual for Evaluation of Industrial Projects 1980 Sales No. E.80.II.B.2

Good general works on cost benefit analysis include:-

Fitzgerald, E.V.K. Public Sector Planning for Developing Countries (Macmillan 1978)

Irvin, G. Modern Cost-Benefit Methods: An Introduction to Financial, Economic and Social Appraisal of Development Projects (Macmillan 19

Bruce, C. Social Cost Benefit Analysis: A Guide for Country and Project Economists to the Derivation and Application of Economic and Social Accounting Prices (IBRD Staff Working Paper No.210, 1976)

Murelius, O. An Institutional Approach to Project Analysis (OECD, Paris, 1

Among critical works are:-

Self, P. Econocrats and the Policy Process: The Politics and Philosophy of Cost-Benefit Analysis (Macmillan 1975)

Carruthers, I.D. "Applied Project Appraisal: The State of the Art" ODI Rev. 2, 1977 pp 12-26

Chambers, R. "Project Selection for Poverty-Focussed Rural Development: Simp is Optimal" World Development No.6 1978, pp 209-219

On the Shadow Exchange Rate:-

Bacha, E. and Taylor, L. "Foreign Exchange Shadow Prices: A Critical Review of Current Theories" Quarterly Journal of Economics, 1971 No.2 pp 197-224

Balassa, B. "Estimating the Shadow Price of Foreign Exchange in Project Appraisal" Oxford Economic Papers, 1974 20, 2

Beyer, J.C. "Estimating the Shadow Price of Foreign Exchange: An Illustrati from India" Journal of Development Studies, July 1975

On border prices:-

Guisinger, S. and Papageorgiou, D. "The Selection of Appropriate Border Prices in Project Evaluation" Oxford Bulletin of Economics and Statistics, 1976, 38.2

On the Shadow Wage Rate:-

Bruton, H.J. "Labour Migration and Shadow Prices" Pakistan Development Review, 1980 XIX pp 65-74

Lal, D. "Disutility of Effort, Migration and the Shadow Wage Rate" Oxford University Papers 1973, p.112 f.

Lal, D. "Supply Price and Surplus Labour: Some Indian Evidence" World Development 1976, Vol.4, No.10/11

Lal, D. Distributional Weights, Shadow Wages and the Accounting Rate of Interest: Estimates for India" Indian Economic Review, Oct. 1977

There have been few convincing practical attempts to estimate National Discount Rates, but UNIDO (1980) and Lal (1977) give some indications for Pakistan and Indian respectively. Other sources, which are of more general interest as applications, are:-

Scott, M.F. MacArthur, J.D. and Newbery, D.M.G. Project Appraisal in Practice: The Little-Mirrlees Method Applied in Kenya (Heinemann 1976)

Little, I.M.D. and Scott, M.F. (eds) Using Shadow Prices (Heinemann 1976)

Scott, M.F. "The Test Rate of Discount and Changes in Base-Level Income in the United Kingdom" Economic Journal, 1977 87, 346, pp 219-241

Khan, M.Z. "Estimation of Shadow Prices for Project Evaluation in Pakistan" Pakistan Development Review 1979, Vol 18 No.2 pp 129-146

Linn, J.F. Economic and Social Analysis of Projects: A Case Study of the Ivory Coast (IBRD Staff Working Paper No. 283, 1977)

Linn, J.F. Economic and Social Analysis of Projects in the World Bank: Principles and Applications (Occasional Paper No.1 Project Planning Centre for Developing Countries, University of Bradford, U.K., 1978)

Roemer, M. and Stern, J.J. The Appraisal of Development Projects: A Practical Guide to Project Analysis, with Case Studies and Solutions (Praeger 1975)

Roemer, M. and Stern, J.J. Cases in Economic Development: Projects, Policies and Strategies (Butterworths 1981)

ANNEX I.16

ECONOMIC EVALUATION OF PROJECTS, SELECTED TERMINOLOGY

Adjusted price

The price of a material, product or service reflecting its real economic value as opposed to its financial or market value. Adjusted price is often used synonymously with accounting price.

Adjusted rate of foreign exchange

The "real" exchange rate as opposed to the official rate. It is an estimate of the shadow rate of foreign exchange.

Alternative projects

Alternative use of funds or an alternative method (technological or economic) of achieving the same objectives, leading to different cost-benefit distribution and different profitability.

Balancing method of planning

A method of national planning consisting of three types of individual balances, materials, resources and foreign trade, and several integrated (synthetic) balances. The core of the method is to compare expected demand and supply for the most important inputs and outputs and to ensure their mutual consistence.

Discounting factor

The formula $\frac{1}{(1+r)^t}$, where "r" stands for a discount rate and "t" is the future time period, used to calculate the present value of future cash outflows and inflows.

Externality

The impact of the project, favourable or not, which is not reflected in its financial accounts.

Import substitution effect

The value of foregone imports, replaced by domestic production fro investment project. In other words the imports, which would have occurred if the project had not been implemented.

Input-output method

A method of national planning and national economy monitoring, based on the matrix representation of real economic values and/or financial flows among different sectors of the economy. In a more sophisticated form an input-output matrix can provide a basis for comprehensive optimization calculations for the whole economic activity within a national economy.

Market parameters

Prices, wages, interest rates, foreign exchange rates, taxes, subsidies, customs duties, rents, etc., prevailing on the market and entering the financial accounts of the project.

Multiplier mechanism

The mechanism of mutual inter-action between an increase of income deriving from a project and a consequent increase in investment and/or output, yielding a further increase in income. This kind of interactive reactions is an additional indirect effect of the initial investment outlay.

National economic evaluation

The appraisal of an investment project from the point of view of the whole society's interests. In other words, the evaluation of the project's contribution to national objectives. Also called social cost-benefit analysis.

National parameters

These are prices, wages, rates and other parameters, adjusted in order to reflect social preferences, national objectives and limitations. In other words, they are shadow prices estimated on the basis of available information.

Opportunity cost

The value of something foregone. In other words, the effect of alternative use of a factor of production.

Premium multiplier

The real number used to multiply a market parameter to adjust it for factors working outside the market.

Repatriated payments

The part of the gross domestic value added being transferred abroad.

Social cost-benefit analysis

See National economic evaluation.

Social surplus

The part of value added remaining after deduction of wages and salaries. The equivalent of net profit in economic evaluation.

Shadow price

Theoretical concept of marginal efficiency or marginal cost of a given production factor, being derived from a mathematical programme.

Social rate of discount

A rate of discount which is used to discount all direct and indirect benefits and costs according to the period of time when benefits and costs occur. The rate should be estimated and fixed by the central planning authority, and represents the rate of decline of value of future income as compared with present income as seen from the national point of view. It is one of the national parameters and can be regarded as the shadow price of capital.

Uniform flows

The income or expenditures flows which are fairly stable over time (over different time periods).

ANNEX I.17

TRAINING COURSE IN INDUSTRIAL PROJECT PREPARATION
EVALUATION AND FINANCING
12 MAY - 15 JUNE 1984
KHARTOUM - SUDAN

BASIC MARKETING CONCEPTS AND DEFINITIONS

NOTE : THIS HANDOUT IS NOT STRICTLY THE PART OF THE COURSE PROGRAMME. IT'S MAIN PURPOSE IS TO UNIFY SOME BASIC CONCEPTS AND DEFINITIONS USED IN THE COURSE OF THE PROGRAMME. - IN VIEW OF PARTICIPANTS' DIFFERENT EDUCTIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A Brief Review *

I. INTRODUCTION: BASIC CONCEPTS AND DEFINITIONS

i) Introductory Definitions:

- Marketing is:
  /a system/ - a system of business activities
  /purpose / - designed to: plan, price, promote and distribute
  /Object of action/ - the want-satisfying goods and services for
  /beneficiaries/ - the market - present and potential household consumers and industrial users.

- Marketing Concept is a philosophy, an attitude or a course of business thinking while Marketing is a process or a course of business action.

- Marketing Management: is a marketing concept in action, or:

> "the analysis, planning, implementation and control of programme designed to bring about desired exchanges with target markets, for the purpose of achieving organizational objectives. It relies heavily on designing the organization's offering in terms of the target markets' needs and desires and using effective pricing, communication and distribution to inform, motivate and service the market.

ii) Evolution of Concepts in Marketing Management

- Product concept is the management orientation that assumes that consumers will respond favourably to good products that are reasonably priced and that little company marketing effort is required to achieve satisfactory sales and profits.

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* This part is based essentially on:

- Ph. Kotler: Marketing Management: Analysis, Planning and Control, Prentice Hall, 1975.
- W.J. St[illegible]: Fundamentals of Marketing. McGraw-Hill, 1971.

Implicit premises:

- the company should concentrate its attention on the task of producing good products that are fairly priced.
- consumers are interested in buying products rather than solving problems.
- consumers know the available competing brands.
- consumers choose among competing brands on the basis of their quality in relation to price.

- Selling Concept: is the management orientation that assumes that consumers will normally not buy enough of the company's products unless they are approached with substantial selling and promotional effort.

Implicit premises:

- the main task of the company is to get sufficient sales for its products,
- consumers will not normally buy enough on their own,
- the consumers can be induced to buy through various sales-stimulating devices,
- the customers will probably buy again and even if they don't, there are many other consumers out there.

- Marketing Concept is the management orientation that holds that the key task of the organization is to determine the needs, wants and values of the target market and to adapt the organization to delivering the desired satisfactions more effectively and efficiently than its competitors.

Implicit premises:

- the organization conceives of its mission in terms of satisfying a defined set of wants of a defined group of customers.

- the organization recognizes that satisfying wants requires an active program of marketing research to learn of these wants.

- the organization recognizes that all consumer - impinging company activities must be placed under integrated marketing control.

- the organization believes that doing a good job of satisfying consumers wins their loyalty, repeat business and favourable word-of-mouth; all of these being crucial in satisfying the organization's goals.

- Societal Marketing Concept: is the management orientation aimed at generating consumer satisfaction and long-term consumer and public welfare as the key to satisfying organizational goals and responsibilities.

Implicit premises:

- the main mission of the organization is to create satisfied and healthy customer and to contribute to the quality of life.

- the organization constantly searches for better products defined in terms of appeal and benefit to consumers. It is ready to promote benefits that are in the consumer's interest even if not in his mind.

- the organization eschews those products that are not in the best interest of the consumer.

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- consumer will sense and patronize those organizations that demonstrate concern for their satisfaction and welfare.

iii) Marketing System and the environment

- External environment:

  - market demand,
  - political and legal forces,
  - social and ethical influences,
  - competition,
  - distribution structure,
  - technology.

- Controllable factors:

  - non-marketing resources:
    - personnel,
    - production,
    - location,
    - finance,
    - public image,
    - research and development, patents;

  - marketing mix:
    - product,
    - price,
    - distribution channels,
    - promotion.

II. MARKETS

i) Consumer market: people, with money to spend and willingness to buy.

Objects:

- durable goods - tangible goods which normally survive many uses,

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- non-durable goods - tangible goods which normally are consumed in one or few uses
- services - activities, benefits or satisfactions which are offered for sale.

Basic classification:

- convenience goods - purchased frequently, immediately and with a minimum of effort.
- shopping goods - those which customer compares on basis of suitability, quality, price, style etc.
- specialty goods - goods with unique characteristics and/or brand identification.

Factors Affecting Demand:

People:

- population,
- regional population distribution,
- urban, sub-urban, rural,
- age,
- sex,
- family life cycle,
- others: religion, education, occupation etc.

With money to spend:

- distribution of disposable income,

And willingness to buy:

- psychological factors: personality, attitude, product benefits desired,
- sociological factors: cultural groups, social classes, small reference groups.

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Characteristics and Marketing Considerations

/ Table 1 /

Buying Decision Process:

- types of situations
  - routinized response behaviour/low-cost frequently purchased items /
  - Limited problem solving / unfamiliar brand in a familiar product class /
  - extensive problem solving / unfamiliar product class , buyer does not know criteria to use /
- stages in the buying process:
  - recognition of unsatisfied need,
  - identification of alternative ways of reducing tension / information search /,
  - evaluation of alternatives,
  - purchase decision,
  - postpurchase behaviour.

ii) Industrial Market: business or institutional organizations who acquire goods and services either to use in making other goods and services or to use in their own business.

Classification:

- raw materials: have received no processing and will become a part of another product.
- fabricating materials and parts: industrial goods which become an actual part of the finished product; will undergo further processing / materials / or will be assembled without any change of form / parts /

TABLE 1

Characteristics of classes of consumer goods

Characteristics and Marketing considerations	Convenience
Characteristics:	
1. Time and effort devoted by consumer to shopping	Very little
2. Time spent planning the purchase	Very little
3. How soon want is satisfied after it arises	Immediately
4. Are price and quality compared?	No
5. Price	Low
6. Frequency of Purchase	Usually frequent
7. Importance	Unimportant
Marketing Considerations:	
1. Length of Channel	Long
2. Importance of Retailer	Any Single Store is relatively unimportant
Number of outlets	As many as possible
4. Stock turnover	High
5. Gross margin	Low
6. Responsibility for advertising	Manufacturer's

and some marketing considerations

	Type of Product	
	Shopping	Speciality
	Considerable	Cannot generalize. May go to nearby store and exert minimum effort, or may have to go to distant store and spend much time.
	Considerable	Considerable
	Relatively long time	Relatively long time
	Yes	No
	High	High
	Infrequent	Infrequent
	Often very important	Cannot generalize
	Short	Short to very short
	Important	Very important
	Few	Few: often only one in market
	Lower	Lower
	High	High
	Retailer's	Joint responsibility

TABLE 1 CONT'D

Characteristics and Marketing considerations	Type of Product		
	Convenience	Shopping	Speciality
7. Importance of point-of-purchase	Very important	Less important	Less important
8. Advertising used	Manufacturer's	Retailer's	Both
9. Brand or store name important	Brand name	Store name	Both
10. Importance of packaging	Very important	Less important	Less important

- installations: manufactured industrial products; long-lived, expensive major equipment of industrial user.

- accessory equipment: industrial products used to aid and implement the production operations of industrial user but does not have a significant influence on the scale of operations in the firm.

- operating supplies: short-lived, low priced goods, purchased with a minimum of effort.

Determinants of industrial market demand:

- number and types of industrial users

  - total market,
  - size of industrial users,
  - regional concentration,
  - vertical and horizontal market.

- buying power of industrial users

- buying motives

Characteristics and marketing considerations:

/ see table 2 /

Buying process:

- types of situations:

  - new task,
  - modified rebuy,
  - straight rebuy,

Classes of industrial [illegible] have characteristics

Characteristics and Marketing considerations	Raw materials
Characteristics:	
1. Unit price	Very low
2. Length of life	Very short
3. Quantities purchased	Large
4. Frequency of purchase	Frequent delivery; long-term purchase contract
5. Standardization of product	Very high; grading
6. Limits on supply	Limited; cannot be increased quickly or at all
Marketing considerations:	
1. Nature of channel	Short; no middlemen
2. Negotiation period	Hard to generalize
3. Price competition	Important
4. Presale/postsale service	Not important
5. Demand stimulation	Very little
6. Brand preference	None
7. Advance buying contract	Important; use of long-term contracts

...l marketing considerations

Type of Production

Fabricating parts and materials	Installations	Accessory equipment	Operating supplies
Low	Very high	Medium	Low
Depends on final product	Very long	Long	Short
Large	Very small	Small	Small
Infrequent purchase, but frequent delivery	Very infrequent	Medium	Frequent
Very high	Very low; custommade	Low	High
Usuall no problem	No problem	Usually no problem	Usually no problem
Short; middlemen only for small buyers	short; no middlemen	Middlemen used	Middlemen used
Medium	Long	Medium	Short
Important	Not important	Not Main Factor	
Not important	Very important	Important	Very important
Moderate	Salesmen very important	Important	Not important
Generally unimportant but some sell is try	High	High	Low
Important; use of long-term contracts	Not usually	Not usually	Not

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- stages in the buying decision process:
  - anticipation or recognition of a problem and its general solution,
  - determination of characteristics and quantity of needed items,
  - description of characteristics and quantity of needed items,
  - search for and qualification of potential sources of supply,
  - acquisition and analysis of proposals,
  - evaluation of proposals and selection of supplier(s),
  - selection of an order routine,
  - performance of feedback and evaluation.

Market segmentation is the process of identifying groups of buyers with different buying desires and requirements.

Market targeting is the firm's decision: which segment to serve.

Conditions for effective segmentation:

- Segments must be measurable and data accessible,
- segments must be accessible through the existing channels,
- segments must be large enough, so as to be profitable.

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III. PLANNING THE MARKETING PROGRAM:

- types of planning:
  - top-down,
  - bottom-up,
  - goals down - plans up
- scope:
  - total company plan,
  - marketing plan,
  - annual marketing plan.
- planning process:
  - situation analysis,
  - determination of objectives,
  - selection of strategies and tactics,
  - evaluation of results.

IV. MARKETING-MIX VARIABLES

i) Product is a set of tangible physical and chemical attributes assembled in an identifiable form

New Products:

- really innovative,
- adaptive replacement,
- imitative products.

New Product Development Process:

- generation of new product ideas,
- screening the ideas,
- business analysis,

- product development,
- test marketing,
- commercialization.

Manufacturers' criteria for new products:

- adequate market demand,
- social and environmental compatibility,
- new product should fit into:
  - production facilities, manpower and management abilities,
  - financial abilities,
  - marketing structure,
  - company's image.
- there should be no legal objections.

Organization for product innovation:

- product-planning committee,
- new-product department,
- product manager,
- venture team,
- outside new-product specialists.

Product-line policies and strategies:

- expansion of product-mix,
- contraction of "
- alteration of existing products,
- development of new users for existing products,
- product positioning,
- trading-up and trading-down,
- product differentiation and market segmentation.

The concept of product life cycle:

- introduction,
- growth,

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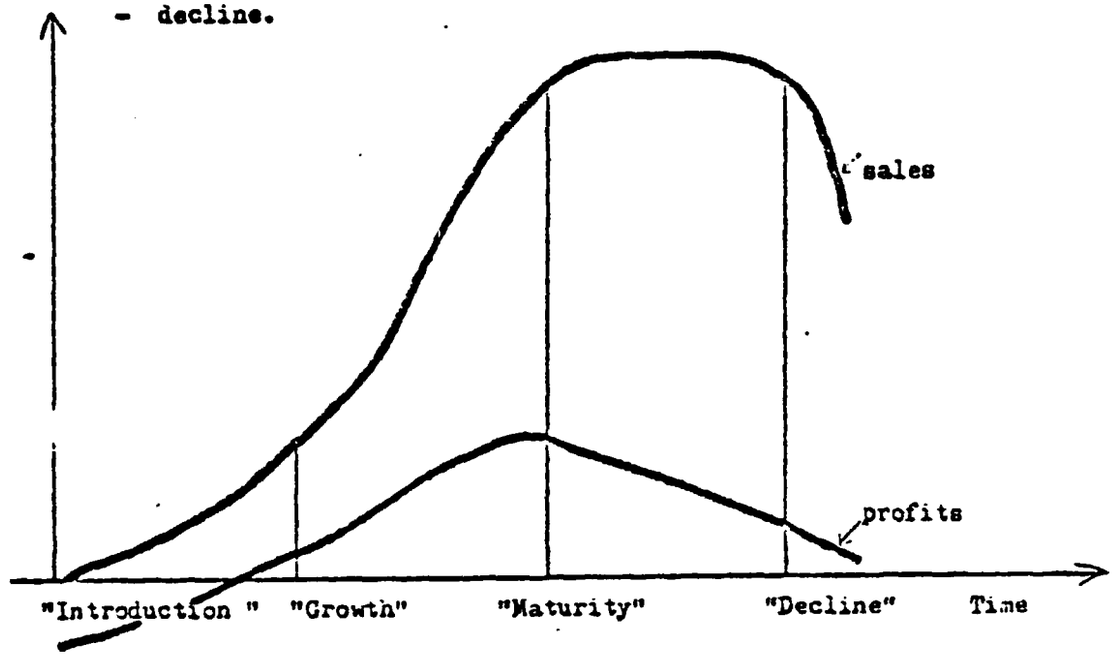
- maturity,
- decline.



Factors influencing changes in product-mix:

- market demand,
- competitive actions and reactions,
- marketing influences,
- production influences,
- financial influences,
- desire to change company image.

Brand, package, other image-building features.

ii) Price

Pricing objectives:

- Achieve target return on investment or net sales,
- stabilize prices,
- maintain or improve market share,
- meet or prevent competition,
- maximize profit.

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Pricing procedure:

- estimate the demand for product,
- anticipate the competitive reaction,
- establish the expected share of the market,
- select the price strategy to be used to reach the target market,
- consider the policies regarding products, channels, and promotion,
- select the specific price.

Pricing strategies:

- "skim the cream" strategy,
- "penetration" strategy.

Price-setting methods:

- price on total cost plus profit desired,
- price on balance between estimates of market demand and costs of production and marketing,
- price to meet competitive market conditions.

Price-changing decisions:

- price elasticity of demand: $e = \dfrac{\dfrac{\Delta Q}{Q_0 + Q_1}}{\dfrac{\Delta P}{P_0 + P_1}}$

- cross elasticity: $e_c = \dfrac{\dfrac{\Delta Q_A}{Q_{0A} + Q_{1A}}}{\dfrac{\Delta P_B}{P_{0B} + P_{1B}}}$

- approaches to calculate elasticity:

  - direct attitude survey,
  - statistical analysis of relationship between price and quantity,
  - market test,
  - analytic inference.

iii) Distribution Channel is a route taken by the title to the goods as they move from the producer to the ultimate consumer or industrial user,

- Channel objectives and constraints:

  - customer characteristics,
  - products characteristics,
  - middlemen characteristics,
  - company characteristics,
  - competitive characteristics,
  - environment characteristics.

- Distinguishing channel alternatives:

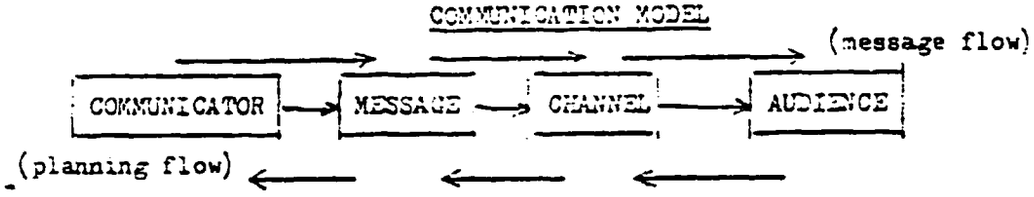
  - types of intermediaries,
  - number of intermediaries,
  - marketing tasks of the participating intermediaries,
  - terms and mutual responsibilities.

- Evaluation of alternatives:

  - economic: -break-even analysis,
    - return on investment.
  - control,
  - adaptive,

- Aspects of physical distribution

iv) Communication - Promotion



- Audience

  - level of aggregation,
  - level of awareness and interest,
  - persuasibility.

- Channels

  - personal influence channels;
    - advocate,
    - expert,
    - social.

  - non-personal influence channels:
    - mass and selective media/magazines, TV. radio, newspapers, billboards/
    - atmospheres,
    - events.

- Message

  - function,
  - structure,

- Communicator:

  - source credibility,
  - source incongruity.

1. ORIENTATION TO FEASIBILITY CONCEPTS.

Once the demand forecast has been established, the physical resources (materials, production equipment, ancillary equipment, transport facilities, utilities, labor etc...) must be analysed to determine the optimal configuration of the project to provide the desired output.

The feasibility investigation should respond to what is desired in the way of products and/or services with what can be done and what is the best way to do it under the circumstances.

In this way, the limitations of physical resources can be regarded as constraints upon the desired output which tend to delimit the domain of feasible production alternatives. Once this domain is determined, the question of whether or not the resources should be allocated for one or another of the production alternatives is a matter for socio-economic cost/benefit analysis.

In order to more fully comprehend physical analysis four concepts must be developed :

1. Constraint
2. Feasibility
3. Objective Function
4. Optimality

A two variable linear model is used to illustrate these concepts.

Constraint is an expression of the limitation on a physical resource. For example, if product X requires 2 units of a given material and Y requires 1 unit and the maximum available is 14, then the constraint is expressed by $2X + Y \leq 14$.

A similar constraint for transportation might be $2X + 3Y \leq 24$.

The Feasible Region is that which satisfies all the constraints of a given physical situation including the non-negativity constraints for the variables. ($X, Y \geq 0$)

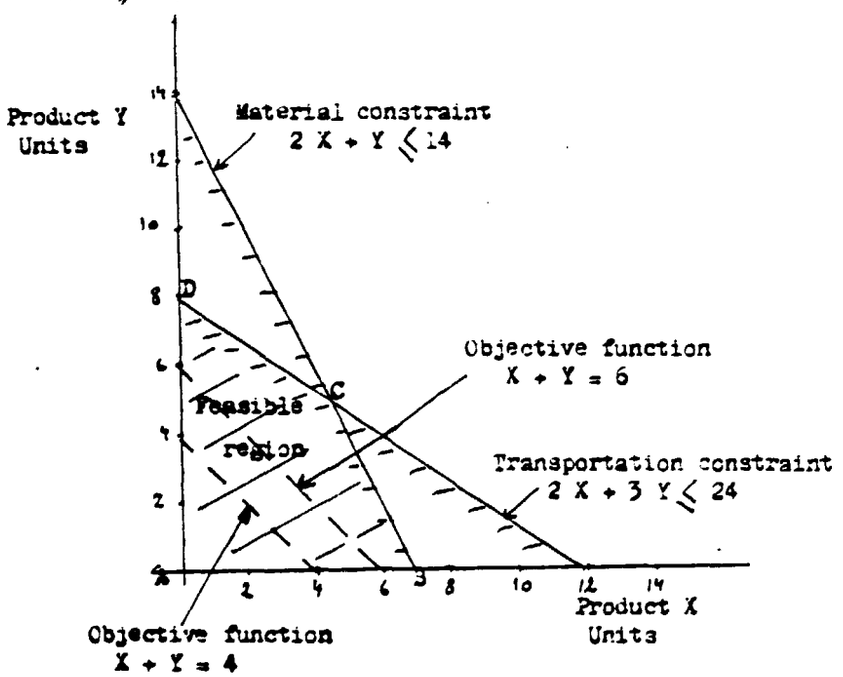


Fig. 1 A Two-Variable Linear Optimization Model

The Objective Function expresses the outcome of choosing a given level for the variables (in this case X and Y). For example, if each unit of X and each unit of Y yields a benefit of 1 unit of exchange, then $Z = X + Y$ where Z is the total benefit (profit) to be attained. Fig. 1 gives the illustrations of this expression for two different values of Z. Note that different coefficients (per unit profit) of X and Y would alter the slope of this expression.

The Optimal Solution is that which falls within the constraints and yields the best outcome (in this case maximum profit; point C would give the optimal result where $X = 4.5$; $Y = 5$ and $Z = 9.5$

These concepts must be borne in mind when attempting to arrive at a decision relating to the physical configuration of a project. The solution must be feasible in the sense that all the constraints are satisfied and should be optimal in terms of objective criteria.

It is useful to think of the constraints as links in a chain. When only one is broken, the chain will pull no weight.

D. SUSSMAN

Engineering and Technology.

2. RELATION BETWEEN PRODUCTION LEVEL AND DEMAND TO INCLUDE PRODUCTION LOSSES.

(Applicable also to material inputs in which production yield is not a factor.)

Of the finished product which issues from a process there will be losses that establish a relation between the demand (products which flow to the market) and the production level in a given period (see fig. 2 below). It is important to understand this relation so that the proper adjustment be made.

$$P - P(L) = D$$

$$P(1 - L) = D$$

$$\boxed{P = \frac{D}{1 - L}}$$

where D = Demand, units per period

L = Production Losses of all types
L = LT + LS + WS + PD , in %

P = Production level, units per period.

This relation is pointed out because, as it is too often the case, the percent losses are erroneously taken as the incremental production requirement which, of course, yields a production level which is too low.

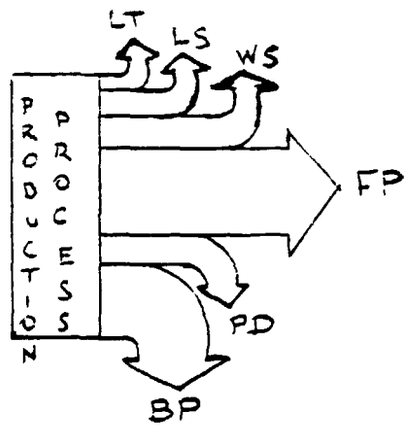


Fig. 2 Distribution of Output of Production Process.

FP = Finished Products to Market %/100
LT = Losses in Transport %/100
LS = Losses in Storage %/100
WS = Warranty Services %/100
PD = Production Defects %/100
BP = By-Products %/100

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Engineering and Technology.

3. CONSTRAINTS ON PRODUCTION BUILDUP.

Capacity of production is expressed as the time rate of production in volume or units, e.g. M^3/hr or tonnes/yr.

Normal Maximum Capacity is the capacity specified or guaranteed by the manufacturer of a plant or production equipment under short term, ideal conditions.

Feasible Normal Capacity is that achievable under normal working conditions at the project site taking into account such factors as : Holidays, Maintenance, Downtime for repairs and tool changes, Operating conditions (i.e. climatic, infrastructural etc...), Labor skills and work standards, Shift variables, Equipment utilization factors, Capacity variations with quality and properties of materials and inputs, etc..

In the early stages of production, aside from those factors which determine the Feasible Normal Capacity as a percentage of the Normal Maximum Capacity, other constraints can, and most probably will, limit production to a level below the feasible normal capacity (see fig. 3).

Some of these constraints might be

- Development of sources of materials and inputs;
- Training of required number of skilled workers;
- Operating efficiency of the plant
- Development of infrastructural services (transport, power, etc...)

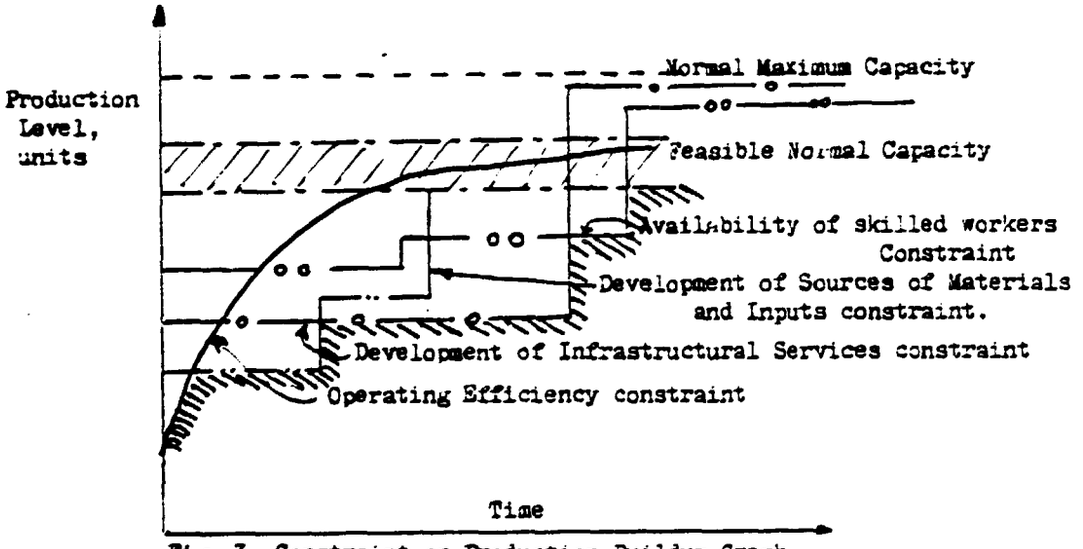

Fig. 3 Constraint on Production Buildup Graph.

The production program is limited by and can not exceed the minimum production level permitted by any one of the constraints.

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Engineering and Technology.

4. PLANT CAPACITY.

The Feasible Normal Capacity is the basis for capacity planning. The constraints of section 3 as well as the possibility for multiple shift operation must be used in matching the capacity to the production program.

Several considerations may be useful:

a) Economy of Scale

Generally, the cost per unit of production will decrease as the plant capacity is increased. See fig. 4 - 1.

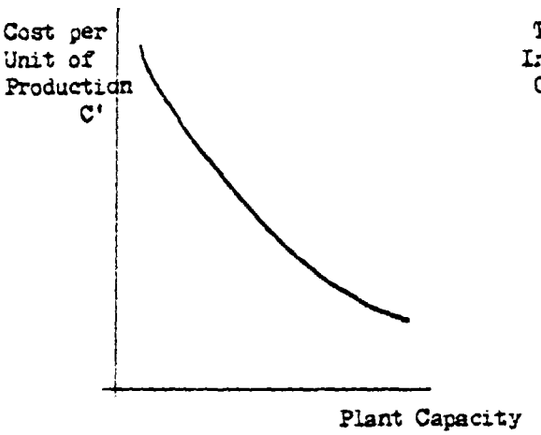

Fig. 4 - 1. Cost per Unit Production vs Plant Capacity

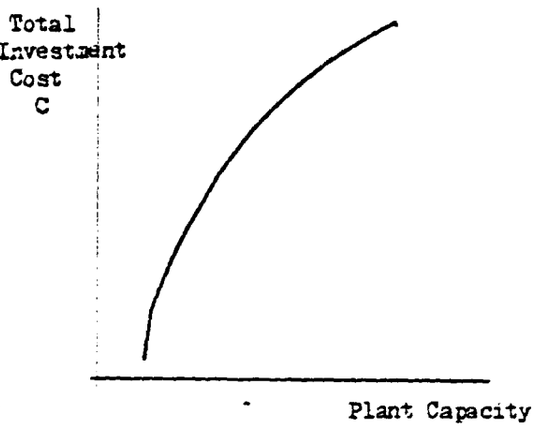

Fig. 4 - 2. Total Investment Cost vs Plant Capacity.

At the same time, the total investment cost will increase but at a rate reduced from the linear form.

The total investment cost C (see fig. 4-2) is related to the production level in one model by $C_2 = C_1\left(\frac{Q_2}{Q_1}\right)^x$ where x is a coefficient that varies from 0.2 to 0.9 (0.6 for the chemical industry)

Similarly, the investment cost per unit C' is given by

$$C'_2 = C'_1\left(\frac{Q_1}{Q_2}\right)^{1-x}$$

b) Relation between Market Uncertainty, Market Projection and Plant Capacity. Static Model.

In practice, the ideal model of a) above is sometimes not achievable since often plants are produced in fixed standard capacities. An interesting composite view of these factors is shown in fig. 4-3. It is assumed that the contribution, the difference between price and variable costs, is constant.

This is justified in the case where material inputs represent the only or major portion of variable costs. Often the other major components of variable costs, labor, is in reality a fixed or semi-fixed cost, varying primarily with any change in the number of shifts employed.

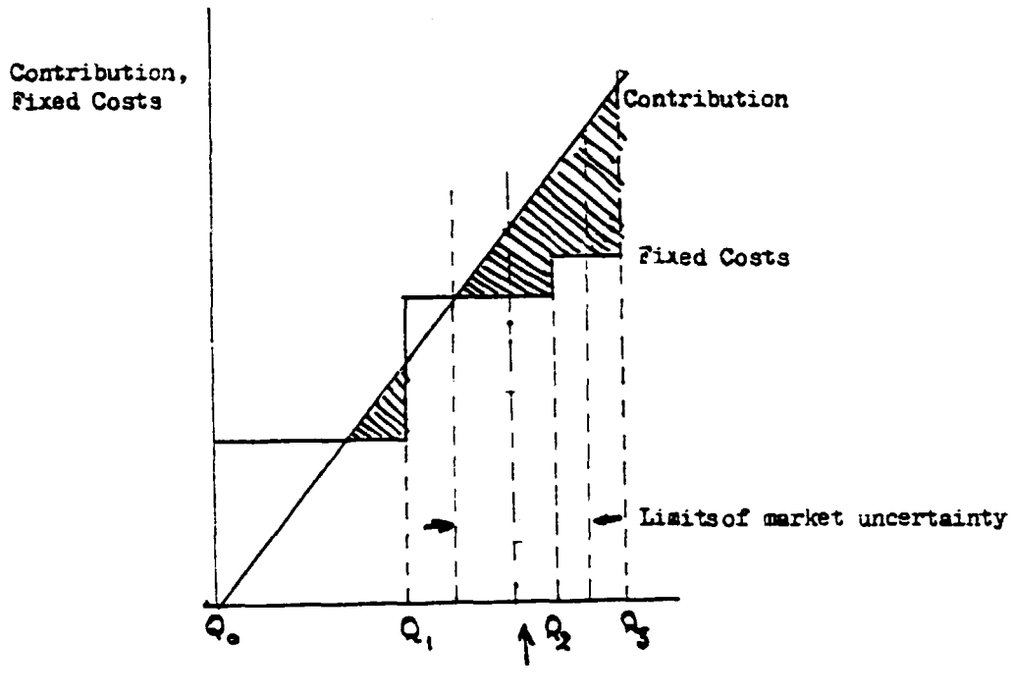

Fig. 4 - 3 Relation between standard capacities (associated fixed costs), market and contribution.

The fixed costs vary with the three standard plants that are available with peak capacities of Q_1, Q_2 and Q_3 respectively. The shaded areas represent the profitable operating conditions.

Capacity Q_3 will yield the best profit but is at the extreme high end of market potential (high risk). The most probable market falls within the range of Q_2 but the profit is slightly lower that that of Q_1 which is a virtual certainty.

What capacity should be chosen, Q_1, Q_2 or Q_3? There is no simple answer. Perhaps risk/reward analysis would be the best approach. If failure could not be tolerated, Q_1 might be chosen over the potentially more rewarding Q_2 and incremental capacity planned for the future. Total costs for the higher production levels would be more costly but might be justified by the lower risk.

The project plan might be to initially install capacity Q_1 and then build up to Q_2 and Q_3 subsequently.

If it is anticipated that the market penetration would occur over a period of years as shown in fig. 4-4, the cash flow for this plan might show the greatest return on investment.

Another advantage is that the project may need much less external financing as the expansion might be covered by the cash flow. In the early years, there would be a considerable amount of unused capacity.

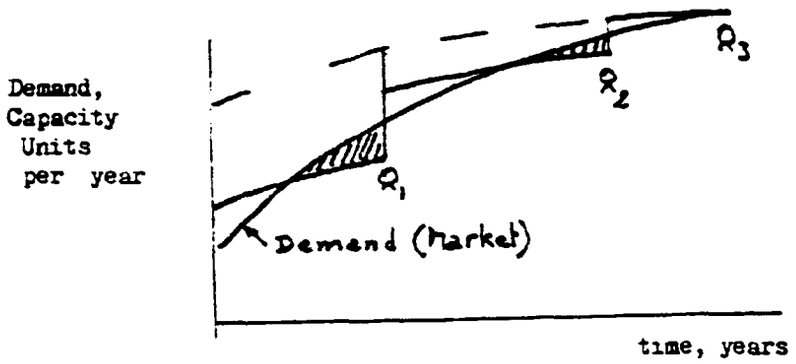

Fig. 4-4 Incremental Production Capacity Buildup

Even in the case where no capacity buildup is planned, it might happen that a lower standard capacity could yield a better return for the project. The cash flows for earlier periods, since they are discounted less, are more prominent in the calculation of return on investment.

Consequently, unused capacity early in the project when market penetration is being established or when the demand may be lower, could have an adverse effect on return so that a lower standard capacity might be a better choice.

Cash flow and return for capacity alternatives should be compared.

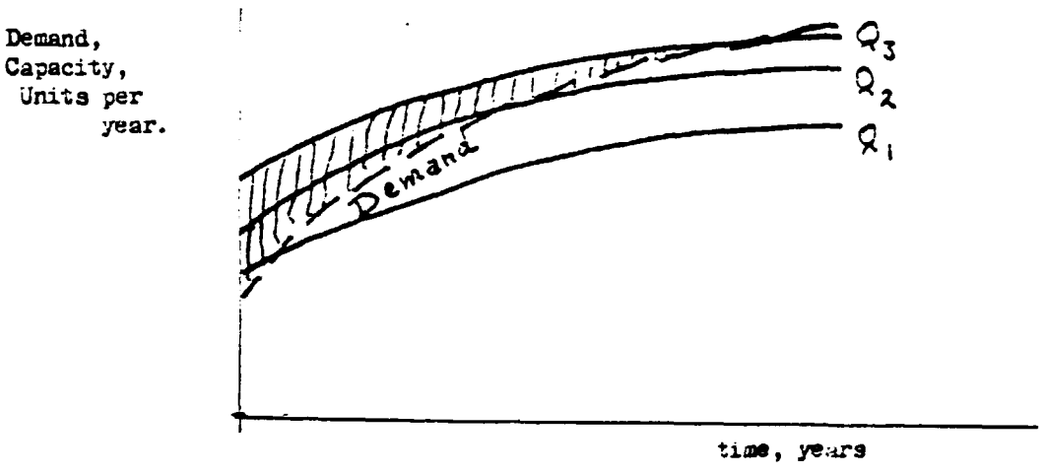

Fig. 4-5 Capacity Alternatives in relation to Demand.

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5. CORRELATION BETWEEN RAW MATERIAL PRICE AND QUALITY.

It happens on occasion that a raw material or input may vary considerably in quality from different regions or as a consequence of seasonal variations. Sugar Cane, for example, varies considerably in sucrose content and moisture content depending upon the region and time of harvest. Certainly, it would not be prudent to plan a project without knowing the quality characteristics of the cane supplied to the project. The plan could be based on cane of standard quality with price adjustments for deviations from standard.

For sugar cane, the measure of total sugar content (sucrose plus invert sugars) is degree Brix (ºB). Other factors that would affect the price would be moisture content and the percentage of invert sugars (not easily cristallized and therefore generally undesireable).

Suppose conditions are as follows:

ºBrix Standard (Bs) = 16 % Invert Sugar Standard (IVs) 5
ºBrix Sample (B) = 20 % Invert Sugar Sample (IV) 7
% Moisture Standard (Ws) = 15
% Moisture Sample (W) = 17

The sugar factor (Fs) and production factor (Fp) represent the percentage of variable costs related to the raw material and to production Fs = 0,7; Fp = 0,3.

To establish the correct price a sugar index Is and a production index Ip are calculated.

$$\text{Sugar Index (Is)} = \frac{W}{Ws} \times \frac{B}{Bs} \times \frac{(100 - IV)}{(100 - IVs)} \times Fs = \frac{17}{15} \times \frac{20}{16} \times \frac{93}{95} \times 0,7 = 0,97$$

$$\text{Production Index (Ip)} = \frac{(1 - Bs/85)}{(1 - B/85)} \times Fp = \frac{(1 - 16/85)}{(1 - 20/85)} \times 0,3 = 0,32$$

$$\frac{\text{Purchase price}}{\text{Base price}} = Is + Ip = 0,97 + 0,32 = 1,29$$

If the Base price is 20 £/tonne then
Purchase price = 1,29 x 20 £ = 25,8 £/tonne.

In the study, the price for raw material would be the standard price with provisions for modified prices depending on quality.

Note also that quality can affect the plant capacity.

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6. STANDARD AND ACTUAL COSTS OF MATERIALS AND INPUTS.

A table to organize the costs of materials and inputs is shown in the Manual ID/206 on page 73 Table 4-1. There is considerable additional information concerning materials and inputs that should be collected and organized so that all factors related to this component of the project (cost, leadtime, storage requirements etc...) will be correctly assessed.

Tables such as those shown in Fig.6-1 and 6-2 should be utilized.

Fig.6-1 Standard Materials and Inputs Table.

Material, Input Classification	Item	Unit Cost For / Local	Quantity req'd per Unit Product	Total Cost For / Local	Sources	Lead Time, days	Storage requirements Conditions, Volume per unit	Storage requirements Total volume	Inventory: Usage rate, units/day (β)	Minimum days coverage	Buffer stock B Units	EOQ, units	Maximum stocks	Coefficient of Turnover (C.T.)

nº days per inventory cycle

$$N = \frac{2OQ}{\beta} = \frac{\text{Economic order quantity}}{\text{usage rate, units per day}}$$

$$C.T. = \frac{\text{Nº working days per year}}{\text{Nº days per inventory cycle (N)}}$$

Fig. 6-2 Cost Analysis Table.

Product or Component	Material or Input	Standard requirement per unit	Standard Cost per unit For / Local	Year 1: Nº Standard Units	Year 1: Nº Actual Units	Year 1: Total Cost	Year 2: Nº Standard Units	Year 2: Nº Actual Units	Year 2: Total Cost	Year 3: Nº Standard Units	Year 3: Nº Actual Units	Year 3: Total Cost	Y 4 etc..
Material Waste Factor Fw													
Material Yield Factor Fy													

The maximum storage requirements for each input or material will be the Economic Order Quantity (EOQ) plus the buffer stocks as explained in section 7.

Particular attention is called to both the yield factor and the waste factor. The number of actual units A as related to the standard units is

$$A = \frac{S}{(1 - Fw)(1 - Fy)}$$

The yield factor relates to the inherent residual useful in a material. For example, the solids in tomatoes used for concentrate represents only 1/6 or so of the weight of raw material so Fy would be 0,167. The waste factor Fw relates to losses in storage, transport, etc...

In figure 6-2 the number of standard units is derived from the production program. This figure also includes losses in the production process.

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7. STORAGE REQUIREMENTS AND ECONOMIC ORDER QUANTITY (E O Q)

Inventory levels for each material and input and for the finished product affect both working capital and fixed capital (in relation to size of storage facilities.

Many models are available for inventory analysis.[1]

(a) Single item static model with buffer stocks.

The objective is to find the Economic Order Quantity (EOQ) and appropriate buffer stocks. The variables of the problem are:

- K Fixed costs associated with processing an order - set up costs
- y Order quantity
- β Usage rate, units per month
- h Holding cost per unit per month

Total Cost per unit time (month) $T.C. = \frac{K}{y/\beta} + h\,\frac{y}{2}$

The EOQ (y^*) is found to be $y^* = \sqrt{\frac{K\beta}{h}}$

(by setting derivative of above function to zero - minimisation process)

To find the level of buffer stocks we must look at the statistical variations in the lead time (time from placement of order for material to delivery).

- L Lead time, days
- σ Standard deviation of usage rate, units per day
- M Mean usage rate, units per day
- X_L Demand during lead time (normally distributed)
- σ_L Standard deviation of demand during lead time

$$\sigma_L = \sqrt{L \times \sigma}\text{, units}$$

- B Level of buffer stocks, units

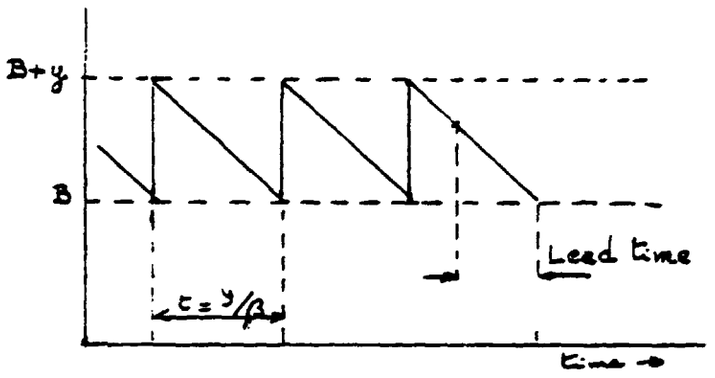


Fig. 7-1 Single item static model with buffer stocks.

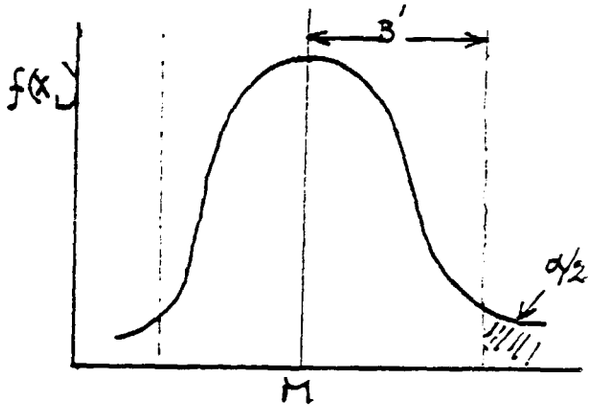


Fig. 7-2 Distribution of Demand during Lead Time.

(1) Most of this discussion derived from Taha, Hamdy, Operations Research.

Assurance is required to a certain degree of confidence that there will not be a shortage of stocks. The level of confidence is established by a parameter Z . The values of this parameter for various levels of confidence are given by statistical tables.

In figure 7-2 B' is given by B' = B + βL (Since β is expressed in units per month, L must be expressed in months.

The amount of buffer stocks is determined as follows:

$$\frac{B'}{\sigma_L} \geqslant z_\alpha$$

$$B' \geqslant z_\alpha \sigma_L$$

$$B = B' - \beta L$$

(b) Single item static model with price breaks.

Suppose a price break occurs when a quantity q or more is ordered, i.e. the price is reduced for a large order quantity. P_1 is the price for $y < q$ and P_2 for $y \geqslant q$

The total cost per unit time for each price is given by

$$C_1 = P_1\beta + \frac{K\beta}{y} + \frac{h\,y}{2} \qquad y < q$$

$$C_2 = P_2\beta + \frac{K\beta}{y} + \frac{h\,y}{2} \qquad y \geqslant q$$

The EOQ for either case, y_m, is the same $y_m = \sqrt{\frac{2K\beta}{h}}$

Two cases can occur. Either $q < y_m$ or $q \geqslant y_m$.

If $q < y_m$ then P_2 (the lower price) will be paid and y^*(the EOQ) = y_m

If $q \geqslant y_m$ a parameter q_1 must be determined (see below)

(1) $q < q_1$ then $y^* = q$

(2) $q \geqslant q_1$ then $y^* = y_m$

Determination of q_1

Example: K = 10 P_1 = 2

h = 1 P_2 = 1 $\qquad y_m = \sqrt{\frac{2 \times 10 \times 5}{1}} = 10$

β = 5 q = 15

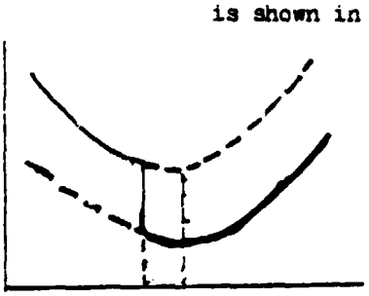
$$C_1(y_m) = C_2(q_1) = P_1\beta + \frac{K\beta}{y_m} + \frac{h\,y_m}{2} = P_2\beta + \frac{K\beta}{q_1} + \frac{hq_1}{2}$$

$$(2 \times 5) + \left(\frac{10 \times 5}{10}\right) + \left(\frac{1 \times 10}{2}\right) = (1 \times 5) + \left(\frac{10 \times 5}{q_1}\right) + \left(\frac{1 \times q_1}{2}\right)$$

$$q_1^2 - 30\,q_1 + 100 = 0$$

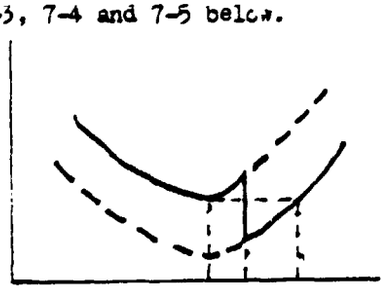
$$q_1 = 26{,}2 \text{ or } 3{,}8 \text{ (use largest value)}$$

A graphic illustration of the alternative solutions to this problem is shown in fig. 7-3, 7-4 and 7-5 below.



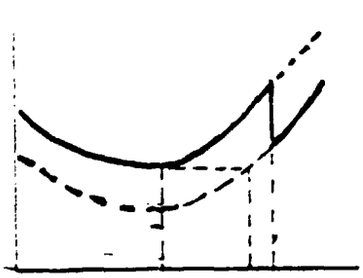
$q < y_m$

$y^* = y_m$ Fig. 7-3



$y_m < q < q_1$

Fig. 7-4 $y^* = q$



$y_m < q_1 < q$

Fig. 7-5 $y^* = q_1$

(c) A Dynamic Model can be used for determining optimal (least cost) production and inventory programs in cases when : a) Demand varies in each period; b) Cost of production and/or storage varies according to period.

Any type of constraint (linear or non linear) or cost function can be incorporated into the model which provides a great deal of flexibility. The model shown by example below gives the optimal level of production by period and the amount of finished goods inventory which can then be related to raw materials inputs and inventory either by implication or by direct inclusion in the model.

Variables (for each period or stage i)

Z_i amount produced in period i, units
D_i demand in period i, units
X_i entering inventory in period i, units
h_i holding cost per unit carried over from period i to i + 1. ℒ/unit
k_i fixed cost in period i, ℒ (set up, ordering cost, etc...)

Stage - period

State - entering inventory for period i + 1 (closing inventory for period i)

Decision variable Z_i or amount to be produced

Cost Functions $C_i(Z_i)$- production cost function. Note: $C_i(Z_i)$ includes k_i

for period 1

$$f_1(X_2) = 0 \leqslant Z_1 \leqslant D_1 + X_2 \left\{ C_i(Z_i) + h_1(X_2) \right\}$$

$$f_i(X_{i+1}) = 0 \leqslant Z_i \leqslant D_i + X_{i+1} \left\{ C_i(Z_i) + h_i(X_{i+1}) + f_{i-1}(X_{i+1} + D_i - Z_i) \right\}$$

The link between stages (periods) is the equation

$$X_{i+1} = X_i + Z_i - D_i \quad \text{or}$$

$$\boxed{X_i = X_{i+1} + D_i - Z_i}$$

Example:

Period i	Demand D_i	Fixed Cost k_i	Holding Cost h_i
1	3	3	1
2	2	7	3
3	4	6	2

$$C_i(Z_i) = \begin{cases} 10\ Z_i + k_i & \text{for the period } 0 \leqslant Z_i \leqslant 3 \\ 30 + 20\ (Z_i - 3) + k_i & \text{for the period } Z_i \geqslant 4 \end{cases}$$

Assume X_1 (entering inventory period 1) = 1

Stage 1 $D_1 - X_1 \leqslant Z_1 \leqslant \sum_{i=1}^{3} D_i - X_1 = (3+2+4) - 1 = 8$

$0 \leqslant X_2 \leqslant \sum_{i=1}^{3} D_i = 6$

This is to set limits on Z_1 and X_2

X_2	$h_1 \times X_2$	Z_1 2	3	4	5	6	7	8	$f_1(X_2)$	Z_1^*
0	0	0+23							23	2
1	1		1+33				"e"		34	3
2	2			2+53					55	4
3	3				3+73				76	5
4	4		"c"			4+93			97	6
5	5						5+113		118	7
6	6							6+133	139	8

Note: Z_1^* represents the least cost given X_2

For example, for $X_2=3, Z_1=5$, holding cost $= h_1 \times X_2 = 1 \times 3 = 3$

$C_3(5) = 30 + 20(5-3) + 3 = 73$.

Only filled matrix elements are feasible. For example, if $X_1 = 1$ (given for the matrix marked "b", $X_2 = X_1 + Z_1 - D_1 = 1+7-3 = 5 \neq 1$

For the "c" element, $X_2 = X_1 + Z_1 - D_1 = 1 + 3 - 3 = 1 \neq 4$

Stage 2 $\quad 0 \leq Z_2 \leq \sum_{i=2}^{3} D_i = 2 + 4 = 6$

$0 \leq X_3 \leq Z_2 \text{ maximum} - D_2 = 6 - 2 = 4.$

X_3	$h_2 x X_3$	0	1	2	3	4	5	6	$f_2(X_3)$	Z_2^*
0	0	0 0 55 = 55	0 17 34 = 51	0 27 23 = 50					50	2
1	3	3 0 76 = 79	3 17 55 = 75	3 27 34 = 64	3 37 23 = 63		"d"		63	3
2	6	6 0 97 =103	6 17 76 = 99	6 27 55 = 88	6 37 34 = 77	6 57 23 = 86			77	3
3	9	9 0 118 =127	9 17 97 =123	9 27 76 =112	9 37 55 =101	9 57 34 = 100	= 109		100	4
4	12	12 0 139 =151	12 17 118 =147	12 27 97 =136	12 37 76 =125	12 57 55 = 124	= 123	= 132	123	5

Example: $X_3 = 2$, $Z_2 = 2$ $\quad$ Holding cost $= h_2 x X_3 = 3 \times 2 = 6$

Production cost $= 10 Z_i + K_i = 10(2) + 7 = 27$

$f_{2-1} = f_1(X_3 + D_2 - Z_2) = f_1(2+2-2) = f_1(2) = 55$ (See stage 1)

Total Cost $= 6 + 27 + 55 = 88$

All blank matrix elements are not feasible. For example, for element "d": $X_2 = X_3 + D_2 - Z_2 = 1 + 2 - 5 = -2$ (negative values for entering inventory are not feasible).

Stage 3 $\quad 0 \quad Z_3 \quad D_3 = 4$

$X_4 = 0$

X_4	$h_3 x X_4$	0	1	2	3	4	$f_3(X_2)$	Z_3^*
0	0	0 0 123 = 123	0 16 100 = 116	0 26 77 = 103	0 36 63 = 99	0 56 50 = 106	99	3

Example: Holding cost $= h_3 \times X_4 = 2 \times 0 = 0.$

Production Cost $= C_3(2) = 10 \times 2 + 6 = 26$

$f_2(X_4 + D_3 - Z_3) = f_2(0 + 4 - 2) = f_2(2) = 77$ (See stage 2)

Total Cost $= 0 + 26 + 77 = 103.$

So, optimal solution is:

Period	Z_i Production	X_i Entering inventory	$(X_{i+1} + D_i - Z_i)^*$
3	3	1	0 + 4 - 3 = 1
2	3	0	1 + 2 - 3 = 0
1	2	1	0 + 3 - 2 = 1

Note for example if $X_4 = 0$ then $X_3 = X_4 + D_3 - Z_3 = 0 + 4 - 3 = 1.$

So $X_3 = 1.$

From stage 2 table, $X_3 = 1 \rightarrow Z_2 = 3$

$Z_2 = 3 \rightarrow X_2 = X_3 + D_2 - Z_2 = 1 + 2 - 3 = 0$

From stage 1 table, $X_2 = 0 \rightarrow Z_1 = 2$. This completes the solution. (X_1 is given as 1).

Note that the maximum finished product inventory in any period would be $X_i + Z_i = 4$ (first period).

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8. METHOD FOR OPTIMIZING THE FUNCTIONAL LAYOUT.

A precedence diagram (cross chart) is developed showing the preferable functional relations between different production centers. An example would be a workshop where products flow between the various machine tools or work stations. The objective is to minimize material handling costs in the factory.

The precedence table of Fig. 8-1 is developed on the basis of the number of movements between work stations.

For example, the relationship between M_1 and M_4 (block indicated in diagram) indicates the importance of locating M_1 near M_4.

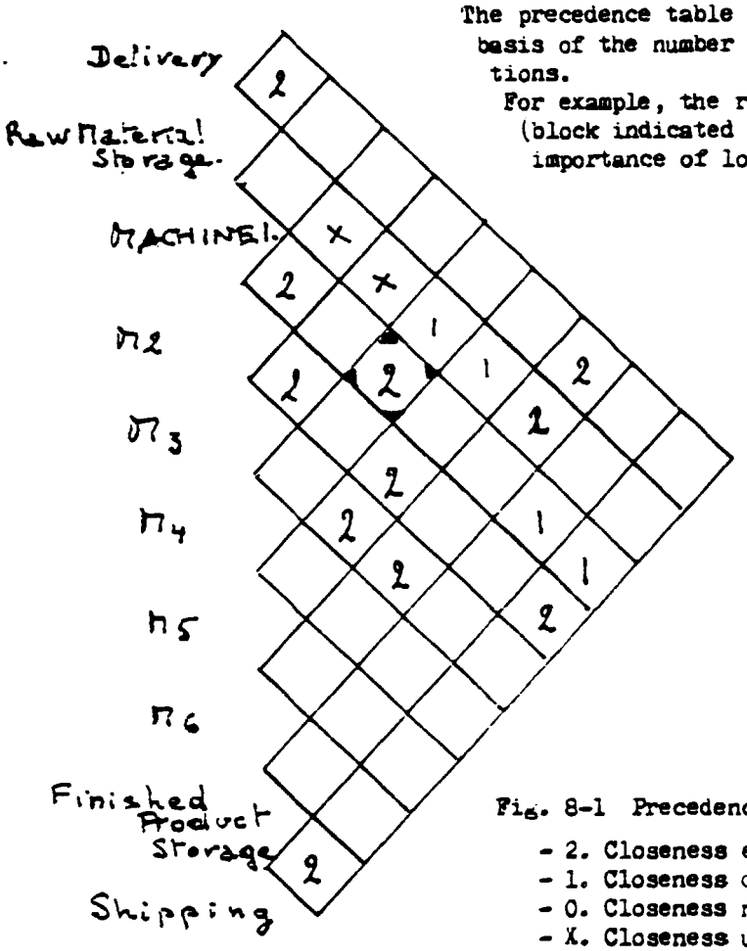

Fig. 8-1 Precedence Table.

- 2. Closeness essential
- 1. Closeness desired
- 0. Closeness not important
- X. Closeness undesireable.

Fig. 8-2 shows the general functional layout resulting from this analysis. Scale models of the equipment can be used to determine the floor area required and the actual building dimensions.

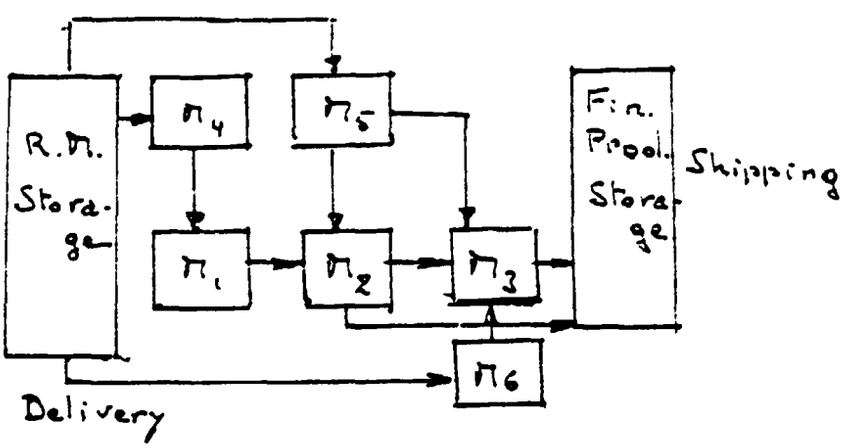

Fig. 8-2 General Functional Layout.

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9. BALANCING PRODUCTION EQUIPMENT SELECTION TO ACHIEVE MAXIMUM UTILIZATION FACTOR.

The selection of the number and types of each equipment should be based upon the machining and/or process time for all of the products manufactured in the factory. For example, for a workshop with three products A, B and C and 2 processes (I Milling, II Drilling) :

Product

	A	B	C
I	3	5	2
II	1	1	4
Production	20	50	30

Fig. 9 Machine time for each product by process, minutes

The weighted average of production time for each process is :

I $3 \times 0.2 + 5 \times 0,5 + 2 \times 0.3 = 3.7$ min/unit average.

II $1 \times 0.2 + 1 \times 0.5 + 4 \times 0.3 = 1.8$ min/unit average

The ration of equipment capacities would be

$$\frac{\text{Capacity Equipment I}}{\text{Capacity Equipment II}} = \frac{3.7}{1.8} = 2 \text{ approx.}$$

This could be satisfied with one unit of equipment I of twice the capacity of equipment II or by purchasing twice as many units of equipment I as compared with equipment II if each has identical capacity.

The objective here is to balance the selection of machinery so that there is a minimum of idle time.

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10. CONSOLIDATED EQUIPMENT DATA.

It is important to consolidate and organize all of the data relating to machinery and equipment so that nothing will be overlooked in relation to costs and the implementation program. It is recommended that a form or other device be utilized to collect the following data.

Example

	EQ I	EQ II	etc..	Total
1. Equipment Code Nº				
2. Equipment description				
3. Required Feasible Normal Capacity Q/U				
4. Normal Maximum Capacity per unit Q/U				
5. Feasible Normal Capacity per unit Q/U				
6. Nº units required				
7. Actual feasible normal capacity Q/U				
8. Power Requirements per unit, kW				
9. Power Factor				
10. Total Power required, kW				
11. Water requirements per unit, m^3/hr				
12. Total Water required, m^3/hr				
13. Water quality				
14. Other Utilities Description Q/U				
15. Cost per unit f.o.b For Loc				
16. Cost per unit c.&.F For Loc				
17. Delivery, installation Cost per unit For Loc				
18. Total Delivery, installation cost For Loc				
19. Total installed cost per unit For Loc				
20. Total cost equipment For Loc				
21. Delivery schedule				
22. Installation Requirements, Description				
23. Expected life (hours, ooo)				

The preceding table is only indicative of the type of information necessary for a number of decisions concerning machinery and equipment and should be adapted to the particular circumstances.

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11. SURCHARGES ON WAGES AND SALARIES. (See manual ID/206)

Labor surcharges arise from paid unproductive time, fringe benefits and payroll taxes. The following example (slightly changed from the manual ID/206) is intended to better explain the procedure for determining them.

Number days per year	365.25	
Fridays	- 52.25	313 days
Number paid unproductive working days		
Holidays	11	
Leave	20	
Sickness	15	
Training	10	
Other	5	61 days
Number of working days per year per worker		252 days

The number of actual employees required must be equal to the nominal number necessary to run the factory increased by a factor 61/252 = 24,2 % to cover lost time.

So, if the nominal number of workers is 500, then 500 x 1,242 = 621 workers must actually be hired.

Now, surcharges will consist of Social Security, Allowances, Payroll Taxes etc...

Total Surcharges		in %	
Social Security			15
Allowances, days			
Leave	20.		
Subsistence	12		
Other	10		
	42	42/252	16,7
Payroll Tax			2,5
Total surcharge			34,2

If the monthly wages are 120 LS, then the monthly wage bill will then be

$$621 \times 120 \times 1{,}342 = 100.006 \text{ LS}$$

This can be compared with the nominal amount of 500 x 120 = 60.000 LS.

So, it is important to consider the excess workers required plus surcharges on these wages. Note also that if housing is required, space will be nedded for 621 rather than 500 workers.

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12. ENGINEERING FORMULAS.

It is often necessary to make preliminary engineering calculations in the early project preparation. A few of the necessary formulas are explained below.

(a) Electric power requirements.

Terminology:

Connected Load (C.L.): The sum total of the nameplate ratings for each machine or equipment in the factory utilizing electrical power expressed in kW.

Load Factor: The proportion of the connected load which is utilized at any point in time (not all machines, etc..., may be operating simultaneously. The average load factor (L.F.A.) should be distinguished from the peak load factor (L.F.P.).

Power Factor (P.F.): A term which accounts for the reactive component of the electrical load and which generally means that the public utility must provide greater service (in kVA) than the kW rating of the equipment

Condensers: Devices which provide the desireable increase in P.F.

Transformers: Devices which reduce the voltage from the level of the grid to a value which can be utilized by the machinery.

kWh : Kilowatt hour, the basic unit of electrical energy.

For transformer installation, the kVA rating of the transformers (or of the gen'set) must be at least

$$kVA = \frac{C.L. \times L.F.P.}{P.F.}$$

The annual cost of electrical energy will be

Total annual cost = C.L. x L.F.A. x Nº operating hours x Cost per kWh.

(b) Pumping fluids (water, etc...)

Sometimes it is necessary to estimate the power requirements for pumping water from wells, rivers etc...

Pressure (P): expressed commonly in Pa (N/m^2)

Pressure head (H): pressure expressed in terms of the height of fluid column.

Density (d): Mass per unit volume of fluid kg/m^3 or kg/dm^3

Headloss (HL): Energy loss in pipes and fittings expressed in meters.

"g": Acceleration of gravity 9,8 m/s^2

Efficiency (EFF): Ratio of power output to power input

Flow rate (Q): Quantity of fluid flow per unit time, m^3/s.

$P = dgH$; Power required = $\frac{P \times Q}{1000 \times EFF}$.

For example, suppose it is required to pump 1,2 m^3/s of water a height of 60 m. The head loss will be assumed to be 20% of the pressure head.

$$P = dgH = 10^3\ kg/m^3 \times 9,8\ m/s^2 \times 60 = 5,88\ (10^5)\ Pa$$

The effective pressure (including head loss) will be

$$P' = 5,88\ (10^5) \times 1,2 = 7,06\ (10^5)\ Pa$$

$$\text{Power required} = \frac{7,06\ (10^5) \times 1,2}{1000 \times 0,75} = 1129\ kW.$$

This would give an indication of the size pumping system as well as electrical requirements.

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13. CRITICAL PATH METHOD.

(from TAHA, Operations Research, McMillan)

The schedule of implementation of a project must be carefully planned as slippages from the original schedule can have severely adverse effects upon the survival of the project.

The critical path is that sequence of activities which are crucial to the implementation schedule. Slippage in any one or more of these activities will generally imply that the project schedule will not be met.

Terminology:

a) Activity is a task necessary for the completion of the project.

b) Event is the start or termination of an activity.

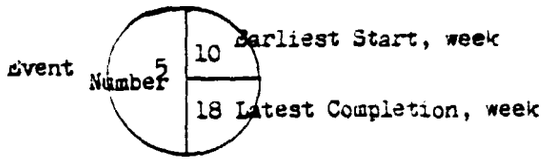
c) Earliest Start (ES) is the earliest time an activity can begin, given the constraints of necessarily preceeding activities.

d) Latest Completion (LC) is the latest time at which an event can end so that all necessarily succeeding activities can be completed on or before the project completion date.

e) Critical Path is the chain of activities in the network which are critical in the sense that a delay in any one will delay the completion of the entire project.

Arrows are used to indicate activities. The duration or estimated time of completion is shown next to the arrow, usually in weeks. The arrow head indicates the direction of time.

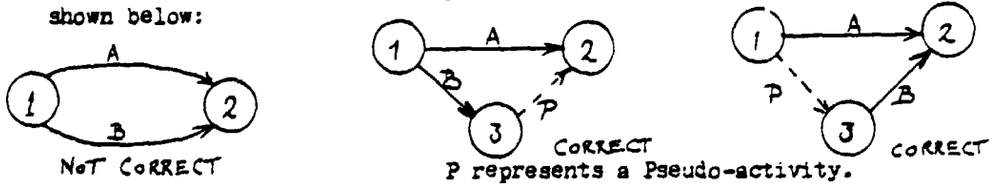
A symbol as shown below is used to indicate an EVENT, identified by an Event Number. Also included are the Earliest Start (ES) and the Latest Completion (LC) expressed in the week of the project.



Rules for the indication of activities.

a) Each activity is represented by one and only one arrow in the network.

b) No two activities may terminate on the same event. If two activities have the same event terminators, a pseudo- or dummy activity must be added as shown below:



P represents a Pseudo-activity.

Procedure

Determine and list

1) What activities must be completed before each activity can start.
2) What activities must follow each activity.
3) What activitiesmust occur concurrently.

Determination of Duration of an activity

a - least (optimistic) time
b - greatest (pessimistic) time
m - most likely time

It is conventional to calculate the duration D of an activity as

$$D = \frac{a + b + 4m}{6}$$

Critical Path Criteria

(1) $ES_i = LC_i$ (Earliest Start = Latest Completion for event i preceeding activity).

$ES_j = LC_j$ (ES = LC for event j succeding the activity)

(2) $ES_j - ES_i = LC_j - LC_i = D_{ij}$ (duration of activity between events i and j)

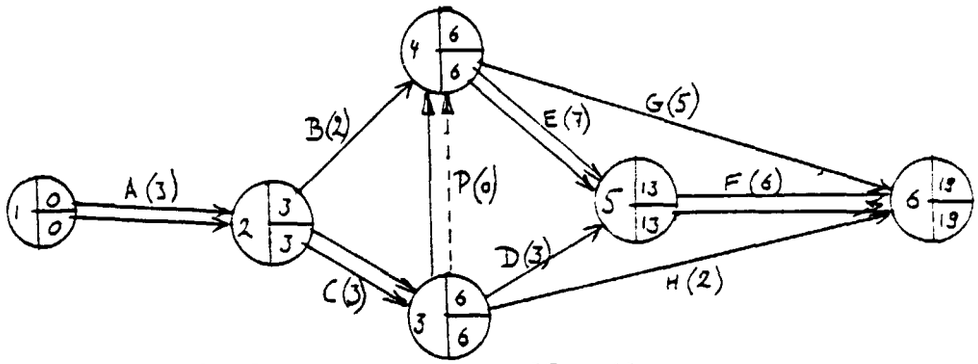
Example: A project consists of the following activities:

A	B	C	D	E	F	G	H	
3	2	3	3	7	6	5	2	Duration (weeks)

The precedence table is as follows:

Activity	Preceeds	Follows	Concurrent
A	B,C		
B	E,G		C
C	D,E,H		B
D	F		
E	F		
F		D,E	
G		B,C	
H		C	

Note: Activity B not on critical path - condition (2) not met ($6-3 \neq 2$)



$ES_2 = 0 + 3 = 3$

$ES_3 = 3 + 3 = 6$

$ES_4 = \max\{(3+2),(6+0)\} = 6$

$ES_5 = \max\{(6+7),(6+3)\} = 13$

$ES_6 = \max\{(6+5),(13+6),(6+2)\} = 19$

$LC_6 = 19$

$LC_5 = 19 - 6 = 13$

$LC_4 = \min\{(19-5),(13-7)\} = 6$

$LC_3 = \min\{(13-5),(19-2),(6-0)\} = 6$

$LC_2 = \min\{(6-2),(6-3)\} = 3$

$LC_1 = 3 - 3 = 0$

Critical Path Activities are A, C, P, E, F.

D. SUSSMAN

ANNEX II.1

STUDY FOR CENTRAL WORKSHOP TO MANUFACTURE SPARE PARTS FOR THE TEXTILE INDUSTRY. General Informations and assumptions.

Project Background

The objectives are to assist textile factories to achieve greater capacity utilization and to save foreign exchange by establishing a Central Workshop to manufacture spare parts for the Sudanese textile industry.

Market & Plant Capacity

The textile industry in the Sudanconsumes annually at least 400 tons of metal spare parts, valued at over LS 20 millions and 40 tons of plastic accessories, valued at over LS 200,000.

Initially, the central workshop will be designed to produce 80 tons of metal parts, and 40 tons of plastic accessories and t to provide training for 70 machine tool operations annually. Provision will be made for future expansion.

Materials & Inputs

When operating at full capacity, the workshop will consume 100 tons of metal castings and 44 tons of plastic raw materials annually, plus some auxilliary materials, electricity and water. It is assumed that castings will be obtained from the Khartoum Central Foundry, which is to be modernized and expanded, and that the plastic raw materials will be imported.

Location & SIte

For technical infrastructure reasons the workshop will be located in Khartoum or K artoum North

Project Engineering

A single-storey building with 3,000 square meters of floor space will be required initially. The area of the site should, however, be 17,000 square meters to allow for future expansion.

Forty four machine tools, similar to those already operating in the Sudan plus two plastic moulding machines and some laboratory equipments and teaching aids will be required.

Water consumption will be 21,000 litres/day and electricity consumption 360,000 KWh/year.

Manpower

The workshop will employ 97 people namely 4 managers, 14 in administration, 4 trainers and 75 production workers.

Implementation Schedulling

Two years will be allowed for construction and it is assumed that capacity utilization will be 50% in the first year of operation, 85% in the second year and 100% in the third year and subsequent years.

Financial Plan

It is assumed that the debt-equity ratio will be 60 : 40 which is usually acceptable in the Sudan for this type of project.

It is assumed that the loan will be for a duration of 8 years with one year grace period and rapdi in 14 equal semi-annual instalements with an interest rate of 15% although it is possible that the foreign part of the loan might be available as supplier s credit at a reduced rate.

Pre-Operating Capital Expenses

Estimated as 3% of the initial fixed investment to cover

- Wages and salaries
- Travelling expenses
- Legal fees
- Registration, etc.

Interest during Construction

A long term loan to cover 60% of the total project cost excluding interest during construction is envisaged. Interest on that loan will be 15% per annum.

Depreciation & Amortization

Depreciation will be based on the rates allowed by the Sudanese Taxation Department for different types of taxed assets.

Pre-operating expenses and interest during construction will be amortized over a period of 5 years.

Business Profits Tax

It is assumed that the workshop will be exempted from business profits tax for the first 5 years of its operations and that thereafter the rate of tax will be 50% of the profits before interest.

Dividends

Dividends will be declared and paid out taking into consideration the availability of cash surplus, the level of retained earnings and the timing of the asset replacements and not according to any pre-set policy.

Physical Resources Required

The following resources will be required to produce 80 tons of metal spare parts, 40 tons of plastic accessories and to train 70 machine tool operators a year.

Premises	Year Required
Land (17,000 squre meters)	1
Buildings (3,000 square meters)	2
Utilities, etc.	2
Equipments	
Machine tools (44)	2
Plastic moulding machines (2)	2
Laboratory equipment	2
Office equipment	2
Teaching aids	2
Vehicles	2
Personnel	
Management (4)	1/2
Administration (14)	2/3
Foremen & supervisors (5)	2
Trainers (4)	2
Workers (70)	3

Raw Materials		Year Required
Castings	Starting	3
Plastic raw materials	Starting	3
Trainees	Starting	2

Financial Information

Cost of Land & Buildings

Land	LS 20 per m^2
Buildings	LS 500 per m^2

Cost of Machinery & Equipment	LS x 1,000
Machine tools	2,800
Plastic moulding machines	600
Air conditioning system	700
Electrical system	1,500
Water supply, compressed air system, etc	550
Office equipment & vehicles	170
Training equipment	180
Total	6,500
Consultant's fees	340
Pre operational expenses	360
Total	7,200

Cost of Raw Materials

Metal castings	LS 2,000 per ton (average)
Plastic raw materials	LS 1,500 per ton

Salary Scales	LS/Annum
General Manager (1)	12,000
Managers (3)	6,000
Clerks etc. (14)	3,000
Supervisors (1)	6,000 each
Foreman (4)	3,000
Workers (70)	2,500
Trainers (4)	4,000

Other Operational Expenses

Maintenance of plant and buildings	LS100,000 per year
General	LS 80,000 per year
Know-how and management (for 4 years)	LS 100,000 per year

Estimated Selling Prices

Metal spare parts	LS 50,000 per ton
Plastic accessories	LS 5,000 per ton
Training fees	LS 300 per trainee

ANNEX II. 2

Name of the Project	Full Production 100 % Qty.	Value	YEAR 2 Start up 50% Qty.	Value	YEAR 3 START UP 35% Qty.	Value	Qty.	Value
10.1. Sales								
Item A METALLIC SP. PARTS								
Local Sales Unit Price 50.000 LS	80 T	4.000.000	40 T	2.000.000	68 T	3.400.000		
Export Unit Price								
Item B PLASTIC SP. PARTS								
Local Sales Unit Price 5.000 LS	40 T	200.000	20 T	100.000	34 T	170.000		
Expoert Unit Price								
Item C								
Local Sales Unit Price								
Export Unit Price								
N.B. Unit Price = ex-factory price								
Total Sales								
Local Sales		4.200.000		2.100.000		3.570.000		
Export—		—		—		—		
Additional Data								
- Indirect Taxes on Local Sales %								
- Cost for Boarding								
Goods (Pre Fob) Cost								
Inland Transport								
Harbour Costs								
Export Taxes								
Others								

Project : Spare parts for Textile Industry.

10.2 Operating Costs.	Full operation year FC	LC	Total	Year: 90 % eff. 50 % cap FC	LC	Total	Year 95 % eff 85 % cap FC	LC	Total
10.2.1 Variable Costs									
1. Raw materials and Inputs									178948
100 T metal castings x 2000 ls/T		200000	200000		111111	111111		178948	
44 Tplastic x 1500 LS/T	66000		66000	36666		36666	59053		59053
2, Utilities									
Water 21 cu.m/dayx 200 x 0,1LS		--	--						
Electricity 360.000 kWh/year x 0,2 LS/kWh		72000	72000		40000	40000x		64421	64421
Total Variable Costs	66000	272000	338000	36666	151111	187777	59053	243369	302422
10.2.2 Fixed Costs									
1. General and admin expenses		80000	80000						
2. Fixed Taxes									
3. External services know how and management for 8 years	100000		100000						
4. Maintenance 100000	50000	50000	100000						
. . . . .									
7. Manpower		323150	323150						
Total Fixed Costs	150000	453150	603150			603150			603150
10.2 Total Operating costs			941150			790927			905572

Project: Spare parts for Textile Industry (Thousand LS)

10.3 Total Investment Costs.	Total FC	Total LC	Total	Year 0 FC	Year 0 LC	Year 0 Total	Year 1 FC	Year 1 LC	Year 1 Total
1. Fixed Investment Costs									
1. Land 17.000 x 20 LS		340	340		340	340			
2. Site prep. and civil works									
3. Buildings 3.000 x 500 LS		1500	1500		1500	1500			
Electricity	1000	500	1500				1000	500	1500
Water	150	400	550				150	400	550
Air con	500	200	700				500	200	700
4. Plant and machinery									
44 machines	2800		2800				2800		2800
2 plastic moulding mach.	600		600				600		600
office equipment, labo eq.	50	120	170				50	120	170
training equipment	150	30	180	70		70	180	30	180
Total Fixed investment Costs	5250	3090	8340	70	1840	1910	5180	1250	6430
2. Preproduction Capital expenditures									
. . . . .									
4. Supervision, coordination	300	40	340		40	40	300		300
5. Training staff and labour		360	360		60	60		300	300
. . . . .									
7. Interest on loans (from Net Cash flow statement which gives needs of financing and, consequently, the interests to be paid during the investment phase)									
Loan of 1.326.000 x 15% in year 0					198,9			198,9	
4.800.000 x 15% in year 1					-			720	
Sub total interest on loans					198,9			918,9	
Total preproduction capital expenditures	300	1517,8	1817,8	-	298,9	298,9	1218,9	300	1518,9
3. Working capital (from table 10.3.3)									
		366	366						
		rounded to	400.000		-				
			300.000	in year	2				
			75.000		3				
			25.000		4				

10.4 Depreciation.

	Amount	Expected Lifetime	Yearly Depreciation
Preoperational expenditures	1817,8	5	363,56
Land	340	inf	-
Buildings	1500	20	75
Infrastructure	2750	10	275
Plant and Machinery	3750	10	375
Total			1088,56 to year 6
Working Capital	400	inf	-
	10557,8		725 after

Salvage value:

Building $1500000 - \frac{1500000 \times 10}{20}$ = 750000

Land 340000

Working Capital 400000

1490000

ANNEX II.5

Project : Spare parts for Textile Industry.

10.3.3 Calculation of the Working Capital.

. . . . . .

2. Raw materials inventory: Castings: $\frac{15 \text{ days}}{365}$ x 200000 — 8219

Plastic $\frac{2 \text{cmonths}}{12}$ x 66000 — 11000

3. Spare parts inventory: $\frac{90}{365}$ x 50000 — 12329

4. Work in progress:

Factory costs:	Material inputs	/ 338000	
	Manpower	323150	
	Fact overheads		
	Maintenance	100000	
	Ext services	100000	
		861150 x	x £ 5days/365 — 11797

£

5. Finished products inventory:

Operating Costs - Sales costs

941150 - - = 941150 x $\frac{30}{365}$ — 77355

6. Cash in hand : 15 days x 1/365 x (Total production costs - Raw materials - Utility - Depreciation) (Operating costs - Raw material - Utilities plus Financial costs).15 /365

941150 - 266000 - 72000 + 700000 (first estimates)x15/365=535[illegible]

7. Credit given to the clients

= 4200000 x 70 % x 28/365 — 225534

	Total	399788
	rounded to	400000

of which 300000 the first year of operation (year 2)
75000 the second year (year [illegible]
25000 the third year (year 4

ANNEX II. 6

Project: Spare parts for Textile Industry.

10.5 Calculation of Bank service. (thousand LS)

First loan : 1326000 LS;15% charge;repayment over 10 years afterva grace period of 2 ye

Years	0	1	2	3	4	5	6	7	8	9	10	11
Service	198,9	198,9	198,9	179,0	159,1	139,2	119,3	99,5	79,6	59,7	39,8	19,9
Repayment			132,6	132,6	132,6	132,6	132,6	132,6	132,6	132,6	132,6	132,6
Total	198,9	198,9	331,5	311,6	291,7	271,8	251,9	232,1	212,2	192,3	172,4	152,5

Second loan 4800000;LS same conditions but one grace period of one year.

Service	-	720	720	648	576	504	432	360	288	216	144	72
Repayment			480	480	480	480	480	480	480	480	480	480
Total	-	720	1200	1128	1056	984	912	840	768	696	624	552

Third loan : 400000 LS; 15% charge; repayment over 8 years, no grace period

Service	-	-	60	52,5	45	37,5	30	22,5	15	7,5
Repayment			50	50	50	50	50	50	50b	50
Total			110	102,5	95	87,5	80	72,5	65	57,5

General total

Service	198,9	918,9	978,9	879,5	780,1	680,7	581,3	482	382,6	283,2	183,8	91.9
Repayment	-	-	662,6	662,6	662,6	662,6	662,6	662,6	662,6	662,6	612,6	632,6
Total	198,9	918,9	1641,5	1542,1	1442,7	1343,3	1243,9	1144,6	1045,2	945,8	796,4	724,5

Spare parts

with outside financing

	Construction		Operational					
	0	1	2	3	4	5	6	7
Net income statement								
Sales			2100	3750	4200			
Operating costs			791	906	941			
Depreciation			1088				1088	725
Interest			979	880	780	681	581	482
Gross profit			758	877	1391	1490	1590	2052
Corporate tax			-	-	-	-	-	1231
Net profit			758	877	1391	1490	1590	821
Cash flow statement								
Inflow sales	-	-	2100	3750	4200			
equity	804	3200	266	-				
LT loans	1326	4000	400					
bd loans	-	-						
salvage value								
Total inflow	2210	8000	2766	3750	4200			
Outflow preoperational	299	1519						
fixed inv.	1910	6430						
replacement								
workin. capital			300	75	75			
Operating costs			791	906	941			
Interest			979	880	780	681	581	482
Loan repayment			663					
Corporate tax								1231
Dividends			p.m.					
Total outflow	2209	7949	2733	2523	2409	2285	2185	3317
Net cash balance	1	51	33	1227	1791	1915	2015	883
Cumulative net cash balance		52	85					
Net cash flow for the investor	- 803	- 3149	- 333	+ 1227	1791	1915	2015	883

Annex II. 7.

8	9	10	11	12
				4200
				941
				725
383	283	184	92	-
2151	2251	2350	2442	2534
1291	1351	1410	1465	1520
840	900	940	977	1014
				4200
				1490
			4200	2710
				941
383	283	184	92	-
	663	613	613	-
1291	1351	1410	1465	1520
3278	3238	3148	3111	2461
922	962	1052	1089	3229
922	962	1052	1089	3229

NPV	i=15%	1861
	i= 20%	675
	i= 24%	+ 314
	i= 25%	- 136,4

IRR = 24,02%

Training Course in Industrial Project Preparation Evaluation and Financing

Practical Exercises

1) Make a critical analysis of the data of the Case Study on which the first set of previsional accounts were established (Sales, Operating Costs, Investment Costs)

The analysis must point out 1* if the figures appear correct (price, quantity) 2* if the capacity of the equipment and machinery seems correct

3* if the relations the project has with enterprises which are supposed to give its intermediate consumptions are correct.

Attached remarks of an expert can be considered as a guide for this analysis but you can have other ideas or express other considerations.

On the basis of your remarks a sensitivity analysis will be conducted and a new cash flow statement established.

2) Inclusion of a foundry into the Spare Parts Factory would apparently present some advantages.

Presently, we lack of techno- economic data on such a small foundry (capacity of about 100 T per year). The foundry must be able to produce iron castings, and aluminium and bronze castings as well. It must comprise a cubilot and an electric furnace.

Please collect any information you can find on that sort of equipment in your institution or wherever you can. (Investment cost, manpower, needs of inputs, energy etc...)

3) For the economic evaluation of the projects we need informations on the incidental charges a product must support between the border and the factory (for imported inputs) and the factory and the border (for exported output).

Evaluate those incidental charges (mainly transport but also fixed costs charged by the forwarding companies) for the different following goods between Port Sudan and El Gezira Province.

1. One machine of 5 tons weight, and 6 cum Value 80.000 LS
2. 4 Tons granulated chemical product, in bags, Volume 3 cu.m

between Juba and Nimule

1. 1 ton tobacco leaves for export
2. 1 ton tools

4) Electricity is an important input of every project studied.
Look for precise data concerning the price-structure of the product 1 kWh (this can be an average structure for thermal power and hydro power)

Fuel:
—
Maintenance including spare parts
—
Labour
—
Profit
—
Financial charges
—
Taxes
Other

5. Structure of Price of Transport. (by truck)

Fuel

Labour

Taxes

Profit

Other

_____ LS/T.km

ANNEX II.9

Training Course in Industrial Project Preparation. Khartoum
May - June 1984.

To Dr Roy Nield,
UNIDO expert in Textile Industry
Khartoum, Sudan.

Khartoum, 30 May, 1984.

Dear Dr Nield,

The following are my comments which you requested concerning the Feasibility Study for a Central Workshop for the Manufacture of Spare Parts for the Sudanese Textile Industry, prepared by Borghi e Baldo Ing, Milan Italy and dated Nov. 19, 1979. The study was prepared under UNIDO contract 79/23 Project SI/SUD/73/802

I have taken the liberty to go slightly beyond a strict assessment of this proposal as we have since visited one of the principal textils manufacturing plants in the country, The Friendship Textile Co Ltd of El Hasaheisa, Sudan with a capacity of 16 M meters per annum, and had an opportunity to discuss first hand with the management the nature of the problems confronting them in relation to meeting their production goals.

Concerning the above study:

(1) Technical adequacy.

The procedure followd in determining the requirements for machinery and equipment was almost precisely that which is advocated, proceeding from detailed drawings of representative spare parts, estimating machining times and finally arriving at the number and type of each machinery and equipment required.

While the procedure was satisfactory at least two of the assumptions upon which the calculations were based are questionable.

It is not clear what standards were utilised in arriving at the machinery times. My suspicion is that European productivity standards were used although detailed technical information with which I could check this is not available to me here. In any case, it is doubtful that Borghi & Baldo (B&B) have made an assessment of productivity standards in Sudan. It is recommended that a follow-up study be accomplished to determine these standards, either through studies performed in other countries with similar development patterns, or by tests conducted under representative conditions in existing Sudanese facilities.

The equipment utilisation factor of 75 % is predicated on lot sizes averaging 100 which I don't believe is practicable given the wide variety of textile machinery types in use in Sudan. Much smaller lot sizes are to be anticipated with the attendant problemsof balancing machinery loads. I would not expect a machinery utilisation factor much in excess of 60 % under these conditions.

The number of work days is taken as 300, which is too high for several reasons. During the Ramadan it is to be expected that productivity will be quite low, effectively reducing the number of working days. Also, under prevailing conditions power outages are frequent and until this situation is corrected some adjustment should be considered for this factor.

.../...

(2) Project Inputs.

The investigation concerning the supplies program for the project is inadequate.

The principal input to the project, precast parts of cast iron, steel, aluminium, brass and bronze, are assumed to be available from the Khartoum Central Foundry, an enterprise which we understand has been used primarily as a training workshop and which certainly presently lacks the capacity and production know how to produce castings in the required quantities and perhaps qualities. In the expansion plans to which B&B has alluded, there is no indication that they have investigate the means by which their proposed principal supplier is to accomplish its mission and leaves open the following questions:
- the existence of a study to effect the expansion;
- thecavailability in Sudan of the metals and plastics that would constitute their principal inputs or the commitment of the necessary import licenses and foreign exchange over the life of the project that would ensure a continuous supply of castings from imported raw materials;
- the source of steel castings which do not, in any case, appear to be in the plans of the Khartoum Central Foundry.

It is not good practice, in any case, to design a project which is limited to the requisitioning of its principal input from a single supplier. Under these circumstances it would be prudent to redesign to a vertically integrated project either through acquisition of the Khartoum Central Foundry (or other) or else by the inclusion of the development of a new foundry incorporated into the project. (It might be wise to include also small forging drop hammers or presses for the manufacture of high strength steel parts). For the integrated project, not only is the management of these highly complementary activities under one roof but the primary inputs to the project, the basic metals and plastics, could be obtained from multiple sources both domestic and foreign.

The supply side of this project must be examined in much greater detail not only to locate the best channels for securing all the materials and inputs necessary for the smooth operation of the workshop, but also to reasonably ensure that the foreign currency facilities will be available to the project when and in the quantities required.

(3) Design and Production know-how.

The study points to the necessity of arranging a working agreement with an existing producer of spare parts to participate in the implementation and early operational periods to provide know-how concerning the design and manufacture of these parts. A satisfactory licensing arrangement of this type with a single company is unlikely for the following reasons:
- the spre parts industry in the industrialised countries is compartimentalised horizontally with respect to market segment. A producer of highly specialised spare parts for the weaving industry, for example, would not be in the business of manufacturing also standardised parts such as gears, pulleys, shafts. Also, in relation to vertical segments, foundries and forging shops are not generally integrated with machining shops except when a particular product line is being produced. The point is that it is unlikey that any of these shops will have in its inventory the array of spare parts designs and the corresponding molds designs that would cover the product line of the proposed project, nor does it seem likely that such a shop or shops would want to share its designs which could so easily escape their control.

It would perhaps be more likely of success to consider appointing one or two manufacturing engineers of long experience in casting and pattern -making and in machine tool operations with skills in the design of the necessary special tools, jigs and fixtures.

Concerning the original equipment manufacturers, it is unlikely that th... they would share the designs and manufacturing technology for their spare parts as this would be contrary to their commercial interests.

(4) Basis for low utilisation of production capacity in the textile industry.

During a visit to the Frienship Textile Co,Ltd noted above, the major reasons for this phenomenon according to management personnel were

(1) shortage of electricity
(2) high turnover of personnel
(3) shortage of spare parts.

My estimate is that this factory which according to reports provides about 50 % of the domestic production operates typically at about 6 million meter per annum or about 38 % of design capacity. The management claimed to have reached about 70 % of the Chinese standards (the factory was built and originally staffed with technical personnel by PRC) although this could only have been for a short period given the fact that they have never run the planned 3 shifts and have been beset with chronic shortages of electricity and trained personnel.

The company has had an arrangement with the Chinese in which spare parts and chemicals are supplied in exchange for local currency. The major problem with the procurement of spare parts has been the long lead times necessitating purchases as much as 3 years in advance.

According to their statements, the seriousness of the problems noted above related to productive capacity are in the order indicated. While it was mentioned, the problem of spare parts availability appeared to be now of lesser importance than the other two problems. The shortage of spare parts would undoubtedly be of greater severity if the other problems were solved as this is a function of the intensity of the usage of the machines. It is true also that the machines has been exposed to only five years or so of equivalent use so that the spare parts demand should increase significantly in time.

A 100 % solution to the spare parts problem should certainly be sought but there is a question of planning. The full demand for spare parts will not materialise until the other problems are solved. The plan for implementation of the project should take into account the schedule for the resolution of the two other problems to avoid the attendant difficulties that may be associated with low utilisation of of the workshop capacity.

It was also indicated by the management of this company that the most common parts failures involve pieces such as loom shuttles which would be extremely difficult for the workshop to produce at this time owing to the complexity of the parts and the material properties required. Additional work should be done in establishing the spare parts demand mixture, so that questions relating to the availability of these specialised parts and the impact on the overall viability of the project will be clearer.

The concept of the spare parts workshop appears to be a good one.

I hope that these comments may help to illuminate some matters that should be resolved prior to proceeding with further planning.

Sincerely yours

David Sussman

ANNEX II. 10

NAME OF THE PROJECT:

SPARE PARTS WORKSHOP

10.1 SALES		PRODUCTION YEAR		START-UP 2 YEAR 60%		3 YEAR 80%		YEAR %	
		QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE
ITEM A METAL SPARE PARTS		80T	2480	40	1240	68	2108		
LOCAL SALES	UNIT PRICE 31.000 LS/T								
EXPORT	UNIT PRICE								
ITEM B PLASTIC SPARE PARTS.									
LOCAL SALES	UNIT PRICE 5.000 LS/T	40T	200	20	100	34	170		
EXPORT	UNIT PRICE								
ITEM C									
LOCAL SALES	UNIT PRICE								
EXPORT	UNIT PRICE								
N.B. UNIT PRICE = ex factory price									
TOTAL SALES			2680		1340		2278		
LOCAL SALES			2680		1340		2278		
EXPORT			-						

ADDITIONAL DATA

- INDIRECT TAXES ON LOCAL SALES in % 10% 268 134 228

- COST FOR BOARDING GOODS.

(FREE FOB) COST

INLAND TRANSPORT

HARBOUR COSTS

EXPORT TAXES

OTHER

CASE STUDY — ANNEX II

NAME OF THE PROJECT: SPARE PARTS WORKSHOP (AFTER SENSITIVITY ANALYSIS) — i = 008 LS — FULL OPERATION YEAR — START UP YEAR 2 with 30% — 50 % with 5% — YEAR 3 85%

	FC	LC	Total	FC	LC	Total	FC	LC	Total
10.2 OPERATING COSTS									
10.2.1 VARIABLE COSTS									
10.2.1.1 RAW MATERIALS AND INPUTS METAL CASTINGS 5500 LS/t = 100T		550	550						
PLASTIC RAW MATERIALS	66	-	66						
2 UTILITIES WATER		-	-						
FUEL									
ELECTRICITY		65	65						
3. DIRECT OVERHEAD COSTS									
4. TAXES									
5. EXTERNAL SERVICES									
6. SEASONAL MANPOWER									
7 OTHERS				681 × 0,5 × 1/0,3			681 × 0,85 = 1/0,85		
10.2.1 TOTAL VARIABLE COSTS	66 +6%	615 +5%	681 + 5% = 715,2			339,33 + 5% = 398,2			603,1 + 5% = 639,8
10.2.2 FIXED COSTS									
10.2.2.1 GENERAL ADMIN EXP + OVERHEAD	-	180	180						
2. FIXED TAXES									
3 EXTERNAL SERVICES (FIXED FOR 4 YEARS ONLY)	100		100						
4 MAINTENANCE	50	20	70						
5. INSURANCE									
6. RENT									
7. MANPOWER (DIRECT AND FIXED)	-	323,15	323,15						
8. OTHERS									
10.2.2 TOTAL FIXED COSTS	150 +5%	523,15 +5%	673,15 +5% = 706,81			706,81			706,81
10.2 TOTAL OPERATING COSTS			1.422,-			1105,-			1346,-

ANNEX II. 12

NAME OF THE PROJECT: SPARE PARTS WORKSHOP 000 LS

10.3 TOTAL INVESTMENT COSTS	TOTAL FC	TOTAL LC	TOTAL	YEAR 0 FC	YEAR 0 LC	YEAR 0 TOTAL	YEAR 1 FC	YEAR 1 LC	YEAR 1 TOTAL
1. FIXED INVESTMENT COSTS									
1. LAND 17000 x 60 LS		1020	1020		1020	1020	-	-	-
2. SITE PREPARATION AND DEVT	20	80	100				20	80	100
3. STRUCTURES AND CIVIL WORKS BUILDINGS 3000 x 60 LS		1200	1200		1200	1200			
ELECTRICITY	31	20	51				31	20	51
WATER	5	20	25				5	20	25
AIR COND.		8	8					8	8
4. PLANT AND MACHINERY 44 MACHINES	2800		2800				2800		2800
PLAST. MOULD. MACHINES	600		600				600		600
LABO, OFFICE, TRAIN. EQUIPT	200	150	350				200	150	350
5. VEHICLES. TRUCKS		115	115					115	115
CARS									
TOTAL FIXED INVESTMENT COSTS	3656	2613	6269	-	2442	2442	4027	432	4459
	+10%	+10%	+10%						
	4022	2874	6896						
2. PRE-PRODUCTION CAPITAL EXPENDITURES									
1. STUDIES									
2. MANAG OF IMPLEMENTATION									
3. ADMIN. COSTS, TENDERING	300	40	340		40	40	200		300
4. SUPERVISION, COORD, TEST. RUN									
TAKEOVER OF CIV WORKS, EQUIP, PLANT									
6. RECR. & TRAINING STAFF & LABOUR		360	360		60	60		300	300
6. OTHER									
7. INTEREST ON LOANS									
TOTAL PRE-PRODUCTION CAP EXPENDITURES	300	400	700	-	100	100	200	300	600
	+10%	+10%	+10%		+10%	+10%			+10%
	330	440	770		110	110	330	330	660
3. WORKING CAPITAL		472	472						
TOTAL INVESTMENT COSTS	4352	3786	8138	-	2552	2552	4352	762	5114

Case Study.

Project Spare parts after Sensitivity Analysis

Name of the Project Sources	Full capacity Year 100 %	Year 1 %	Year 2 %	Year 3 %
10.3.3 Calculation of Working Capital				
1. Advance Payments on Raw materials Amount A x $\frac{\text{NB Days}}{365}$ =				
B =				
C =				
2. Raw Materials Inventory Amount A x $\frac{\text{NB Days}}{365}$ =	550 x $\frac{30}{365}$ = 45,209			
B =	66 x $\frac{60}{365}$ = 10,849			
C =				
3. Spare Parts Inventory Amount x $\frac{\text{NB Days}}{365}$	50 x $\frac{90}{365}$ = 12,328			
4. Work in Progress Annual Factory Cost x $\frac{\text{NB Days}}{365}$	$\frac{10}{365}$ x1289= 35,319			
5. Finished Products Inventory (Operating Costs - Sales Costs) x $\frac{\text{NB Days}}{365}$	1422x $\frac{30}{365}$ = 116,877			
6. Cash in Hand Total Production Costs Minus Raw Materials Minus Utility Minus Depreciation x $\frac{15 \text{ Days}}{365}$	573x$\frac{15}{365}$ = 23,548			
7. Credit Given to the Clients Sales x $\frac{\text{NB Days}}{365}$	2680x $\frac{28}{365}$ =205,589			
Sub total	449,719 + 5%	300	450	
Minus Credit Given by the suppliers Amount A x $\frac{\text{NB Days}}{365}$	-	(1) -	-	-
B				
C				
Net Working Capital Requirements in full capacity year in start-up years (% (Between) the last year of the start-up period and the NWC in full operation year).	472,204	300	150	22,204

(1) We have taken a very confortable portion of the Working Capital during the first year of activity for taking account of the undertainty of the start-up years.

Case Study Annex II . 14

Project Spare Parts after Sensitivity Analysis

	Name of the Project	Amount	Expected life time	Yearly depre-ciation	Replacements in years 3 5 6 9 10 11 12 15 18
10.4	Depreciation				
10.3.2	Pre operational expend-itures	770	30R5	154	
10.3.1	Land	1020		-	
	Buildings	1200 ~~154~~)	20 to 30	40	
	Infrastructure	627)	~~15 to 20~~ 10	81	
	Plant and Machinery	3400 ~~550~~	10	375	
	Vehicles Trucks	115	5	23	7
	Cars	-	3	-	
	Total			673 to year 6 519 from year 7	

Salvage Value

Land	1020
Building	800
Working Capital	472
	2292

NAME OF THE PROJECT: SPARE PARTS WORKSHOP

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
NET INCOME STATEMENT													
SALES			1340	2278	2680	2680	2680	→			→	→	2680
OPERATING COSTS			1105	1347	1422	1422	1322	→			→	→	1322
EQUITY TAX 2,5%			192	192	192	192	192	→			→	→	192
SALES TAX + SEC TAX 5%			134	228	268	268	268	→			→	→	268
DEPRECIATIONS			673	673	673	673	673	519	→		→	→	519
GROSS INCOME			-764	-162	125	125	225	379	→		→	→	379
CASH FLOW STATEMENT													
INFLOW SALES			1340	2278	2680	2680	2680	→			→	2680	2680
EQUITY	2552	5114	391	-									
~~LONG TERM LOANS~~													
~~SHORT TERM LOANS~~													
SALVAGE VALUE													2232
TOTAL INFLOW			1731	2278	2680	2680	2680	→			→	2680	4912
OUT FLOW PREOPERATIONAL EXPENDITURES	110	660											
FIXED INVESTMENT	2442	4454											
REPLACEMENTS	-	-						115					
WORKING CAPITAL	-	-	300	150	22	-							
OPERATING COSTS VARIABLE	-	-	398	640	715	715	715	715	715	715	715	715	715
FIXED	-	-	707	707	707	707	607	607	607	607	607	607	607
~~INTERREST~~ LONG TERM													
SHORT TERM													
~~LOAN~~ REPAYMENT LONG TERM													
~~SHORT TERM~~													
~~CORPORATE~~ TAXES			326	420	460	460	460	460	460	460	460	460	460
TOTAL OUTFLOW	2552	5114	1731	1917	1304	1882	1782	1897	1782	→	→	→	1782
NET CASH BALANCE	-	-	-	361	776	798	898	783	898			898	3130
CUMULATIVE NET CASH BALANCE				361	1137	1935	2833	3616	4514	5412	6310	7208	10338
CASH FLOW FOR THE INVESTOR	-2552	-5114	-931	361	776	798	898	783	898	→	→	898	3130

Internal Rate of Return = 2,44 %

ECONOMICAL APPRAISAL OF THE PROJECT SPARE PARTS WORKSHOP. ANNEX II.15.

TRANSFORMATION OF THE PRICES OF THE STUDY.

ITEMS	TYPE	PRICING RULE ACCORDING TO THE MANUAL ID/244 (p. 56)	Price	TRANSPORT Pt SUDAN-KH	DUTY	CLEARANCE 2%	CIF PRICE	×	FOR. EXCHANGE ADJUSTED RATE	QTY	VALUE
OUTPUTS											
METAL SPARE PARTS	IMPORT SUBST.	ACIF	31.000 LS/t	- 100 LS/t →	30.900 LS × 1/1.40 →	22.071 × 1/1.02 →	21.639	×	1,8/1,3 → 29.961	× 80T	2.396.897 LS
PLASTIC SPARE PARTS	IMPORT SUBST.	ACIF	5.000 LS/t	- 100 LS/t →	4.900 LS × 1/1.40 →	3.500 × 1/1.02 →	3.431	×	1,8/1,3 → 4.751	× 40T	190.045 L.S.
											2.586.942 L.S.
MATERIAL INPUTS.											
METAL CASTINGS	DOM. PROD.	ADMP	5.500 LS/t							× 100T	550.000 L.S.
PLASTIC GRANULATES	IMPORTED	ACIF + INCID. CHARGES	1.500 LS/t (in Khartoum)	- 100 LS/t →	1.400 LS × 1/1.40 →	1.000 × 1/1.02 →	980	×	1,8/1,3 → 1357 LS; CLEAR + 20 LS; TRANS + 100 LS; 1477 LS	× 100T	147.700 L.S.
UTILITY	ELECTRICITY	ADMP at COST /	65.000 LS/y								65.000 LS
OVERHEAD	GAL ADM. 180.000 LS										
of which	70.000 MAT INPUTS.	ADMP at COST /	70.000 LS/y								70.000 LS
	20.000 IMPORTED	ACIF + inc. charges	20.000 LS/y	if 2 Tons - 200 LS →	19.800 LS × 1/1.40	14.143 × 1/1.02 →	13.866	×	1,8/1,3 → 19.198 LS; CLEAR + 277 LS; TRANS + 200 LS		19.675 LS
	90.000 MANPOWER = element of VA.										
MAINTENANCE	50.000 EXT SERVICES AND MANPOWER	—									
	50.000 SP. PARTS IMPORTED	ACIF + inc. charges	50.000 LS/y	if 5 Tons - 500 LS →	49.500 LS × 1/1.40 →	35.357 × 1/1.02 →	34.664	×	1,8/1,3 → 47.996 LS; CL + 693 LS; TRANS + 500 LS; 49.189 LS		49.189 LS
											901.364 LS
										+5%	45.078 LS
											946.442 LS
INVESTMENT COSTS											
BUILDINGS		ADMP									1.200.000 LS
SITE PREPARATION	FC 20.000 IMPORT	ACIF + inc. charges	20.000 LS	if 5 Tons - 500 LS →	19.500 LS × 1/1.40 →	13.928 × 1/1.02 →	13.655	×	1,8/1,3 → 13.907; + CL 273; TRANS 500		14.680 LS
	LC 80.000	ADMP	80.000 LS								80.000 LS
CIVIL WORKS AND INFRAST.	FC 36.000	ACIF + inc. charges		if 7 Tons - 700 LS →	35.300 LS × 1/1.4 →	25.214 × 1/1.02 →	24.720	×	1,8/1,3 → 34.227 + [illegible] + 700		35.421 LS
	LC 48.000	ADMP									48.000 LS
MACHINES	IMPORTED LC 3.400.000	ACIF + ind. charges	3.400.000 LS	if 120 Tons - 12.000 LS →	3.388.000 LS × 1/1.4 →	2.420.000 × 1/1.02 →	2.372.549	×	1,8/1,3 → 3.285.068 + 47.451 + 12.000		3.344.519 LS
LABO EQUIP, OFFICE	IMP. FC 200.000	ACIF + inc. charges	200.000 LS	if 20 Tons - 2.000 LS →	198.000 LS × 1/1.4 →	141.428 × 1/1.02 →	138.655	×	1,8/1,3 → 191.984 + 2.773 + 2.000		196.757 LS
	LC 150.000	ADMP	150.000 LS								150.000 LS
VEHICLES	IMPORTED(1) FC 115.000	ACIF + ind. charges	115.000 LS	if 8 Tons - 800 LS →	114.200 LS × 1/1.4 →	81.571 × 1/1.02 →	79.972	×	1,8/1,3 → 110.730 + 1599 + 800		113.129 LS
											3.988.506 LS
										+10%	398.851 LS
											4.386.757 LS
(1) EVEN IF PURCHASED FROM A LOCAL DISTRIBUTOR.											
REPATRIATED VALUE ADDED.											
OPERATIONAL PHASE	EXTERNAL SERVICES		100.000 LS/y During 4 first years					×	1,8/1,3 →		138.462 LS
INVESTMENT PHASE	SUPERVISION		300.000 LS					×	1,8/1,3 →		415.385 LS.

Project: SPARE PARTS WORKSHOP

INTEGRATED VALUE ADDED ANALYSIS (000 LS)

(See TABLE 9 p. 33 of IDCAS MANUAL ID/244)

Sees		YEARO	1	2 (50%)	3 (80%)	4 (100%)	5	6	7	8	9	10	11	12
	VALUE OF OUTPUT.													
II.16	Domestically marketed (imp. subst.)			1293,5	2199,-	2587,-	→	→	→	→	→	→	→	2587,-
II.15	Residual value ADTP of Building only as Working Capital and Land have not been included in Investment Costs.													880,-
	VALUE OF MATERIAL INPUTS.													
	Investments (Land = 0) year 0	1320												
	For year 1: Total Invest. of Annex II.16 minus invest. year 0 above		3060,7											
	Replacements								1131					
	Current Material Inputs.													
II.16	Variable			409,4	687,1	809,8	→	→	→	→	→	→	→	809,8
II.16	Fixed 946.642 LS - 800.835 $^{LS}_{DS}$ = 145.807 LS			145,8	145,8	145,8	→	→	→	→	→	→	→	145,8
	NET DOMESTIC VALUE ADDED	-1320	-3060,7	737,3	1367,5	1649,4	1649,4	1649,4	1523,3	1649,4	1649,4	1649,4	1649,4	2530,4
	Repatriated Payments.													
II.16	External Services			138,5	138,5	138,5	138,5	-						
II.16	Supervision		415,4											
	NET NATIONAL VALUE ADDED	-1320	-3476,1	598,8	1231,-	1511,9	1510,9	1649,4	1523,3	1649,4	1649,4	1649,4	1649,4	2530,4
	Social Rate of Discount: 17% = 12% Interest rate on world capital market + 5% showing the necessity for the country of choosing highly profitable projects in the present state of scarcity of foreign currency.													
	ABSOLUTE EFFICIENCY TEST (DISCOUNTED FORMULA)													
	NPV for SRD = 17%. Coef. a_t	1	0,855	0,731	0,624	0,534	0,458	0,390	0,333	0,285	0,243	0,208	0,178	0,152
	$VA_t a_t$	-1320	-2971	444,7	770,4	801,5	685	639,5	508,9	467,2	399,3	341,3	291,7	383,-
	$\Sigma VA_t a_t = 1441,5 > 0$													
III.11	WAGES DISTRIBUTED W_t			323,15	→	→	→	→	→	→	→	→	→	323,15
II.16	. WAGES included in GALADRIN			90,-	→	→	→	→	→	→	→	→	→	90,-
	$\Sigma W_t a_t$ for SRD = 17% = 1998 (TOTAL WAGES)			413,15	→	→	→	→	→	→	→	→	→	413,15
	$\Sigma VA_t < \Sigma W_t a_t$	CONCLUSION: Under this form, the project cannot be accepted from the point of view of the collectivity (no social surplus created.)												

ANNEX III. 1

Training Course in Industrial Project Preparation Evaluation and Financing

. Additional Data for the Case Study.

Possible Alternative: Ajoining a small foundry to the workshop.

Reason: Commercially oriented foundries are not usually interested in producing small quantities of complicated items such as will be needed by the type of workshop envisaged in the study.

Initial investment costs

Land 500 sq.metres
Buildings simple shed type 300 sq.metres x 100 LS/sq.m
Equipment : 3 crucibles
burner
blower
stand-by generator 150 kVA (75.000 LS)
moulding boxes
sand - testing equipment
tools
spare parts

225.000 LS

Personnel: 1 Foreman technician
3 Pattern makers
3 moulders
6 Auxiliaries

Total 13 Costs ?

Raw Materials (per annum) scrap iron 120 ton @ 100 LS/T
scrap brass 24 ton @1200 LS/T
scrap aluminium 16 ton @1200 LS/T

Output targets	Foundry	Workshop
Iron	75	60
Brass	15	12
Aluminium	10	8
	100	80

Maintenance of the foundry: 10.000 LS per annum

ANNEX III. 2.

NAME OF THE PROJECT: SPARE PARTS WORKSHOP WITH FOUNDRY (000 LS)

10.1 SALES			FULL PRODUCTION YEAR		START-UP YEAR 20%		YEAR 35%		YEAR 50%		YEAR 75%		YEAR 90%		YEAR 10 e	
			QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VALUE	QTY	VAL
ITEM A	METALLIC SPARE PARTS															
	LOCAL SALES	UNIT PRICE 31.000	80T	2480	16T	496	20T	620	20T	620	40T	1240	60T	1860	64T	1984	8T	248
	EXPORT	UNIT PRICE														
ITEM B																
	LOCAL SALES	UNIT PRICE														
	EXPORT	UNIT PRICE														
ITEM C																
	LOCAL SALES	UNIT PRICE														
	EXPORT	UNIT PRICE														
N.B. UNIT PRICE = ex factory price																
TOTAL SALES																
	LOCAL SALES			2480		496		620		620		1240		1860		1984		248
	EXPORT															

ADDITIONAL DATA

- INDIRECT TAXES ON LOCAL SALES = %

- COST FOR BOARDING GOODS.
  (FREE FOB) COST
  INLAND TRANSPORT
  HARBOUR COSTS
  EXPORT TAXES
  OTHER

NAME OF THE PROJECT:
SPARE PARTS WORKSHOP
SMALL FOUNDRY INCORPORATED

	FULL OPERATION YEAR			START UP YEAR 1			YEARS 3-4			YEARS 5-6			YEAR 7			YEAR 8-9			YEAR 10-12		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
10.2 OPERATING COSTS																					
10.2.1 VARIABLE COSTS																					
10.2.1.1 RAW MATERIALS AND INPUTS																					
120T scrap iron x 100 LS/T		12,-	12																		
24T scrap brass x 1200 LS/T		28,8	28,8																		
16T scrap alu x 1200 LS/T		19,2	19,2																		
500 kg fix x 3 LS/kg		15,-	15,-																		
2 UTILITIES WATER		-	-																		
COAL 10 TX 2 LS		14,-	14,-																		
15000 [illegible] FUEL 3 LS/		4,5	4,5																		
36000 LS for 8 [illegible] 36 each run		108,-	108,-																		
ELECTRICITY		21,6	21,6																		
Lubricant for genset																					
3. DIRECT OVERHEAD COSTS																					
4. TAXES																					
5 EXTERNAL SERVICES																					
6 SEASONAL MANPOWER																					
7 OTHERS																					
10.2.1 TOTAL VARIABLE COSTS		223,1	223,1	-	55,8	55,8		62	62	-	111,6	111,6		167,3	167,3		179,5	179,5		223,1	223,1
10.2.2 FIXED COSTS																					
10.2.2.1 GENERAL ADMIN EXP		180	180		30	30		30	30		140	140		160	160		160	160		180	180
2 FIXED TAXES		-																			
3 EXTERNAL SERVICES (FIXED) for 6 years	50		50	50		50	50		50	50		50	50		50	-		-	-		-
4 MAINTENANCE (preventive)	40	40	80	10	10	20	12	12	24	20	20	40	30	30	60	30	30	60	40	40	80
5. INSURANCE	-	5	5		3	3		3	3		4	4		5	5		5	5		5	5
6. RENT	-	-																			
7. MANPOWER (DIRECT AND FIELD (PROGRESSIVELY)	-	323,15	323,15		161,6	161,6		161,6	161,6		240	240		280	280		300	300		323,15	323,15
8. OTHERS																					
10.2.2 TOTAL FIXED COSTS	90	548,15	638,15	60	204,6	324,6	62	266,6	328,6	70	404	474	80	475	555	30	495	525	40	548,15	588,15
10.2 TOTAL OPERATING COSTS	90	771,25	861,25	60	320,4	380,4	62	328,6	390,6	70	515,6	585,6	80	642,3	722,3	30	674,5	704,5	40	771,25	811,25

NAME OF THE PROJECT
SPARE PARTS WORKSHOP WITH FOUNDRY

	TOTAL			YEAR 0			YEAR 1			YEAR 4			YEAR 6			YEAR 9		
10.3 TOTAL INVESTMENT COSTS	FC	LC	TOTAL	FC	LC	TOTAL	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
1. FIXED INVESTMENT COSTS																		
1 LAND 17000 x 60 LS		1020	1020		1020	1020												
2 SITE PREPARATION AND DEVT	20	80	100				20	80	100									
3 STRUCTURES AND CIVIL WORKS																		
BUILDINGS 2000 x 1100 LS		17000	17000		800	800								400	400			
ELECTRICITY 3x50KVA 30 000	30	80	110				30	10	40	30	10	40	30	-	30	-	-	-
WATER	5	20	25				5	20	25									
AIR CON	-	4	4					4	4					4	4			
4. PLANT AND MACHINERY + LABo																		
MECH MACHINES	2000	400	2400				500	200	700	600	-	600	600		600	300	-	300
FOUNDRY	150	75	225				150	75	225									
5 VEHICLES. TRUCKS																		
CARS	-	115	115					75	75					40	40			
TOTAL FIXED INVESTMENT COSTS	3365	2738	5103		1820	1820	705	464	1169	630	10	640	630	444	1074	300		300
	+10%	+10%	+10%		+10%		+10%	+10%	+10%	+10%	-		+10%	+10%	+10%	+10%		+10%
	3702	3012	5613		2002	2002	776	510	1286	693	11	704	693	488	1181	330		330
2 PRE-PRODUCTION CAPITAL EXPENDITURES																		
1. STUDIES																		
2. MANAG OF IMPLEMENTATION	100	50	150				80	25	25	100		100	50	25	75			
3. ADMIN. COSTS, TENDERING																		
4. SUPERVISION, COORD, TEST. RUN																		
TAKEOVER OF CIV WORKS, EQUIP, PLANT																		
6. RECR & TRAINING STAFF & LABOUR		150	150					50	50		50	50		50	50			
6. OTHER																		
7. INTEREST ON LOANS																		
TOTAL PRE-PRODUCTION CAP EXPENDITURES +10%	220	220	440	-	-	-	88	83	138	110	55	165	55	83	138			
3. WORKING CAPITAL. APPROX.	-	400	400	-	-	-	-	200	200	-	100	100	-	100	100			
TOTAL INVESTMENT COSTS	3719	3632	6344	-	2002	2002	831	733	1624	803	166	969	798	671	1419	330	-	330

ANNEX III.5

Name of the Project:
SPARE PARTS WORKSHOP WITH FOUNDRY

NET INCOME STATEMENT

	YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
SALES	-	-	996	620	620	1240	1240	1860	1984	1984	2480	2480	2480
OPERATING COSTS													
DEPRECIATION													
INTEREST													
GROSS PROFIT													
CORPORATE TAX													
NET PROFIT													

CASH FLOW STATEMENT

		YEAR 0	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	YEAR 11	YEAR 12
INFLOW	SALES			996	620	620	1240	1240	1860	1984	1984	2480	2480	2480
	EQUITY	2002	1624	24,7		216,8		664,6						
	LONG TERM LOANS													
	SHORT TERM LOANS													
	SALVAGE VALUE													2600
	TOTAL INFLOW	2002	1624	520,7	620	1436,8		1904,6	1860	1984	1984	2480	2480	5080
OUT FLOW	PREOPERATIONAL EXPENDITURES		138			165		138						
	FIXED INVESTMENT	2002	1286			704		1181			330			
	REPLACEMENTS							83						
	WORKING CAPITAL		200			100		100						
	OPERATING COSTS VARIABLE			55,8	62	62	111,6	111,6	167,3	179,5	179,5	223,1	223,1	223,1
	FIXED			328,6	328,6	328,6	474	474	555,-	525	525	588,2	588,2	588,2
	INTEREST LONG TERM													
	SHORT TERM													
	LOAN REPAYMENT LONG TERM													
	SHORT TERM													
	CORPORATE TAX 2,5% ON EQUITY			30,7	31,3	31,3	111,7	111,7	128,3	128,3	128,3	128,3	128,3	128,3
	10% ON SALES.			49,6	62,-	62	124,-	124,-	186,-	198,4	198,4	248,-	248,-	248,-
	TOTAL OUTFLOW	2002	1624	520,7	543,9	1512,9	821,3	2323,3	1036,6	1031,2	1361,2	1187,6	1187,6	1187,6
	NET CASH BALANCE	-	-	-	76,1	-76,1	418,7	-418,1	823,4	952,8	622,8	1292,4	1292,4	3892,4
					76,1	-	418,7	-	823,4	1776,2	2399,-	3691,4	4983,8	8876,2
CUMULATIVE	NET CASH BALANCE													
CASH FLOW FOR THE INVESTOR		-2002	-1624	-24,7	76,1	-832,9	418,7	-1683,3	+823,4	952,8	622,8	1292,4	1292,4	3892,4

INTRINSIC RATE OF RETURN: 6,51%

ECONOMIC APPRAISAL OF THE PROJECT: SPARE PARTS WORKSHOP WITH FOUNDRY

TRANSFORMATION OF THE PRICES OF THE STUDY

ITEMS	TYPE	PRICING RULE					VALUE
OUTPUTS							
METAL SPARE PARTS	IMPORT SUBST.	ACIF	See Annex II.16				2 396.897 LS
MATERIAL INPUTS							
SCRAP METAL	Dom. PROD.	ADVP	75.000 LS				75.000 LS
UTILITIES COAL	Dom. PROD.	ADVP	14.000 LS				14.000 LS
FUEL	IMPORTED	ACIF + ins. charges	300 US$/T + 10% LS Transport	30 × 1.8 LS/US$ = 57 LS + 100 LS = 157 LS/T × 31.5 gal/T × 0.0035 T/gal			20 212 LS
LUBRIFIANT	IMPORTED	ACIF + ins. charges	80 % of fuel for gen set				3.880 LS
OVERHEAD & GAL ADMINISTRATION 180 000 LS			See Annex II.16			70.000 LS + 19.675 LS	89.675 LS
MAINTENANCE			80% of Annex II.16	99.189 LS × 80/100			38.891 LS
INVESTMENT COSTS.							
BUILDINGS	Dom. prod.	ADVP				1200000 + 10 %	1320.000 LS
SITE PREPARATION	IMPORT	ACIF 20% + ins. charges	See Annex II.16			94.680 + 10 %	109.148 LS
CIVIL WORKS	Dom. PROD.	ADVP 80%	143.000 + 10% = 157.300 LS → FC 104.500 LS				
	104.500 LS IMPORTED	ACIF + ins. charges	if 1ST − 1500 (TRANS) → 103.000 LS × 1/1.4 (DUTY LC) → 73.571 LS (LC 52.800 LS) × 1/1.02 (CLEAR) → 72.129 LS × 1.8/1.3 (FOR EACH) →				99.871 + 1500 + 1142
	52.800 LS LOCAL	ADVP					102.813 LS
PLANT & MACHINERY			2425.000 LS + 10% = 2667.500 LS → FC 2365.000 LS, LC 302.500 LS				52.800 LS
	302.500 LS LOCAL	ADVP					302.500 LS
	2.365.000 LS IMPORTED	ACIF + ins. charges	2365.000 LS if 100 Tons − 10000 LS (TRANSP) → 2.355.000 LS × 1/1.4 (DUTY) →			1.682.143 × 1.8/1.3 (FOR EACH) → 2.329.781 + 10.000 + 3983	2.337 104 LS
VEHICLES	126.500 LS IMPORTED	ACIF + ins. charges	115.000 + 10 % = 126.500 LS, 126.500 LS if 8 Tons − 80 LS → 125.700 LS × 1/1.4 (DUTY) →	89.786 × 1/0.9 (CLEAR) → 88.026 × 1.8/1.3 (FOR EACH) →			124.442 LS
REPATRIATED VALUE ADDED							
OPERATIONAL PHASE: EXTERNAL SERVICES			50.000 LS/y during 6 years				49 231 LS
INVESTMENT PHASE: SUPERVISION			280.000 LS	1.8/1.3 (FOR EACH)			306.615 LS

INTEGRATED VALUE ADDED ANALYSIS (000 LS)

(See Table 9, p 33 IDCAS MANUAL ID/244)

Project: SPARE PARTS WORKSHOP WITH FOUNDRY

	YEAR 0	1	2	3	4	5	6	7	8	9	10	11	12
VALUE OF OUTPUT													
Domestically marketed			479,4	599,2	599,2	1198,4	1198,4	1198,4	1317,5	1317,5	2396,9	2396,9	2396,9
Residual value (approx)													1200,-
VALUE OF MATERIAL INPUTS													
Investments BUILDINGS	880						440						
SITE PREPARATION		104,1											
CIVIL WORKS		35,1			43,5		37						
MACHINERY		1028,2			661,8		661,8			330,9			
VEHICLES		81,2					43,3						
REPLACEMENTS							81,2						
Current Material Inputs													
Variable			22,6	28,3	28,3	56,6	56,6	84,8	94,5	94,5	113,1	113,1	113,1
Fixed GAL ADM			44,8	44,8	44,8	69,7	69,7	79,7	79,7	79,7	89,7	89,7	89,7
MAINTENANCE			9,9	19,8	19,8	19,8	19,8	29,7	29,7	29,7	39,6	39,6	39,6
INSURANCE			3	3	3	4	4	5	5	5	5	5	5
NET DOMESTIC VALUE ADDED	-880	-1289,5	339,1	511,1	-194,2	1048,3	-814,-	1532,5	1718,6	1381,7	2149,5	2149,5	3349,5
Replicated payments													
External Services			69,2	69,2	69,2	69,2	69,2	69,2	-				
Supervision		306,6											
NET NATIONAL VALUE ADDED	-880	-1537,1	329,9	441,9	-263,4	978,1	-283,2	1529,3	1719,6	1381,7	2149,5	2149,5	3349,5
NPV for Social Rate of Discount = 17% : 1.139,93													
WAGES DISTRIBUTED			161,6	161,6	161,6	240	240	280	300	300	323,15	323,15	323,15
+ GAL ADM EXP (60% WAGES)			45	45	45	70	70	80	80	80	90	90	90
Total			206,6	206,6	206,6	310	310	360	380	380	413,15	413,15	413,15
NPV for SRD = 17% :		: 1.398,47											

$\Sigma VA_{a_t} < SW_{a_t}$ CONCLUSION: Even under this form the project must be rejected. We have to reduce the initial investment of machinery in using idle equipment, for example.

ANNEX. IV. 1

EFFECTS METHOD PROCEDURE.

Step 1. Establishing cash flow statement of the project and identification of the enterprises which will give to the project its Local Intermediate Consumptions (LIC). This procedure will identify the new industrial or infrastructural projects which are necessary to create for making the initial project feasible. For example, extension of power supply capacity or transport infrastructure.

Step 2. Breakdown of Inputs into Local Intermediate Consumptions (LIC)
Direct Value Added (broken down into its components: Wages, Taxes, Income of Enterprises)
Direct Imports
for one normal capacity year. (See Annex IV. 2)

Step 3. For each identified LIC, calculation of
indirect Imports
indirect Wages
indirect Taxes
indirect Income of Enterprises
through input-uotput analysis or through Cash Flow Statement analysis of each LIC.
(See Annex IV. 3 and Annex IV. 4)

Step 4. Computation of Included Value Added VA_i broken down into its components by adding Direct Value Added + Indirect Value Added

$$VA_{dir} \qquad VA_{indir} = VA_i$$

(See Annex IV.3)

Step 5. Computation of Imports included, Imp_i including repatriated payments

$$Imp_{dir} + Imp_{indir} = Imp_i$$

(See Annex IV.3)

Step 6. Compare to Alternative Situation (Extended present situation)
VA_i of the project - VA_i of the alternative situation = Supplementary Value Added ($\triangle VA_i$) broken down into its components $\triangle$ Wages$_i$, $\triangle$ Taxes$_i$, $\triangle$ Income of Enterprises$_i$ (See Annex IV.5)

Step 7. This can give a good idea of the distribution of Value Added among the different economic agents if there are not too big differences from one year of operation to another. If the differences are significative, it is necessary to compute $\triangle VA_i$ for each year of the project.

Step 8. Computation of Included Imports (Imp_i) for the Investment Phase
(See Annex IV.6 and Annex IV.7)

Step 9. Comparison of Imp_i of the Investment Phase (cost of the project for the economy) to the series of $\triangle VA_i$ (benefits of the project) by discounting. That gives an Internal Rate of Return that can be used for comparing the project with other projects.

Step 10. Eventually substraction from the present value of the project $\Sigma \triangle VA_i\, a_t - \Sigma Imp_i a_t$ discounted at the Social Rate of Discount chosen in the IDCAS Method, the values of $\triangle$ Wages$_i$, also discounted, for knowing if there is a Social Surplus left over.

ANNEX IV.2

EFFECTS METHOD

Transformation of Previsional Accounts into a DIRECT VALUE ADDED ACCOUNT.
(IMPORTS + LOCAL INTERMEDIATE CONSUMPTION + VA_{dir} = OUTPUT)
Operational Phase

Project: Alternative:

Items	Sources	Amount	Local Origin	Direct Imports	CIF Price	Import Duties
Raw Materials and Inputs						
Utilities						
Gal Admin. and Overhead Costs						
External Services						
Maintenance						
Other						
i.a.- Incidental charges attached to Direct Imports - Local incidental charges preceeding loading for export						
Total Intermediate Consumption						
Local Wages Wages paid in Foreign Cur.						
Taxes (+ Export Taxes)					+ Import Duties on Direct Imp.	
Financial Charges Local Paid in For. Cur.						
Income of Enterprises Local Paid in For. Cur.						
Total DIRECT VALUE ADDED DIRECT NATIONAL VALUE ADDED EXPATRIATED PAYMENTS					+ Import Duties on Dir. Imp.	
SALES (ex-factory prices) (+ Incid. charges before loading for export + export duties)						
SALES (fob price or inclusive Sales tax)						

EFFECTS METHOD — ANNEX IV. 3

Calculation of the INCLUDED VALUE ADDED ($VA_i = VA_{dir} + VA_{indir.}$)

Operational Phase

Project: Alternative:

Local Intermediate Consumption (1)	Amount (2)	Structure of VA_i (3)	Product (2)x(3) (4)	General Totals Income Categ. (5)	General Totals VA_{dir} (6)	Σ Col(4) VA_i of LIC (7)	VA_i of the project (6)+(7)
Raw Material 1.		Wages		Loc Wages			
		Taxes		Exp Wages			
		Inc Enterp		Taxes			
		Imp_i		Imp Duties			
Raw Material 2.		Wages		Fin.charg.			
		Taxes		loc.			
		Inc Enterp		expat.			
		Imp_i		Income Ent			
Input 1.		Wages		local			
		Taxes		expat.			
		Inc Enterp					
		Imp_i		Total VA_i			
Input 2.		Wages		Mat VA_i			
		Taxes		expat VA_i			
		Inc Enterp					
		Imp_i		Imp_i			
Electricity, water		Wages		+ VA_i expat			
		Taxes		Total Imp_i			
		Inc Enterp					
		Imp_i					
Fuel		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Gal administr.and overhead costs		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
External Services 1.		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
External Services 2.		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Maintenance		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Transport		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Other		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Other		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					
Other		Wages					
		Taxes					
		Inc Enterp					
		Imp_i					

EFFECTS METHOD. ANNEX IV.4

Examples of structure of VA_i (hypothetical country)

Branches	Rate of $Imp._i$	Rate of VA_i	Wages $_i$	Taxes $_i$	Income of Enterprise
Agriculture	0,03	0,97	0,14	0,03	0,8
Mining	0,2	0,8	0,5	0,1	0,4
Electricity	0,4	0,6	0,2	0,1	0,3
Fuel of foreign origin but locally procured	0,7	0,3	–	0,2	0,1
Textile	0,2	0,8	0,3	–	0,5
Mecan. industry	0,6	0,4	0,3	–	0,1
Building, Civil Works	0,3	0,7	0,3	0,05	0,35
Transport	0,4	0,6	0,3	0,1	0,2
Services	0,2	0,8	0,5	0,1	0,2

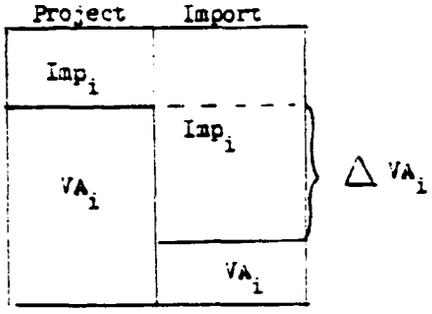
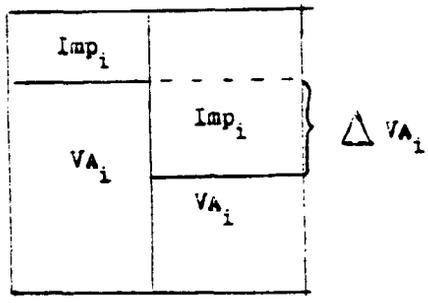
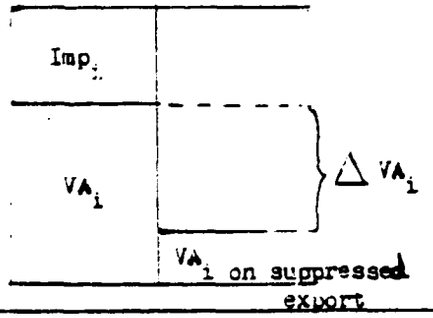
The Coefficients $Imp._i$ and VA_i as well as Included Wages, Included Taxes and Included Income of Enterprises can be derived from

- the Inter-industrial Exchange Table of the National Accounts of the country

or from the structure of price of the local enterprises giving to the project its intermediate consumptions.

EFFECTS METHOD

Calculation of SUPPLEMENTARY VALUE ADDED $\triangle VA_i$ (Operational Phase)

Type of project	VA_i Components	Project	Without the Project	$\triangle VA_i$
1. Import Substitution	Wages (Household)			
	Taxes (State)			
	Income of Enterprises (Enterprises)			
	Alg. Sum			
2. New Technology Introduction	Wages (Household)			
	Taxes (State)			
	Income of Enterprises (Enterprises)			
	Alg. Sum			
3. Export	Wages (Household)			
	Taxes (State)			
	Income of Enterprises (Enterprises)			
	Alg. Sum			
4. Composite Project	Wages (Household)			
$\sum \triangle VA_i$ under 1., 2. or 3.	Taxes (State)			
	Income of Enterprises (Enterprises			
	ALG. Sum			

EFFECTS METHOD ANNEX IV.6

DIRECT VALUE ADDED Calculation

(Investment Phase)

Project: Alternative:

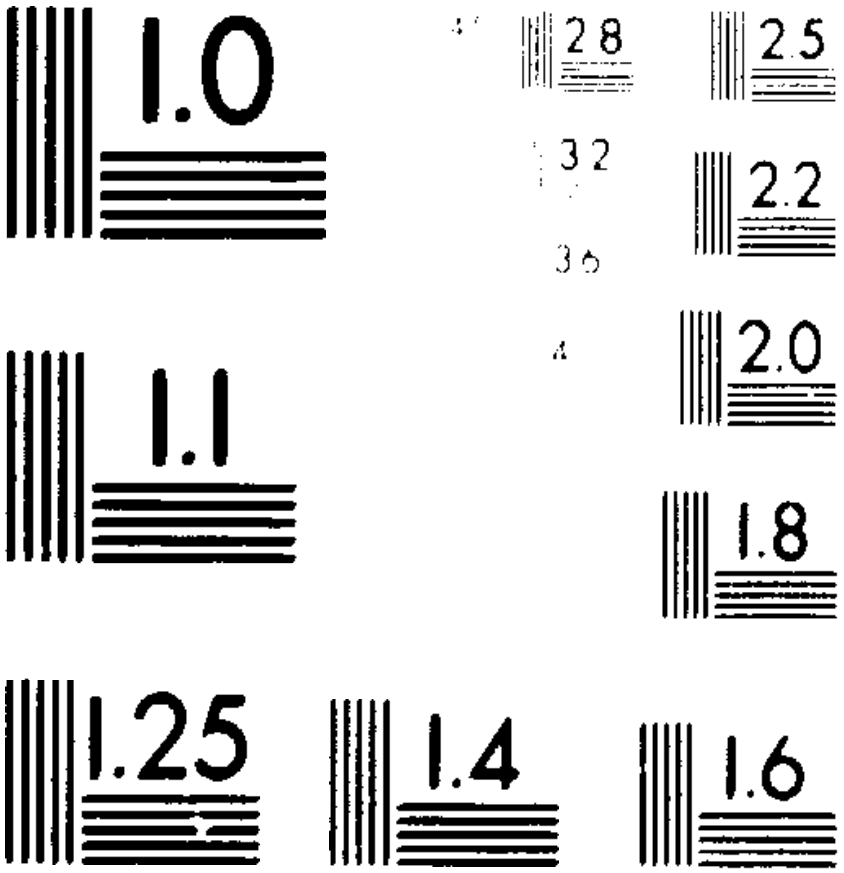
Preproduction Capital Expenditures	Sources	Amount	Local Origin	Direct Import	CIF Price	Import Duties
Pre-production Capital Expenditures						
Services						
Direct Manpower						
Taxes						
Financial charges						
Other						
Fixed Investment Costs						
Land						
Site preparation and devt						
Structures and Civil Works						
Buildings						
Machinery						
Plant and Machinery						
Transport						
Services						
Incidental charges attached to direct import						
			Total			
Components of Direct Value Added included into the aoovementioned posts						
Land						
Direct Manpower						
Taxes			+ Import Duties on Direct Imports			
Financial charges						
Total Direct Value Added						
National Direct Value Added			+ Import Duties on Direct Imports			
Value Added Expatriated						

EFFECTS METHOD

ANNEX IV.7

INCLUDED VALUE ADDED (VA_i) Calculation
Investment Phase

Local Intermediate Consumptions (1)	Amount (2)	Structure of VA_i for the branches (3)	Product (2)x(3) (4)	General Totals Income Categ. (5)	VA_{dir} (6)	Σ Col(4) VA_i of LIC (7)	VA_i of the project (6)+(7)
1.		Wages Taxes Inc Enterp Imp_i		Loc Wages Exp Wages Taxes Imp Duties Fin.charg. loc expatr Income Ent loc expatr			
2.		Wages Taxes Inc Enterp Imp_i					
3.		Wages Taxes Inc Enterp Imp_i					
4.		Wages Taxes Inc Enterp Imp_i					
5.		Wages Taxes Inc Enterp Imp_i		Total VA_i Nat VA_i Expat VA_i			
6.		Wages Taxes Inc Enterp Imp_i					
7.		Wages Taxes Inc. Enter Imp_i		Imp_i + Expat VA_i Total Imp_i			



Transformation of Previsional Accounts into a DIRECT VALUE ADDED ACCOUNT.
(IMPORTS + LOCAL INTERMEDIATE CONSUMPTION + VA_{dir} = OUTPUT)
Operational Phase

Project: Spare parts workshop Alternative: with small foundry attached

Items	Sources	Amount 75%	Local Origin	Direct Imports	CIF Price	Import Duties
Raw Materials and Inputs						
Scrap metal 75.000LSx75%	AnnIII.5	56,25	56,25			
Utilities Fuel		111	111			
Gal Admin. and Overhead Costs						
50% = Manpower		80	80			
External Services = Manpower		50				
Maintenance		60	30	30	20	8
Other						
i.a.- Incidental charges attached to Direct Imports - Local incidental charges preceeding loading for export	from line "Maintenance"		2			
Total Intermediate Consumption		307,25	279,25	30	20	8
Local Wages	Ann III.5	280+80 (80 from Gal Adm. and Overhead Costs)				
Wages paid in Foreign Cur.		50				
Taxes (+ export Taxes)	III 5	514,5		+ Import Duties on Direct Imp.		8
Financial Charges Local Insurance Paid in For. Cur.	III.5	5				
Income of Enterprises Local Paid in For. Cur.	III.5	825,4				
Total DIRECT VALUE ADDED		1552,7		+ Import Duties on Dir. Imp.		8
DIRECT NATIONAL VALUE ADDED		1502,7				
EXPATRIATED PAYMENTS		50				
SALES (ex-factory prices) (+ Incid. charges before loading for export + export duties)	III.5	1660 -				
SALES (fob price or inclusive Sales tax)		1660				

EFFECTS METHOD — ANNEX IV.9

Calculation of the INCLUDED VALUE ADDED ($VA_i = VA_{dir} + VA_{indir.}$)

Operational Phase

Project: Spare parts workshop — Alternative: with small foundry attached

Local Intermediate Consumption (1)	Amount (2)	Structure of VA_i (3)		Product (2)x(3) (4)
Raw Material 1. scrap (see structure in note 1.)	56,25	Wages	0,25	14,06
		Taxes	0,1	5,63
		Inc Enterp	0,55	30,94
		Imp_i		-
Raw Material 2.		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Input 1.		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Input 2.		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Electricity, water		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Fuel	111	Wages	0,2	22,2
		Taxes	0,1	11,1
		Inc Enterp		
		Imp_i	0,7	77,7
Gal Administr. and overhead costs	80	Wages	0,5	40
		Taxes	0,2	16
		Inc Enterp		
		Imp_i	0,1	8
External Services	1. 2	Wages	0,5	1
		Taxes	0,1	0,2
		Inc Enterp	0,2	0,4
		Imp_i	0,2	0,4
External Services	2.	Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Maintenance (see note 2)	30	Wages	0,3	9
		Taxes	0,1	3
		Inc Enterp		
		Imp_i	0,6	18
Transport 0,1x56,25 (see note 3)	5,6	Wages	0,3	1,68
		Taxes	0,2	0,56
		Inc Enterp		1,12
		Imp_i	0,4	2,94
Other		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Other		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		
Other		Wages		
		Taxes		
		Inc Enterp		
		Imp_i		

General Totals Income Categ. (5)	VA_{dir} (6)	Σ Col(4) VA_i of IIC (7)	VA_i of the project (6)+(7)
Loc Wages	360	65,74	425,74
Exp Wages	50		50
Taxes	314,3	36,59	350,89
Imp Duties	8		8
Fin.charg. loc.	5		5
Fin.charg. expat.			
Income Ent local	823,4	62,56	885,96
Income Ent expat.	-		-
Total VA_i	1560,7	164,89	1725,59
Nat VA_i	1510,7	164,89	1675,59
expat VA_i	50	-	50
Imp_i	20	106,16	126,16
+ VA_i expat	50	-	50
Total Imp_i		106,16	176,16

Notes:

1) Scrap metal: collected by small independant enterprises;
assessment of price structure:

Cost is mainly manpower	0,25
then transport	0,1
taxes	0,1
income of enterprise	0,55

(profit rate is high in that activity

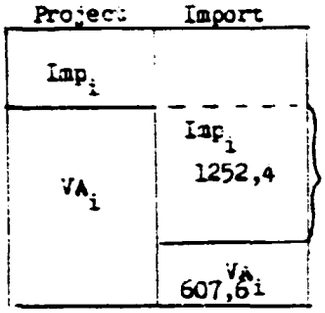
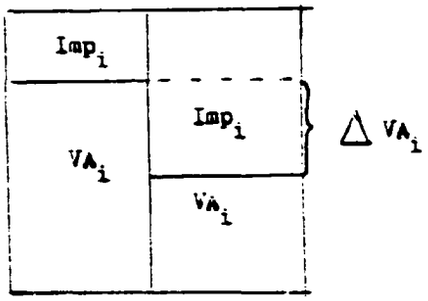
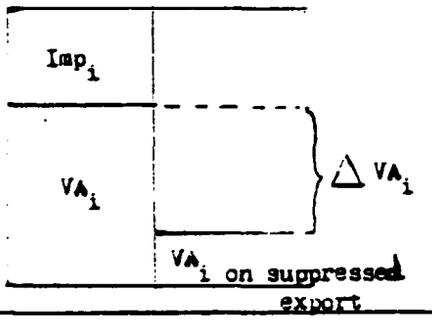
2) Maintenance
Mechanical industry structure

3) Transport: 5,625
This cost is derived from scrap cost structure as explained in the note 1) above (56,25 x 0,1)

EFFECTS METHOD — ANNEX IV. 10

Calculation of SUPPLEMENTARY VALUE ADDED ΔVA_i (Operational Phase)

Year 7

Type of project	VA_i Components	Project	Without the Project	ΔVA_i
1. Import Substitution	Wages (Household)	425,74	37,2	388,54
	Taxes (State)	358,89	496 / 24,8	- 161,91
	Income of Enterprises (Enterprises)	885,96	49,6	836,36
	Alg. Sum	1675,59	607,6	1062,99
2. New Technology Introduction	Wages (Household)			
	Taxes (State)			
	Income of Enterprises (Enterprises)			
	Alg. Sum			
3. Export	Wages (Household)			
	Taxes (State)			
	Income of Enterprises (Enterprises)			
	Alg. Sum			
~~Composite Project~~	Wages (Household)			
$\sum \Delta VA_i$ under 1., 2. or 3.				
Situation without the project:	Taxes (State)			
Import = Sales = 1860 LS Structure of import: CIF price + import duties + incidental charges If import duties = 40 % of CIF price if incid.charges= 10 % of CIF price We have CIF price = $1860 \times \frac{1}{1,5}$ = 1240 LS Import duties = 496 LS Inc Charges = 124 LS	Income of Enterprises (Enterprises			
	Alg. Sum			

Wages 0,3 (37,2) Inc of Ent 0,4 (49,6) Taxes 0,2 (24,8) Imp_i 0,1

ANNEX IV.11

EFFECTS METHOD

DIRECT VALUE ADDED Calculation

(Investment Phase)

Project: Spare parts workshop Alternative: with small foundry attached

Preproduction Capital Expenditures	Sources	Amount	Local Origin	Direct Import	CIF Price	Import Duties
Pre-production Capital Expenditures						
Services	Annlll.4	250	50	200	200	
Direct Manpower		/150/				
Taxes						
Financial charges						
Other						
Fixed Investment Costs						
Land		/1020/				
Site preparation and devt		100	80	20	13,3	5,3
Structures and Civil Works						
Buildings		1200	1200	-	-	-
Machinery		145	48	95	63,3	25,3
Plant and Machinery		2200	200	2000	1333,3	533;3
		225	75	150	100	40
Vehicles		115	115			
Transport (1,3)						
Services on import (6,4)		151,1	151,1			
Incidental charges (133,4) attached to direct import						
		5405	Total	2465	1709,9	604
				+ 10%	+ 10 %	+ 10 %
				(see note 2. of Annex IV.12)		
Components of Direct Value Added included into the aocvementioned posts						
Land		1020				
Direct Manpower Training staff	III.4	150				
Taxes		-	+ Import Duties on Direct Imports 604			
Financial charges						
Total Direct Value Added		1170				
National Direct Value Added		1170	+ Import Duties on Direct Imports 604			
Value added Expatriated						

EFFECTS METHOD

ANNEX IV. 12

INCLUDED VALUE ADDED (VA_i) Calculation
Investment Phase (Total investment)

Local Intermediate Consumptions (1)	Amount (2)	Structure of VA_i for the branches (3)		Product (2)x(3) (4)	General Totals Income Cate. (5)	VA_{dir} (6)	Σ Col(4) VA_i of LIC (7)	VA_i of the project (6)+(7)
1. Services	50	Wages	0,5	25	Land	1020		1020
		Taxes	0,2	10	Loc Wages	150	587,2	737,2
		Inc Enterp			Exp Wages			
		Imp_i	0,2	10	Taxes		98,01	98,01
2. Building, Civil Works	1248	Wages	0,5	624	Imp Duties	604		604
		Taxes	0,35	436,8	Fin.charg. loc			
		Inc Enterp			expatr			
		Imp_i	0,3	374,4	Income Ent loc		544,02	544,02
3. Mechanical Ind	275	Wages	0,3	82,5	expatr			
		Taxes	0,1	27,5				
		Inc Enterp						
		Imp_i	0,6	165				
4. Vehicles (See Note 1)	115	Wages	0,05	5,75				
		Taxes	0,1	11,5				
		Inc Enterp	0,1	11,5				
		Imp_i	0,75	86,25				
5. Services	151,1	Wages	0,5	75,55	Total VA_i	1774	1229,23	3003,23
		Taxes	0,2	30,22	Nat VA_i			3003,23
		Inc Enterp						+10 % (2)
		Imp_i	0,2	30,22				3303,55
6. Site preparation	80	Wages	0,3	24	Expat VA_i	-	-	-
		Taxes	0,05	4				
		Inc Enterp	0,35	28				
		Imp_i	0,3	24	Imp_i	1709,9	689,87	2399,77
7.		Wages			+ Expat VA_i	-	-	-
		Taxes						
		Inc. Enter						
		Imp_i			Total Imp_i	1709,9	689,87	2399,77
								+10 %
								2639,75
Total	1919,1			1919,1				

Notes

1. Vehicles are imported through local agents and paid in local currency. So they are considered as LIC. This is mainly a commercial activity with a structure cost as follows:

$Wages_i$	0,05
$Taxes_i$	0,1
Inc of $Enterp_i$	0,1
Imp_i	0,75

2. + 10 % for taking account of contingency added to amounts of investment costs (See Annex III.4)

ANNEX IV. 13

CONCLUSIONS OF THE EVALUATION OF THE CASE STUDY BY EFFECTS METHOD.

The Supplementary Value Added ($\triangle VA_i$) computed for year 7 in Annex IV.10 is the following:

Supplementary Wages $\triangle$ Wages$_i$	= 388,54
Supplementary Taxes $\triangle$ Taxes$_i$	=- 161,91
Supplementary Income of Enterprises $\triangle$ Inc of Enterp.$_i$	= 836,36
Supplementary Value Added $\triangle VA_i$	1.062,99

We see that the State will be the loser in that operation , by comparison to the previous situation which was perception of duties on imports, the Enterprises will be the winners.

We have first calculated Imp$_i$ for the Total Investment of the project (See Annexes IV.11 and 12) but it has been also necessary to compute roughly the Imp$_i$ for all the years of investment because investments were spread till the Year 9. $\triangle VA_i$ were also computed for each ye year of the project. It has been possible to calculate a sort of IRR which can serve to compare the project to other, if necessary. The present value of the project was also calculated, by analogy with the IDCAS Method, at a Social Rate of Discount of 17% for verifying if there is some Social Surplus left over.

The results of these calculations are summarised below.

Years	0	1	2	3	4	5	6	7	8	9	10	11	12
Imp$_i$	264	600	369	-	362	-	462	-	300	-	-	-	-
$\triangle VA_i$			200	300	300	700	700	1063	1200	1200	1400	1400	1400
$\triangle \pi_i$			235	353	353	341	341	388,	353	353	380	380	380
- Imp$_i$ + $\triangle VA_i$	-264	-600	-169	+300	- 62	+700	238	1063	900	1200	1400	1400	1400

IRR = 33, 61 %

For SRD = 17 %, $\triangle VA_i \; a_t$ - Imp$_i$ a_t = 1.321

$\triangle \pi_i \; a_t$ = 1.389

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This negative value confirms that there is no social surplus created through the activity of the project. However the difference is very small and the situation can be improved with small modifications in the amount of investments.