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September 1969

ENGLISH

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

REPORT ON THE UNIDO ADVISORY MISSION
IN INDUSTRIAL PROJECT IMPLEMENTATION
TO EL SALVADOR

id.69-5857

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

TABLE OF CONTENTS

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	<u>Page</u>
I THE MISSION	1
A. Terms of Reference	1
B. Members of Mission	1
C. Salvadorean Representative (counterpart)	1
D. Objectives and Procedures	1
E. Acknowledgement	2
II OUTLINE OF MISSION	3
A. Opening Ceremony and Introduction	3
B. Basic Techniques in Project Implementation	3
C. Application of Techniques to Salvadorian Projects	4
D. Advanced Techniques in Project Implementation	5
E. Administration and Control	6
III CONCLUSIONS AND RECOMMENDATIONS	7
IV FURTHER POTENTIAL UNIDO ASSISTANCE	8
APPENDICES	
A. List of Participants	9
B. Working Groups for Project	11
C. List of Reference Material	12
D. Copy of Plans for Implementation of Salvadorian Projects Prepared by Working Groups	14

I. THE MISSION

A. Terms of Reference:

To assist the National Council for Economic Planning and Coordination in improving implementation of Salvadorian industrial projects, by introducing and applying more effective techniques in programming and scheduling three actual industrial projects of prime importance to the country and assisting local counterparts to become acquainted with these techniques.

B. Members of Mission

Mr. Mostafa H. A. Handy (UNIDO)
Team leader and director of the mission

Robert Stobaugh
(Lecturer on Business Administration, Harvard University Graduate School of Business Administration)
Expert in Project Implementation

C. Salvadoran Representative (Counterpart)

Ing. Ricardo Flores Cerna
Chief of Industrial Development Division
National Council for Economic Planning and Coordination, El Salvador
Counterpart

D. Objectives and Procedures

The objective of the mission was to programme several selected industrial projects to be implemented in El Salvador and to train a number of local counterparts in the appropriate techniques of project scheduling and control. For this purpose a workshop was organized by UNIDO with the National Council for Economic Planning and Coordination as counterpart, from 16-30 August 1969, with two 3-½ hour sessions each day. The workshop was attended by twenty-two participants who represented the Salvadorian Industrial Development Institute (INSAFI), the Central Bank and two universities. The participants were of a high calibre and included a number of department heads from INSAFI. Although all of the participants read English and most spoke it well, simultaneous interpretation (by Mr. Carlos A. Fernandez) was available as needed. The list of participants and their titles are shown in Appendix A. Each participant received a certificate of completion.

THE FIRST PART OF THE WORKSHOP WAS SPENT IN TEACHING THE BASIC TECHNIQUES OF PROJECT PROGRAMMING AND SCHEDULING TO THE PARTICIPANTS.

THE NEXT PART OF THE WORKSHOP WAS THE APPLICATION OF THESE TECHNIQUES TO THREE SALVADORIAN PROJECTS. FOR THIS PURPOSE THE PARTICIPANTS WERE DIVIDED INTO FIVE WORKING GROUPS, AS LISTED IN APPENDIX B. AT THE CONCLUSION OF THIS SECOND PHASE OF THE WORKSHOP, THE PARTICIPANTS HAD A THOROUGH KNOWLEDGE OF THE BASIC PROGRAMMING AND SCHEDULING TECHNIQUES AND COULD APPLY THEM IN PRACTICE.

THE LAST PART OF THE MISSION WAS SPENT IN TEACHING ADVANCED TECHNIQUES IN PROJECT PROGRAMMING AND SCHEDULING, COST PLANNING AND CONTROL, RESOURCE ALLOCATION AND ORGANIZATION AND CONTROL SYSTEMS FOR PROJECT IMPLEMENTATION AND MANAGEMENT.

A list of reference material used on the project is shown in Appendix C.

Copies of the implementation plans for the Salvadorian projects are in Appendix D.

E. Acknowledgement

I wish to express my appreciation to Ing. Ricardo Flores Cans for the organization and programme arrangements which helped to make the mission a success, to the Central Bank for the use of meeting rooms and to Prof Robert Stobaugh of the Graduate School of Business Administration, Harvard University and a member of the mission for his valuable contribution to the mission.

My appreciation also goes to Ing. Ernesto Sol for his assistance to the Mission.

II. OUTLINE OF MISSION

A. Opening Ceremony and Introduction

1. Greetings from Ing. Ricardo Flores Cena
2. Brief speech by Ing. Edgardo Suarez, Executive Secretary of National Council for Economic Planning and Coordination
3. Presentation of Messrs. Mostafa H.A. Hamdy and Robert Stobaugh by Ing. Flores Cena
4. Message from Mr. I.H. Abdel Rahman, the Executive Director of UNIDO, read by Mr. Mostafa H.A. Hamdy
5. Discussion of scope of course by Messrs. M.H.A. Hamdy and R. Stobaugh, including steps in project development, steps in project implementation, and relationship of project implementation to overall project development.

B. Basic Techniques in Project Implementation

1. Network development

- a. Lecture. Production planning versus project planning, use of bar (Gantt) charts, principles of network analysis, relationship of bar charts to network diagrams.
- b. First exercise (performed by all participants on an individual basis, followed by class discussion). Prepare bar chart and activity-on-arrow diagram (arrow diagramming) and calculate shortest possible completion time for the eight-activity exercise shown in Reference No. 8 with required time for each activity as indicated by Instructor.
- c. Second exercise (individual basis, followed by class discussion). Prepare activity-on-arrow diagram and calculate shortest possible completion time for 15-activity exercise shown in Reference No. 8 with required time for each activity as indicated by Instructor.
- d. Third exercise (individual basis, followed by class discussion). Prepare activity-on-arrow diagram and calculate shortest possible completion time for 31-activity exercise made up by Instructor. Reference 8.

2. Activity-on-arrow versus activity-on-node (precedence diagramming)
 - a. Lecture. Principles of activity-on-node and discussion of activity-on-node versus activity-on-arrows, including reading of Reference 11.
 3. Use of activity-on-node
 - a. Exercise (individual basis, followed by class discussion). The first and second exercises listed above.
 - b. Case (performed by participants on individual basis, followed by discussions in 4 or 5-man groups, followed by class discussion). "Arrow Diagramming Exercise", Reference 10.
 4. Computations of basic scheduling data
 - a. Lecture. Forward pass, backward pass, earliest finish (EF), latest finish (LF), earliest start (ES), latest start (LS), total float (TF), free float (FF), and significance of floats.
 - b. Exercise (individual basis, followed by class discussion). Calculation of EF, LF, ES, LS, TF, and FF for first and second exercises listed above and discussion of significance and use.
 - c. Case study (individual basis, followed by group discussions, followed by class discussions). Network calculations for Reference 10, including discussion of the significance and use of each time parameter in project implementation scheduling and control.
 5. Implementation of industrial project
 - a. Case (group basis, followed by class discussion). A 21-activity industrial project from Reference 7. Preparation of complete network, including computations.
- C. Application of the above discussed Techniques to Salvadorian Projects
- Application of basic techniques to Salvadorian projects (group basis, followed by class discussions). Description of projects,

setting of assumptions for developing the project implementation model, preparation of networks, descriptions of activities, scheduling data computations and conclusions for three Salvadorean projects. The results of the work of the five groups are shown in Appendix D. The groups used feasibility studies provided by INSAPI as the basic source of information; also, technical experts from INSAPI were available to answer technical questions (Ing. Federico Huguet for the Polyvinyl Chloride and Wallboard from Bagasse projects, and Ing. Lorenzo Rivera for Handkerchiefs project) related to the manufacturing processes and resource requirements of project activities. The preparation and discussion of the implementation plans was the largest single activity of the mission. The significant characteristic of this part was two-fold. One was that the mission provided direct technical assistance to El Salvador in programming and scheduling three actual industrial projects which are being implemented in the near future. The country now has plans and schedules for implementing these projects which are of vital importance in negotiating with contractors; in allocation of resources especially the scarce ones; in determining the backward and forward linkages with existing projects as well as with projects which are being implemented; in setting up the appropriate organization for implementing the project and in monitoring and controlling project implementation and the establishment of pertinent decision-making and information systems.

D. Advanced Techniques in Project Implementation

1. Time/cost analysis

- a. Lecture. General discussion of time/cost analysis, with specific reference to understanding of concepts and limitations in use. Reference 7.
- b. Exercise (in class). "CPM (Critical Path Method) Problem", Reference 14.
- c. Case study (individual basis, with questions answered by Instructor). "Space Constructors Inc.", Reference 15.

2. Resource allocation

- a. Lecture. Concepts and techniques of resource allocation, with discussion of single versus multiproject scheduling and use of project activity floats. Reference 7.
- b. Exercise (individual basis, followed by class discussion). Problem with 8 activities and 3 resources made up by Instructor. References 7 and 17.

3. Handling of uncertainty in activity time

- a. Lecture. Discussion of problem of uncertainty in activity time and use of PERT (Project Evaluation and Review Techniques) techniques, including discussion of limitations.
- b. Case study (individual basis, followed by class discussion). "PERTing a Pumping Unit", Reference 12.

E. Organization and Control

1. Organization

Lecture. Organization for project implementation including various levels and elements of the organizational hierarchy as well as their functions and relationships such as Government, INSAPI, Project Office and Contractors and any outside technical assistance such as bilateral, multilateral and international assistance, during various phases of project planning and execution. Effective financial planning based on network scheduling data. Reference 17.

2. Contractors

Lecture. Selection of contractors and types of contracts. Relationship between consultants and contracts. References 2 and 3.

3. Control

Lecture. Control systems for project implementation. Information necessary for project follow-up and control. Use of bar charts and networks in project and financial control. Control techniques based on combined utilization of bar charts and networks for various levels of project organization. Financial control. Techniques for reprogramming and rescheduling of project implementation and updating of project implementation schedule and financial plan. References 7 and 13.

III. CONCLUSIONS AND RECOMMENDATIONS

It was the unanimous feeling of the participants, the Salvadorian representative, the Government and the members of the UNIDO team that the mission was an unqualified success, both in terms of meeting the goal of programming specific Salvadorian projects and in teaching the participants the use of the techniques.

The participants expressed great enthusiasm concerning the value of the training received as part of the mission and are making plans to train employees of local industries to use these techniques and further their application in the country.

It is the feeling of the UNIDO team that the high calibre and enthusiasm of the local participants played an important role in making the mission a success.

Three specific recommendations were made by a number of participants:

1. Make the programme longer so that more material can be covered. For example, the control of actual projects under construction could be added to the programme and much more time could be spent on aspects of project organization and control.
2. Put on another programme in El Salvador covering in depth subjects such as organization and control for project implementation and financial planning and control for project implementation based on network analysis.
3. Make UNIDO programmes better known.

IV. FURTHER POTENTIAL UNIDO ASSISTANCE

1. Discussions have been place to identify the needs of El Salvador in industrial development and how UNIDO could assist the country in satisfying part of them. One of the major areas discussed was the reorganization of the Salvadorian machinery for industrial planning and implementation with a special attention to the Salvadorian Industrial Development Institute (INSAFI) which is a development agency rather than an institute. One or two UNIDO man missions would have to go to El Salvador for reviewing the present machinery and recommending measures for improving it, based on the present and potential industrial planning and implementation needs of the country. According to the country's needs the mission will then recommend further UN technical assistance to be requested, in particular a request to UNDP for a Special Fund Project, assigned to INSAFI, to develop and sustain its activities in the field of industrial planning and implementation. A request to this effect will be discussed by the Government with UNIDO in October 1969.
2. A training workshop on Organization and Control for the Implementation of Industrial Projects will also be requested, to supplement and act as a follow-up project to the work done by the Advisory Mission of August 1969.
3. Another request will be submitted to UNIDO for assisting the Industrial Development Division of the National Council for Economic Planning and Co-operation in applying sectoral planning and programming and related techniques.

APPENDIX A
LIST OF PARTICIPANTS

<u>Name</u>	<u>Position, Institution</u>
Sr. Salomon Angel	Financial Manager Industrial Development Institute of El Salvador, INSAFI
Lic. Mauricio Cuellar	Chief Industrial Branches Department INSAFI
Sr. Alfredo Herrador	Chief, Promotion Department INSAFI
Lic. Carlos Castillo	Chief, Commercialization Department INSAFI
Dr. Luis E. Gutierrez	Adviser to President INSAFI
Lic. Francisco Linares	Assistant to Financial Manager INSAFI
Ing. Mauricio Suarez D.	In Charge of Project Implementation INSAFI
Ing. Juan Jose Morono N.	Project Engineer INSAFI
Sr. Arturo Valiente	Recent Graduate Industrial Engineering INSAFI
Ing. Ernesto Sol T.	Business Correspondent
Sr. Victor Burgos	Professor, Industrial Engineering Department, University of Jose Simeon Canas
Ing. Roberto Orellana	Professor Engineering and Architecture Department University of El Salvador
Ing. Daniel Aguilar	

APPENDIX A (continued)

<u>Name</u>	<u>Position, Institution</u>
Lic. Juan A. Nuñez B.	Professor School of Business Administration University of El Salvador
Lic. Manuel Robles G.	Professor, School of Economics University of El Salvador
Lic. José Luis Argueta	Secretary and Professor School of Economics University of El Salvador
Lic. Roberto Ancaño	Economist Central Bank of El Salvador
Lic. Salvador M. Rivera	Economist Central Bank of El Salvador
Sr. Jeremias Cabrera R	Recent Graduate Industrial Engineering
Srita. Ana Irma Battle	Recent Graduate Industrial Engineering
Sr. Raymundo E. Rodríguez	Recent Graduate Industrial Engineering
Lic. José David Polanco	Professor, School of Economics University of El Salvador

APPENDIX B

WORKING GROUPS FOR PROJECTS

<u>Group No.</u>	<u>Project Name</u>	<u>Project Members</u>
1	Wallboard from bagasse	Argueta Battle Linares Polanco Sol
2	Polyvinyl chloride	Cuellar Gutierrez Herrador Suarez
3	Handkerchiefs	Aguilar Nunes Rivera Rodriguez
4	Wallboard from bagasse	Angel Burgos Moreno Orellana Valiente
5	Handkerchiefs	Cabrera Castillo Robles Suarez

APPENDIX C
LIST OF REFERENCE MATERIAL

<u>Item No</u>	<u>Title</u>
1	"Implementation of Industrial Projects", UNIDO ID/WG.39/2, pp.5-8.
2	Sidney A. Bresler and Mark J. Hertz "Negotiating with Engineering Contractors" <u>Chemical Engineering</u> , 11 October 1965, pp. 209-220.
3	John T. Gallagher "A Fresh Look at Engineering Construction Contracts" <u>Chemical Engineering</u> , 11 September 1967 pp. 218-224.
4	UNIDO, <u>Manual on the Use of Consultants in Developing Countries</u> .
5	Maurice D. Kilbridge and Robert B. Stobaugh, Jr. "Design of an Empirical Study of Problems in Implementing Industrial Projects in Developing Countries" ICR 453.
6	"General Procedure Followed in Network Scheduling".
7	John Fondahl and Mostafa H.A. Hamdy "Procedures for Programming and Control of Implementation of Industrial Projects in Developing Countries", UNIDO/IPP/2, 14 February 1968
8	"Creating the Logic Diagram - Principles".
9	P.K. Levy, C.L. Thompson and J.D. Wiest "The ABC's of the Critical Path Method" <u>Harvard Business Review</u> , September - October 1963.
10	"Arrow Diagramming Exercise" EA-P 381.
11	"Activity-on-Arrow vs. Activity-on-Node".
12	"PERTing a Pumping Unit" EA-P 383.
13	Mostafa H.A. Hamdy "Problems Encountered in the Application of Network Analysis Techniques in Project Implementation in Developing Countries and Pertinent Recommendations", pp. 13-16 and 19.
14	"CPM Problem" EA-P 382.
15	"Space Constructors Inc." EA-P 380.
16	"A Brief Primer on Project Network Scheduling under Resource Constraints" EMD 3/69.
17	Mostafa H.A. Hamdy, "Network Techniques for Project Implementation in Developing Countries", pp. 6-18.

APPENDIX C (continued)

Item No

Title

- 18 "Multiproject Scheduling Exercise"
19 Glossary of Terms in Network Analysis

Additional Reading Material

- 20 Study on Industrial Project Implementation "Problems Encountered
in Implementing Industrial Projects in Developing Countries" by
Professor Maurice D. Kilbridge, Graduate School of Business
Administration, Harvard University, Boston, Mass., U.S.A.
21 Case Studies on Industrial Project Implementation "Industrial
Project Implementation in the Sudan", by Professor Mohamed I. Dessouky,
Visiting Associate Professor, Department of Mechanical and Industrial
Engineering, University of Illinois, Urbana, Illinois, U.S.A.

GROUP I

BAGASSE PROJECT FOR WALLBOARD

- Objective:** To manufacture wallboard made from sugarcane bagasse and other chemical substances. These wallboards are to be used in the construction and furniture industries.
- Inputs:** The main raw material, as far as weight and volume is concerned, comes from sugarcane bagasse - a surplus waste material from the final production process in sugar mills. The rest of the raw materials are made up of chemical ingredients such as resin, ammonia, wax and fire retardants.
- Market:** The market which this project will try to capture, is that of Central America as well as other international sites outside the isthmus. At the present time the need for a product of this type is being met by imports, such as plywood which represents a high percentage. Therefore, this product, to a large extent, will be a substitute for plywood.
- Production:** The production capacity for the plant in question will be 30 million square feet of $\frac{1}{4}$ " wallboard, to come from the processing of 10,000 metric tons of sugarcane bagasse, and working 250 days per year.
- Site:** The plant will be located near the raw material source, at "Guazapa", close to the North Highway approaching San Salvador. An access road will have to be built from the Highway to the plant site.
- Investment:**
- | | |
|---|--------------------|
| <u>First alternative - used equipment</u> | |
| Capital investment | \$ 550,000 |
| Working Capital | 200,000 |
| Total | <u>\$ 750,000</u> |
| <u>Second alternative - new equipment</u> | |
| Capital investment | \$1,550,000 |
| Working Capital | 200,000 |
| Total | <u>\$1,750,000</u> |
- Technology:** The production process which has been selected is known as the "dry process" because of the advantages it represents. The installation of machinery and the actual functioning of such will be performed by Salvadorian personnel, some of whom will be trained abroad.

GROUP I

SACAZO BAGAS PLANT FOR BOARD 1/
SUPUESTIONES, ASSUMPTIONS

1. Existe factibilidad
Study of existing feasibility of project
2. Necesitase ampliar via de acceso
Access road needs widening
3. Terreno Urbanizado
Site clean and urbanized
4. Se nombrarara distribuidor
A distributor will be contracted
5. Se haran 2 licitaciones: construcción pozo y planta
Two biddings will be necessary: well and plant
6. Habra un solo contrato con firma suministradoras de maquinaria
Only one contract with supplies firm of machinery is needed
7. Suministro de materia prima estacional y proveniente de dos ingenios
Seasonal supply of local raw material coming from two mills
8. Suministro de materia prima extranjera de un solo proveedor
Supply of foreign raw material from one source
9. Entrenamiento a obreros en el país, por personal enviado previamente al exterior
Training of local workers by personnel trained previously abroad
10. Selección de obreros procedrá despues de seleccionar personal administrativo
Selection of workers depends on selection of administrative personnel
11. Servicios incluye: agua, energia electrica, telefono
Services include the following utilities; water, electric power, telephone

1/ These plans and the schedule for implementation of the various projects are listed in both English and Spanish. The latter is meant to assist any Salvadorian official who is not proficient in English, to be able to read them and understand the time phased project implementation model, since these projects will soon be implemented.

GROUP I

PROYECTO DE BAGASO PARA TABLEROS DE PARIS

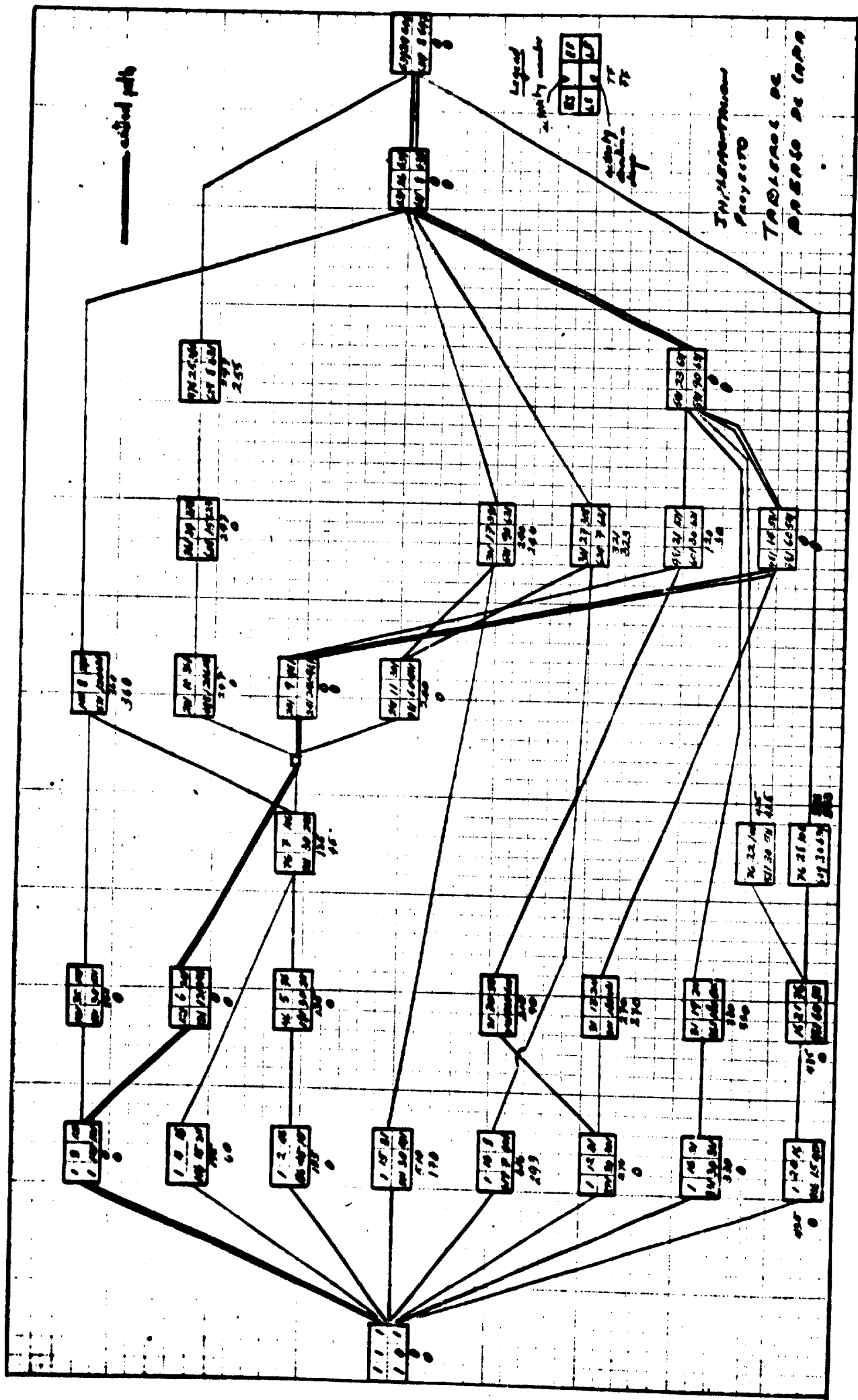
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BAGASSE PROJECT FOR WALLBOARD

<u>Actividad Numero</u>	<u>depende de</u>	<u>DESCRIPCION DE ACTIVIDAD</u>	<u>DESCRIPTION OF ACTIVITY</u>	<u>DURATION (days-days)</u>
1	-	Factibilidad, Financiamiento; aprobados, Sociedad formada	Feasibility, Financing; approved Business has been incorporated	-
2	1	Licitación, Adjudicación y Contratación de carretera de acceso	Bidding and contract for access road	45
3	1	Elaboración y Aprobación de Planos (Planta) y otros	Plans and blueprints (Plant) and others	140
4	1	Contrato de servicios (ANDA, CAESS, etc)	Contract of utilities and services	15
5	2	Construcción del camino de acceso	Construction of access road	30
6	3	Licitación y Adjudicación de Construcción general	Bidding of general construction	75
7	5,4	Instalación de servicios	Installation of services and utilities	30
8	7,32	Construcción de Pozo	Construction of well	120
9	6,7	Construcción de planta	Construction of plant	240
10	6,7	Construcción de oficinas	Construction of offices	120
11	6,7	Construcción de Bodega	Construction of warehouse	60
12	1	Selección, revisión y contratación de maquinaria	Selection, revision and contract of machinery	75
13	12	Arribo de maquinaria disponible	Arrival of available machinery	180
14	13,9	Instalación de maquinaria disponible	Installation of available machinery	60
15	1	Contratación de materia prima importada	Contract of imported raw materials	30
16	1	Contratación de materia prima nacional	Contract of local raw materials	7
17	11, 15	Arribo de materia prima importada	Arrival of imported raw materials	90
18	1	Selección de personal para enviar al extranjero	Selection of personnel to be sent abroad	30

- 17 -

<u>Actividad Numero</u>	<u>dependo de</u>	<u>DESCRIPCION DE ACTIVIDAD</u>	<u>DESCRIPTION OF ACTIVITY</u>	<u>DURATION (dias-days)</u>
19	18	Entrenamiento de personal en el extranjero	Training of this personnel abroad	180
20	1	Elaboración de organigrama	Making of organization chart	15
21	20	Selección de personal administrativo	Selection of management personnel	60
22	21	Selección obreros y su contratación	Selection of workers and contracts	30
23	14, 19, 22	Adiestramiento de obreros en el país	Local training of employees	90
24	10	Compra de equipo de oficina	Buy office equipment	15
25	24	Envío de equipo de oficina	Send office equipment	8
26	8, 17, 27, 23	Prueba de producción	Production try-out run	16
27	11, 16	Envío de materia prima nacional	Send local raw materials	7
28	21	Contratación de firma distribuidora	Contract marketing system	30
29	25, 26, 28	Puesta en marcha (normalization)	Start-up	90
30	12	Arribo de maquinaria hecha a la orden	Arrival of machinery tailor-made	360
31	9, 30	Instalación de maquinaria hecha a la orden	Installation of machinery tailor-made	30
32	3	Licitación y adjudicación de pozo	Bidding for well	30



GROUP I

CONCLUSION

1. From the network diagram the project will take 646 days to be completed. This includes the start-up production.
2. The activities which permit the largest total float are 15, 16, 20, 22 and 28, and have a total float that fluctuates between 435 and 616 days. This indicates that these activities could be delayed up to these limits without affecting the total duration.
3. Activities with the largest free float are numbers 8, 19, 22, 27 and 28 which fluctuate between 323 and 533 days. These activities could then be delayed up to these limits without affecting the start time of the activities that directly follow them.
4. The critical path is determined by activities 1, 3, 6, 9, 14, 23, 26, 29 which have zero value for their total and free floats, that is to say, none of these could be delayed without affecting the total duration of the project (or its earliest finishing time) nor the earliest starting time of the subsequent activities along the critical path.
5. The total float of 616 days corresponding to activity 16 means that the contracts of local raw material could be delayed 616 days without affecting the total duration of the project, and, therefore, looking for the most adequate times to reduce total costs is possible. The 293 days of free float for this activity shows how long it can be delayed without affecting the starting time of the next activity which is the sending of the local raw material.
6. Cost wise the floats of activity 15 are of great importance since we can delay this contract by 510 days.

GROUP II

IMPLEMENTATION OF POLYVINYL CHLORIDE PLANT PROJECT

This project and recommendations, are based on detailed studies of the potential market, including market prices and pricing policies; the products to supply this market and the available processes for their manufacture; the possible plant location and an analysis of the investment required and an estimate of its profitability.

The initial phase in a programme for the development of a chemical complex in El Salvador should be a plant to manufacture Polyvinyl Chloride (PVC) resin base, and Polyvinyl Chloride Compounds.

During the first phase of operations the raw material should be obtained from imported Vinyl Chloride Monomer (VCM).

In order to insure initial production and management know-how the project should be organized with participation by a Company presently established in the PVC industry, either on a joint venture basis or other suitable arrangement.

The modern port facilities of Comisión Ejecutiva del Puerto de Acajutla (CEPA) with ample low cost power, excellent water supply of low mineral content and absence of iron at a temperature of 60°F, ease of waste disposal and proximity to San Salvador over either good roads or rail service, all dictate the location of Acajutla.

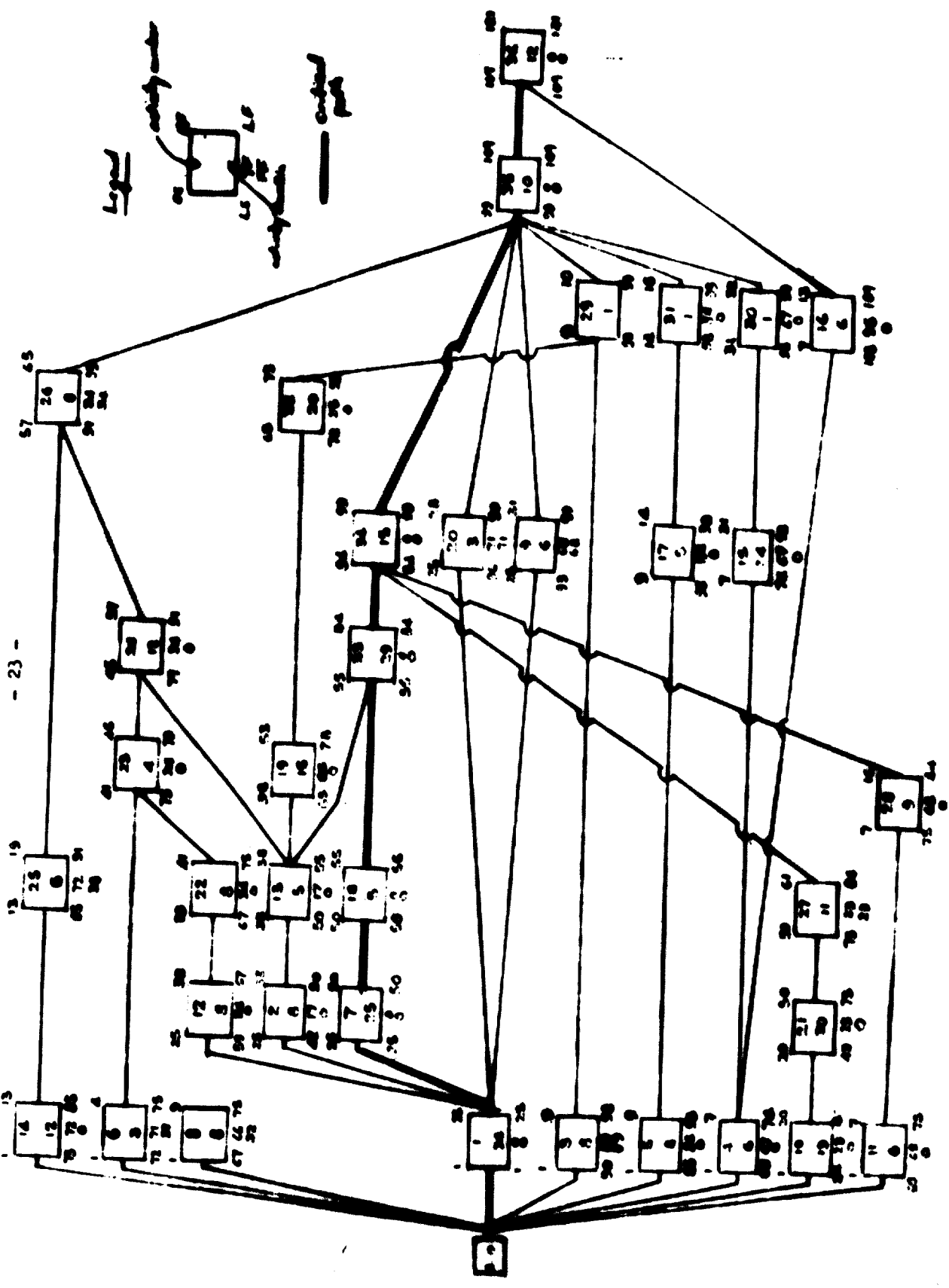
GROUP II

ASSUMPTIONS AND LIST OF PROJECT ACTIVITIES WITH RESPECTIVE TIME DURATIONS

Preconditions for the fulfilment of this project: the corporation has been formed and financing plans, drawings for installations, list of equipment and materials, purchase of land site at Acajutla, have all been approved.

	<u>Weeks</u>
1. Preparation and approval of plans for building plant and housing	24
2. Bids and bids adjudication of contracts for industrial plant and housing	8
3. Recruitment of administrative and professional personnel from U.S.A.	8
4. Recruitment of administrative and professional personnel from El Salvador	6
5. Recruitment of Salvadorian workers	8
6. Signing of contracts with CTEPA for services for installation of piping at Acajutla pier and CTEPA lands	3
7. Signing of contract with CEL for direct supply of energy	25
8. Procurement of permit from Department of Public Works for right of way for all piping	8
9. Signing of contract with Insurance Company	6
10. Procurement of quotations and signing of contract for machinery and equipment arriving from foreign countries	19
11. Procurement of quotations and signing of contract for machinery and equipment to be bought in El Salvador	6
12. Signing of contract for supply of piping for vinyl chloride	8
13. Cleaning and levelling of acquired land	5
14. Negotiation and signing of contract for the supplying of all foreign raw materials	12
15. Training in the U.S.A. of all Salvadorian technical personnel	24
16. Training of administrative personnel at El Salvador	6
17. Training of Salvador workers	5
18. Hook-up of electrical energy	5

	<u>Weeks</u>
19 Perforation of wells, hook-up of drinking and industrial water, drainage and sewage	15
20 Phone service hook-up	3
21 Manufacturing and packing of machinery coming from foreign countries	30
22 Preparation of piping coming from foreign countries	8
23 Shipment of pipe from foreign countries to Acajutla	4
24 Installation of piping for discharge of vinyl chloride from CEMA's pier to plant	12
25 Preparation for the initial shipment of raw material from foreign countries	6
26 Shipment of raw materials from foreign countries to Acajutla	8
27 Shipment of machinery and equipment from foreign countries to Acajutla	11
28 Preparation and manufacture of machinery and equipment in El Salvador and shipment to Acajutla	9
29 Transportation of administrative and professional personnel from U.S.A. to Acajutla	1
30 Transportation of Salvadorian technical personnel from U.S.A. to Acajutla	1
31 Transportation of local workers to Acajutla	1
32 Construction of housing for administrative and technical personnel	20
33 Construction of industrial plant and foundations for machinery	29
34 Installation of machinery and equipment	15
35 Testing of equipment	10
36 Start of production	12



GROUP II

CONCLUSION

- I The Critical Path of the project has the following activities:
- No. 1. Preparation and approval of plans for buildings and housing.
 - No. 7. Signing of contract with CEL (Power Co.) for direct energy supply
 - No. 18. Hook-up of electrical energy.
 - No. 33. Construction of industrial plant and foundations for machinery.
 - No. 34. Installation of machinery and equipment.
 - No. 35. Testing of equipment.
 - No. 36. Start production.
- II The minimum duration time for project implementation will be 120 weeks.
- III The time shown above could be considered reduced if activity No. 7 does not depend upon the approval of a Legislative Decree, a matter that usually takes a lot of time in almost any country.
- IV The Network allows us to focus our attention on those activities which are floating, thus allowing the saving of time and money, such as is the case of activities Nos. 3 and 5, concerning the hiring of personnel
- V The Network also allows us to determine when to allocate the date to sign contracts, such as the case of activity No. 12, which refers to the buying of piping for vinyl chloride.
- VI From the results obtained, we can see that it is not possible to offer our products before two and a half years.

GROUP III

IMPLEMENTATION OF COTTON HANDKERCHIEFS PLANT

1. Item to be produced Low priced handkerchiefs
2. Estimated national consumption and production of handkerchiefs:

	<u>Estimated Consumption^{a/}</u>	<u>Importation^{b/}</u>	<u>Estimated Nat. Prod.^{c/}</u>
1961	734,026	520,580	213,446
1962	820,504	460,858	359,646
1963	864,158	575,751	288,407
1964	947,872	571,277	376,595
1965	1,002,302	338,000	670,302
1966	1,090,990	338,341	752,649

To obtain a consumption figure in unit amounts we have proceeded as follows:

The feasibility study indicates that in 1966 24,465 k of handkerchiefs were imported, which is the equivalent of 219,642 dozer; this means that each kilogramme is equal to about eight dozen handkerchiefs. Therefore, making use of the same relation for the kilogramme consumption as exposed in the study (91,521 kilogrammes - page 15), we come up with an approximate consumption of 7.0 million handkerchiefs.

3. Consumption and production of handkerchiefs in Guatemala, Nicaragua and Costa Rica.

In the rest of Central America the same conditions exist. Merchants import the ready-made cloth and produce handkerchiefs as there are no plants for their manufacture from yarn. Thus, the consumption and production of this product in Guatemala, Nicaragua and Costa Rica, could be estimated at 75 per cent of the consumption in El Salvador which means that total consumption in these countries, including El Salvador, would be 32.0 million handkerchiefs.

4. Volume of Production that the Projected Plant Could Have

(a) Using the estimated consumption figures for the four countries during 1966; (b) estimating that the plant would take care of the 75 per cent consumption of El Salvador, 60 per cent of Guatemala, 50 per cent of Nicaragua and 50 per cent of Costa Rica (page 17); and (c) estimating an annual increase of 8 per cent in the production of the plant, the volume of plant production could be projected so:

a/ Page 15

b/ Page 13

c/ To establish a difference between estimated consumption and importations made. In the country, up to now, there is no plant for the manufacture of cotton handkerchiefs. There are only merchants that make them using imported cotton materials (page 17).

1st year of operation	12,000,000 handkerchiefs
2nd " "	12,960,000 "
3rd " "	13,996,800 "
4th " "	15,116,544 "
5th " "	16,325,858 "

5. Minimum size that plant should have to make it profitable

It is considered that the plant should initiate its operations with a minimum of 52 weaving machines to reach a reasonable profit in accordance with investment to be made. With this number of weaving machines it is estimated that the factory could fill the needs of 12,000 handkerchiefs in the first year of operations. Furthermore, the weaving machines will have enough capacity up to the third year of operations based on the 3 per cent annual average increase.

6. Raw materials to be used and their origin

The most important raw material - yarn for handkerchiefs - will be obtained locally, inasmuch as there are four textile plants in the country that produce such yarn.

The combined production of the four plants mentioned is of 180,000 pounds per month, an amount that would probably cover the needs of the plant in this project. The yarn could be purchased already dyed or raw, in which case the necessary equipment for dyeing should be procured, most probably by the projected firm. The other inputs will consist mostly of chemical products which will be imported from Switzerland, Federal Republic of Germany and the United States.

7. Initial Investments to be made

Machinery costing \$1,467,771.11 will be needed and this will consist of equipment for the preparation of raw yarn, weaving of the yarn, finishing of the cloth and for the manufacturing of the end product. Such machinery will necessarily have to be imported from outside of Central America. The looms could be bought in Sweden and the rest of the machinery in the United States and the Federal Republic of Germany.

The other investments will be represented by:

Land of 2,998.88 square meters and buildings of 2,726.25 square meters of construction. The buildings would cost approximately \$313,518.75 and the land, \$14,994.40.

8.

Initial Personnel

Direct working force	54
Indirect working force	27
Technical personnel	2
Administrative personnel	10
Sales personnel	<u>3</u>
	<u>96</u>

9.

Profitability of the Project

I DISBURSEMENTS

Annual fixed Costs	# 607,311.28
Annual Variable Costs	<u>1,730,260.79</u>
Total	<u><u>2,337,572.07</u></u>

II RECEIPTS

2,892,456.00

III NET ANNUAL PROFIT

554,883.93

IV PROFITABILITY: $\frac{554,883.93}{2,821,221.30} = 19.67\%$

Base: first year of operations producing
12,000,000 handkerchiefs.

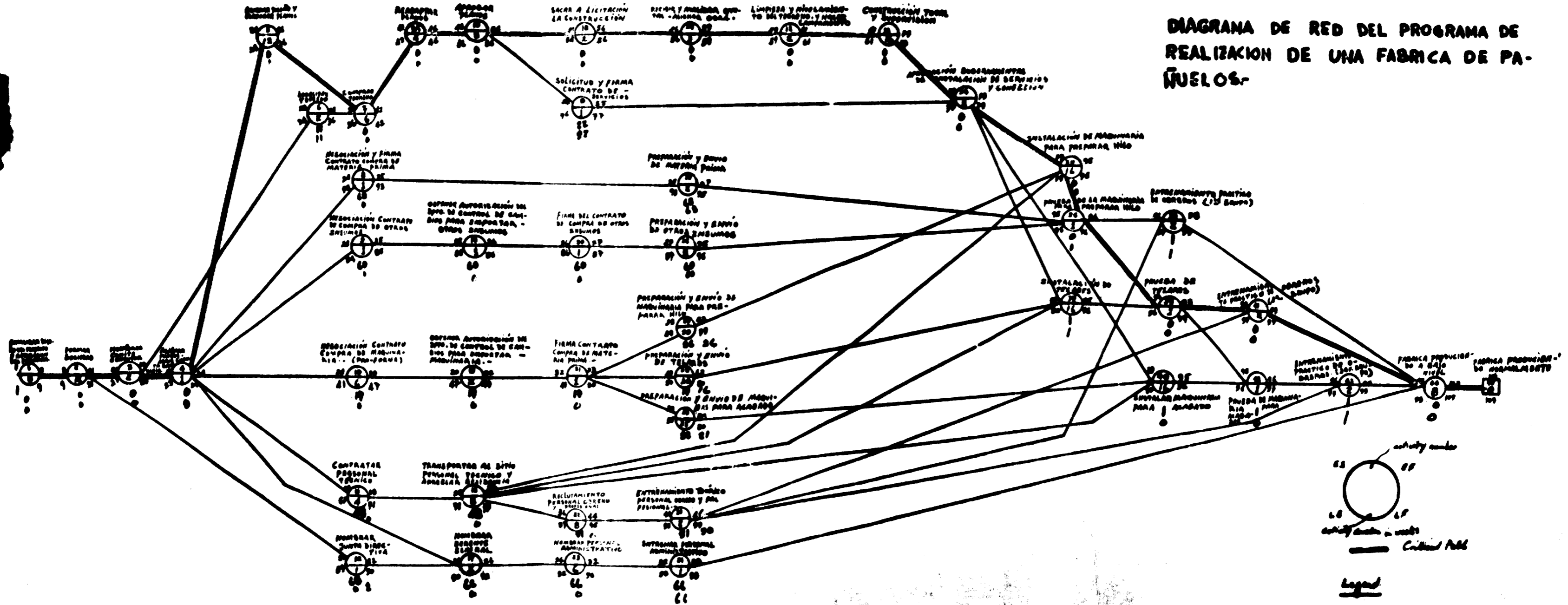
GROUP III

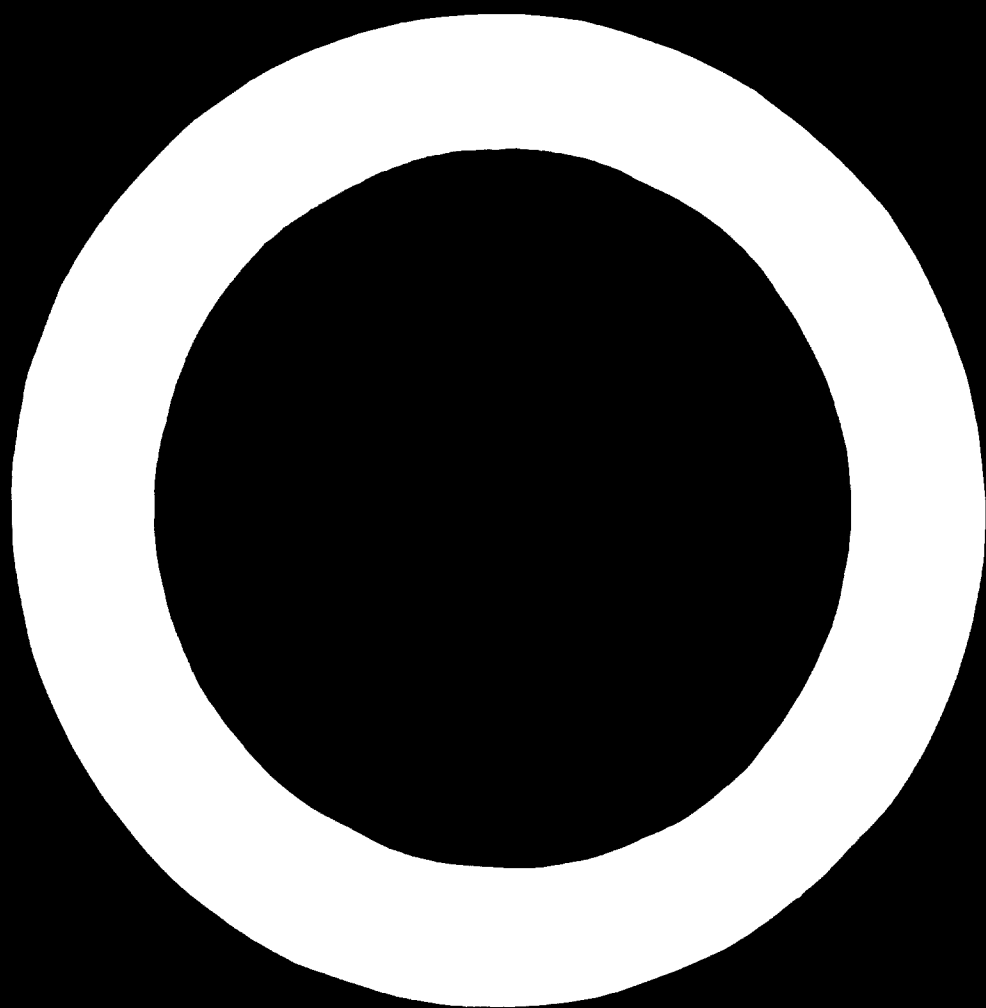
LIST OF PROJECT ACTIVITIES

1. Complete Project Design and Approval of Financing.
2. Create Corporation.
3. Establish Committee of Consultants.
4. Allocation of Initial Funds, opening of Bank Account.
5. Allocation and drawing of design for building construction.
6. Selection of Site.
7. Negotiation and signing of Real State Deed for acquisition of site in Apopa and Alongside Highway.
- 7a. Adjustment of design for building construction.
8. Negotiation and signature of contract to buy raw materials.
9. Negotiation of contract to buy other inputs (chemical products from other countries).
10. Negotiation ^{of} contract (pro-forma) to buy machinery.
11. Negotiation of contract for foreign technical personnel.
12. Creation of Board of Directors.
13. Government approval of construction plans (Blue Prints).
14. Procurement of necessary approval from Exchange Control Office for importation and payment of other materials (inputs).
15. Procurement of necessary approval from Exchange Control Office for importation and payment of machinery.
16. Transportation to site of foreign technical personnel and preparation of their residence
17. Selection of General Manager.
18. Open BID for building construction.
19. Petition and signature of utilities contract - power, water, etc.
20. Signature of contract buying other inputs.
21. Signature of contract buying machinery.
22. Recruitment and hiring of workers.
23. Recruitment and appointment of administrative and professional personnel.
24. Consideration of bids for construction and approval of best offer.
25. Preparation and shipment of raw materials to site.
26. Preparation and delivery of all other materials (inputs) to site.
27. Preparation and shipment of machinery for the preparation of yarn.
28. Preparation and shipment of looms.

29. Preparation and shipment of machinery for finishing the handkerchiefs.
30. Theoretical Training of workers.
31. Training of Professional and administrative personnel.
32. Cleaning and levelling of acquired land.
33. Total construction of building and supervision of such construction.
34. Government approval and connexion of utilities.
35. Installation of machinery for preparation of yarn.
36. Trial run of machinery for yarn preparation.
37. Installation of looms - weavers.
38. Practical training of workers in running of yarn machinery.
39. Trial run of looms - weavers.
40. Installation of finishing machinery.
41. Practical training of workers in running of looms - weavers.
42. Trial run of finishing machinery.
43. Practical training of workers in operation of finishing machinery.
44. Factory producing at low level.
45. Factory producing at normal level.

DIAGRAMA DE RED DEL PROGRAMA DE REALIZACION DE UNA FABRICA DE PAÑUELOS.





GROUP III

CONCLUSION

1. The shortest completion time for this project is 106 weeks.
2. The critical path includes the following activities:
1, 2, 3, 4, 5, 7, 7a, 13, 18, 24, 32, 33, 34, 35, 36, 39, 41 and 44.
3. It is not necessary to appoint the General Manager (activity No. 17) before week No. 90, thus economizing on the overall expenses of the enterprise.
4. For the same reason as mentioned above, the appointment of administrative personnel (activity No. 23) can be done during week No. 92.
5. The preparation and shipment of machinery to prepare yarn (activity No. 27) can be delayed for 26 weeks when it is definite that the shipment will take the time indicated in the diagram, without affecting the erection of the looms and 17 weeks without affecting the total time of the project; the preparation and shipment of machinery for finishing the handkerchiefs could be delayed 21 weeks without affecting the erection of this machinery in the time previously projected and could be delayed 22 weeks without affecting the total time of the project.
6. The preparation and shipment of raw materials and other inputs could be delayed for 50 and 56, respectively, without affecting the total time of the project.
7. If the investments indicated in conclusions No. 5 and No. 6 are delayed to the maximum, without affecting the total duration of the project, we can save on the credit interest obtained or use our own capital for other purposes.
8. The appointment of the technical personnel (activity No. 11) can be made during week No. 87, without affecting the project.
9. The recruitment of workers and professional personnel (activity No. 22) can be done during week No. 87, without affecting the total time of the project.

GROUP IV

IMPLEMENTATION OF BAGASSE MOULDED WALLBOARDS

This activity deals with establishing a factory to produce compressed wall boards utilizing as the main raw material, the available sugar cane bagasse.

INSAFI decided to conduct a research to ascertain possibilities for developing this industry in El Salvador and contracted the services of a qualified Consultants firm in order to work out the preliminary feasibility study.

Once the preliminary feasibility for this project was established, it was promoted and private enterprises have become interested. The plant is expected to be located in Guazapa, 25 kilometres from San Salvador alongside the international highway to the Northern Border and it will be necessary to improve the access road, approximately 2 kilometres from the main road.

The boards will be produced in several thicknesses and finishes, to be used in ceiling, partitions, front house sidings and in the furniture manufacture.

The corporation will only deal with production. Distribution and sales will be handled by a separate independent concern.

GROUP IV

ASSUMPTIONS

NETWORK
ACTIVITY

I. MACHINERY AND EQUIPMENT

(18)

Machinery and equipment will be obtained from one single source on account of the nature of this product which requires a special patented process. Besides, the suppliers are able to deliver the necessary technical assistance. The complete shipment will be received at Salvadorian customs in 48 weeks.

II. CONSULTANTS

In view of the considerable investment and the lack of sufficient knowledge on the manufacturing process, it is necessary to contract a consultants firm.

III. PERSONNEL

1. General Manager
2. Production Manager and Assistants
3. Administrative Personnel
4. Technical Personnel
5. Workers

IV. FINANCING

(1)

We have assumed that the actions for negotiating the Loan and obtaining the benefits of the Industrial Development Law have already been completed.

V. RAW MATERIAL

(25)

We have assumed that the Bagasse will be delivered to the plant by the supplier and the contract will contain clauses for calendar applicable to programmed deliveries. However, our plans indicate that our warehouse will be ready for storing initial Bagasse deliveries.

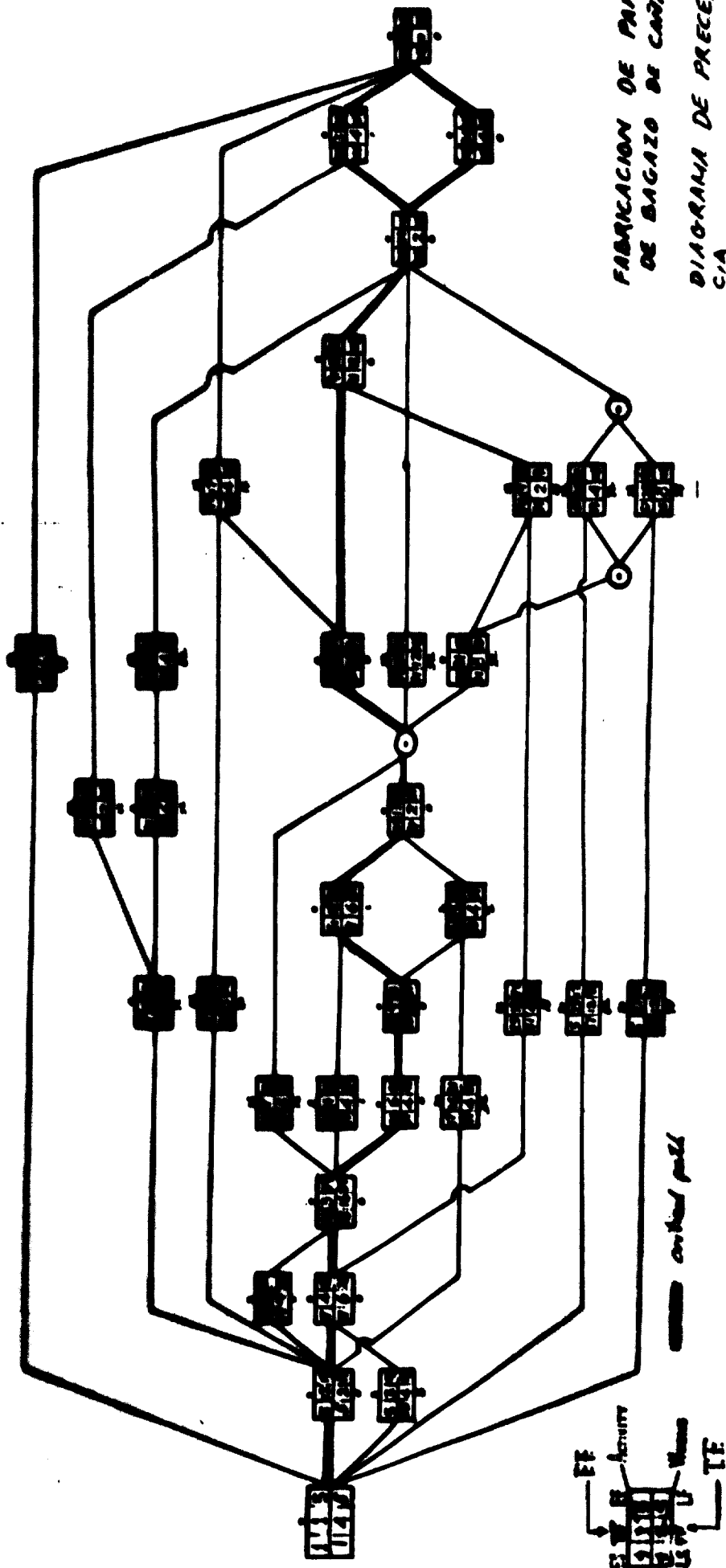
GROUP IV

LIST OF PROJECT ACTIVITIES

<u>ACTIVITY</u>	<u>DESCRIPTION</u>	<u>SPANISH VERSION</u>	<u>TIMING WEEKS</u>
1	Recruit Technical and Management Personnel for Implementation including the general Manager.	Reclutar Personal Técnico y administrativo para implementación incluyendo Gerente General de la Empresa.	4
2	Selection and Contracting Consultant Services.	Seleccionar y contratar servicios de Consultoría.	12
3	Quotations on Machinery.	Cotizaciones de Maquinaria	4
4	Selection of Machinery and general equipment.	Selección Maquinaria y Equipo en general.	6
5	Plant Design and Approval, including other related installations.	Diseño y Aprobación de Planta y demás Instalaciones.	16
6	Invitation to Bid and Contract for levelling ground and Building Road.	Licitación y Contrato de Terracería, Carretera.	4
7	Bids and Contracts for Plant, Warehouse Housing.	Licitación y Contrato de Planta, Bodega y Viviendas.	4
8	Acquisition of site.	Adquisición del Terreno.	4
9	Cleaning and Levelling acquired site. Building Road.	Limpieza y Terracería del Terreno adquirido. Construcción de Carretera.	8
10	Recruit and Train Production Manager and Assistants.	Reclutar y Adiestrar Gerente de Producción y Auxiliares.	24
11	Bid and Contract for Drilling Water Wells.	Licitación y Contrato Perforación Pozos.	4
12	Water Well Construction Work.	Construcción de Pozos.	6
13	Installation of Water Services.	Instalación Servicios Agua.	2
14	Negotiating Power and Light Services.	Negociación Servicios Luz y Fuerza.	4
15	Installation of Power and Lighting Services, Substation.	Instalación de Servicio eléctrico, Luz Y Fuerza, (Subestación).	4

<u>ACTIVITY</u>	<u>DESCRIPTION</u>	<u>SPANISH VERSION</u>	<u>TIMING WEEKS</u>
16	Negotiating Communication Services.	Negociación Servicio Comunicaciones.	8
17	Installing Communication Services.	Instalación de Servicios de Comunicación.	4
18	Acquisition C.I.F. of Machinery and equipment for Production.	Adquisición C.I. F. de Maquinaria y Equipo de Producción.	48
19	Moving Machinery and Equipment for Production, from Custom to Plant site	Transporte de Maquinaria y Equipo de Producción de Aduana a Planta.	2
20	Construction of Plant Buildings.	Construcción de Planta.	32
21	Construction of Warehouse.	Construcción de Bodega.	8
22	Construction of Housing Facilities	Construcción de Vi-Vienda.	12
23	Installing Machinery and Production Equipment.	Instalación de Maquinaria y Equipo de Producción.	12
24	Testing the Machinery Trial run.	Prueba de Maquinaria, Operacion.	2
25	Negotiating, Working out and signing Contracts for Bagasse supply in site.	Negociación, Preparación, firma contratos suministros en Planta de Bagazo.	12
26	Receiving (Transportation) and Storing the Bagasse.	Recepción (Transporte) y almacenamiento del Bagazo.	4
27	Negotiating and Acquiring other raw materials.	Negociación y Adquisición de Otras Materias Primas.	12
28	Transporting O.R.M. to Plant.	Transporte de O.M.P. a la Planta.	8
29	Recruiting and Training Administrative Personnel for Regular Operation.	Reclutamiento y Adiestramiento de Personal Administrativo para la operación regular.	6
30	Recruiting Workers.	Reclutamiento de Obreros.	2

<u>ACTIVITY</u>	<u>DESCRIPTION</u>	<u>SPANISH VERSION</u>	<u>TIMING WEEKS</u>
31	Practice Training of Workers.	Adiestramiento Práctico de Obreros.	4
32	Recruiting Technical Personnel (Skilled Workers) etc.	Reclutamiento del Personal Técnico. (Obreros especializados, etc.)	6
33	Theoretical Training, Technicians.	Adiestramiento Teórico de los Técnicos.	4
34	Practice Training, Technical Personnel	Adiestramiento Práctico del Personal Técnico.	4
35	Regular Operation in the Plant.	Operacion Regular de la Planta.	



FABRICACION DE PANELS
DE BAGAZO DE CAÑA

DIAGRAMA DE PRECEDEN
C/A

SAN SALVADOR
EL SALVADOR, Guatemala

GROUP IV

CONCLUSION

While working out the Precedence Diagram, the Critical Path was determined and as a result it was found that the time needed from starting implementation to the start of regular production was one hundred and nine weeks.

The Critical Path is determined by the following activities:

1, 2, 4, 5, 6, 9, 12, 13, 20, 23, 24, 31 and/or 34.

On the diagram or network it is evident that the activities Hiring and Training personnel have ample free and/or total floats, which indicates the convenience for undertaking these activities in such a way so as to reduce the amounts of total float in two weeks.

GROUP V

IMPLEMENTATION OF COTTON HANDKERCHIEF PROJECT

DESCRIPTION OF THE PROJECT

This project is to manufacture handkerchiefs for the Central American Common Market. The main object is to save our badly needed foreign currencies. We intend to suppress imports mainly from Japan, give work to our unemployed and use our raw materials such as cotton, thus helping our national economy.

The location of this plant will be near San Salvador - 10 miles away, where the soil has to be solid enough to sustain the heavy vibrations of the machinery. Our plant has to be close to a river in which we can throw away sewage.

The plant will produce almost 4,000 dozen handkerchiefs per day, enough to cover the demand of the Central American Common Market.

The machinery will come from three countries, e.g. Federal Republic of Germany, U.S.A. and Switzerland.

The Government of El Salvador will extend the tax exemptions scheme to this project since it has considered the plant to be of great importance to the economy. This will be the first plant of this type in Central America and we will use local raw materials and a good number of Salvadorian workers.

The plant will consist of 52 looms in a modern building occupying an area of 2,726 square meters. The total cost of the project will be \$2,821,221. Total cost per dozen handkerchiefs will be \$2.21 Class 6A6 and 2.09 Class B.

GROUP V

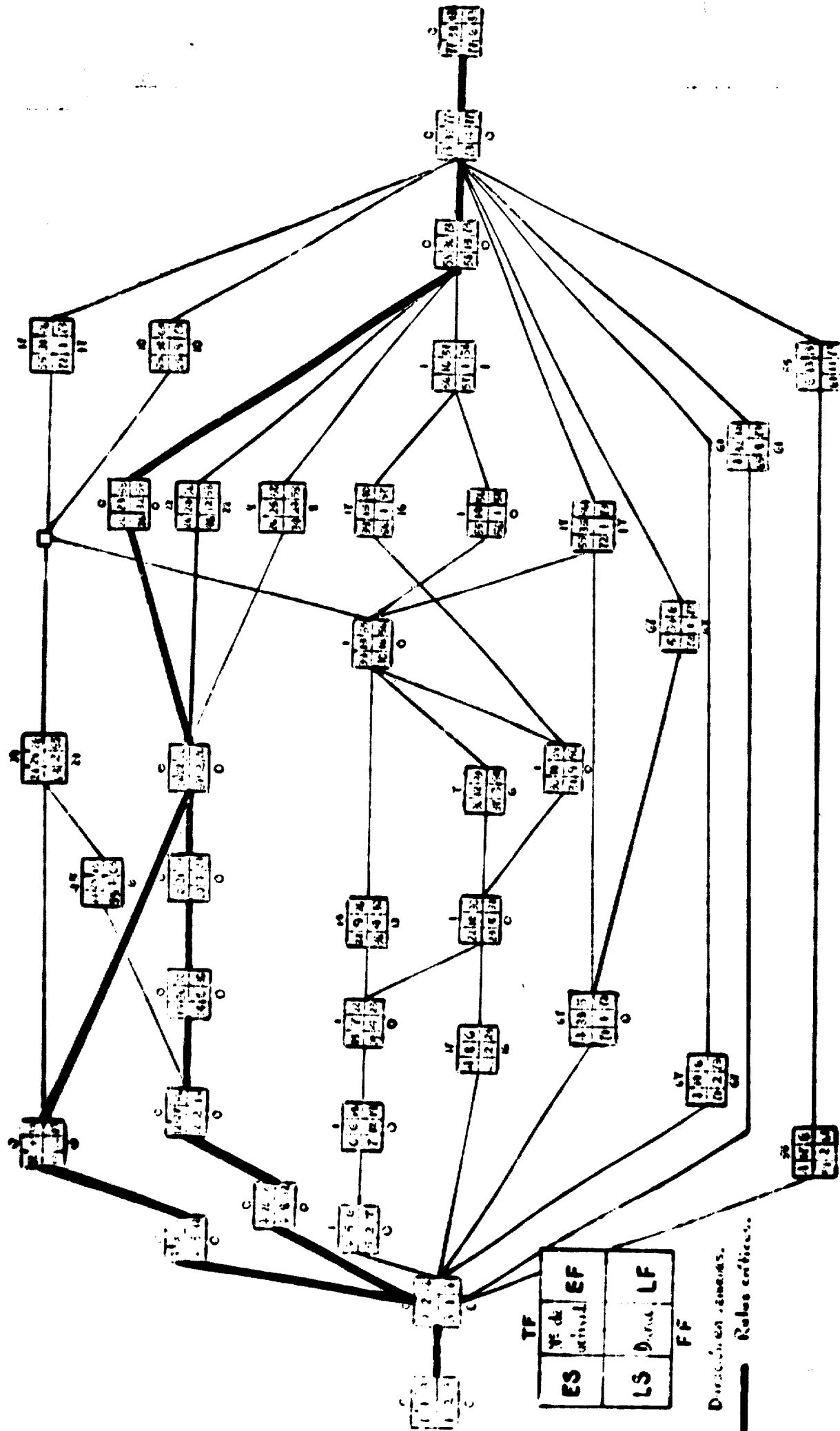
List of Activities ^{1/}

List of Activities, Duration and Sequence

<u>Activity No.</u>	<u>Description</u>	<u>Follows</u>	<u>Duration in weeks</u>
1	Normalize financing	-	2
2	Appoint Project Manager and Collaborators	1	1
3	Preparation and presentation of application for tax exemptions of industrial development	2	8
4	Study and resolution of application	3	12
5	Selection and contract of consulting firm	2	2
6	Selection of site	5	12
7	Buying of land	6	4
8	Selection of firm to elaborate construction plans	2	2
9	Government approval of construction limits	7	4
10	Elaboration of plans and blue prints	7, 8	8
11	Government approval of blue prints	10	9
12	Bidding and selection of construction firm	10	3
13	Plant construction	9, 11, 12	16
14	Government inspection of building and installation	13	1
15	Applications for utilities and services	11	1
16	Connection of utilities and services	14, 15	1
17	Worker recruiting	2	2
18	Training of workers (theoretical)	17	12
19	Recruiting of administrative personnel	2	2
20	Send for specifications and prices of textile machinery	4, 27	4

^{1/} This is based on Alternative I, Size 3 of the Feasibility Report prepared by INSAPI.

<u>Activity No.</u>	<u>Description</u>	<u>Follows</u>	<u>Duration in weeks</u>
21	Analysis of offers of textile machinery	20	4
22	Contract for textile machinery	4, 21	2
23	Order and arrival of weaving machinery	22	32
24	Order and arrival of preparation machinery	22	12
25	Order and arrival of finishing machinery	22	24
26	Contract of textile technician	2	8
27	Arrival of textile technician	26	2
28	Price investigation of foreign raw material	27	4
29	Study of offers of foreign raw material	4, 28	2
30	Arrival of first lot of foreign raw material	13, 29	8
31	Arrival of first lot of local raw material	13, 29	1
32	Design and Production of packages and label	2	8
33	Investigate prices of office equipment and vehicles	2	1
34	Purchase of transport equipment	33	1
35	Purchase of office equipment	13, 33	1
36	Installation of machinery and testing	16, 23 24, 25	15
37	Practical training of workers and testing	18, 19 30, 31 32, 34 35, 36	4
38	Normalisation of production	37	6



GROUP V

CONCLUSION

ANALYSIS OF NETWORK

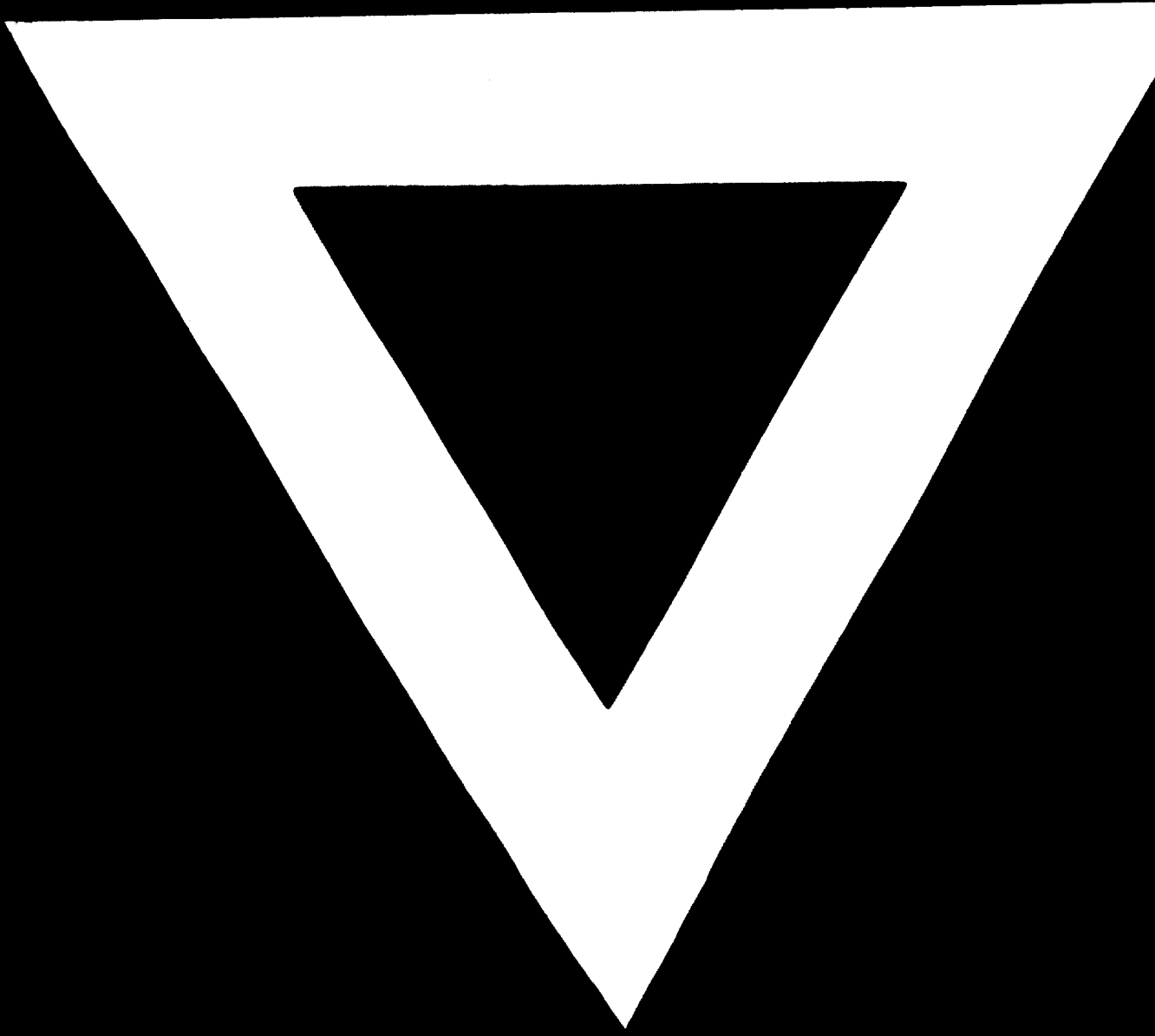
Starting with the assumption that the Board of Directors has been formed, the first activity, financing, needs only to be formalized since it has already been approved. The second activity is to name and appoint a project manager who will be in charge of the implementation through to the normalization of production. This is estimated to have a duration of 82 weeks.

CRITICAL PATH

At the beginning there are two critical paths. One deals with the application for the benefits of the law of industrial development. The other path deals with the textile technician and textile machinery, in particular, the arrival of machinery from Switzerland and its installation and testing.

There are several activities that start at the same time and have an ample free float and total float.





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